5. CUMULATIVE IMPACTS

5.1 Introduction

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time, when adding the incremental impact of a proposed Project to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such actions (40 CFR 1508.7). Chapter 3, "Affected Environment" presents information about past and present environmental conditions, including past trends that are expected to continue into the future. Chapter 4, "Environmental Consequences" presents the environmental and socioeconomic consequences of implementing the proposed Project and the alternatives. This chapter addresses the cumulative impacts of the Haile Gold Mine Project when combined with other past, present, and RFFAs.

Principles of Cumulative Impacts Analysis

- Include past, present, and future actions.
- Include all federal, nonfederal, and private actions.
- Focus on each affected resource, ecosystem, and human community.
- Focus on truly meaningful effects.

The cumulative impact assessment provides a broader assessment of potential impacts associated with implementing the proposed Project and alternatives by considering a wide array of other activities, new and ongoing projects, and programs in the Project area and vicinity. The potential interactions between the Haile Gold Mine Project and RFFA and programs are identified in order to assess potential adverse or beneficial cumulative impacts. Each of the 18 resource areas evaluated in the EIS was screened to determine the potential for cumulative impacts, as described below. Those resources with the potential for cumulative impacts were carried forward to further analysis.

The key to a cumulative impact analysis is the identification of RFFAs within a clearly defined geographic and temporal scope. These elements are defined below:

- **Reasonably Foreseeable Future Actions –** Potential federal or nonfederal actions identified within the geographic and temporal scopes of the proposed Project and alternatives. The predicted impacts of the RFFAs are combined with the potential direct and indirect impacts of the proposed Project to determine potential future cumulative impacts on a given resource. The term "reasonably foreseeable" is not defined in the regulations. For this analysis, RFFAs are those for which information available suggests that they are likely to occur.
- **Geographic Scope –** The geographic area over which past, present, and RFFAs are identified and evaluated. The geographic scope is related to specific environmental resources. For example, the geographic area over which impacts on air resources (related to the airshed) are considered is different than the area considered for transportation (the county road system). The geographic scope of a cumulative impacts analysis is influenced by both direct and indirect impacts.
- **Temporal Scope –** The time span over which past, present, and RFFAs are identified and cumulative impacts are evaluated. The time span depends on the duration of the impacts of the proposed Project.

The identification of past, present, and RFFAs and trends involves some uncertainty, as does the assessment of the magnitude of impacts now and in the future. The cumulative impacts analysis is designed to explore the range of potential cumulative impacts while recognizing that uncertainty.

Cumulative effects are identified to allow decision makers to be informed that changes may be necessary in existing programs or that future regulatory initiatives may be required.

5.2 Methods

The analysis of cumulative impacts related to the proposed Project and alternatives followed the four steps described below.

Step 1: Project-related impacts identified in Chapter 4 were reviewed to determine which environmental resources would likely be affected both by the Project and by other past, present, and RFFAs. The environmental resources not likely to be affected by the proposed Project and therefore not likely to be affected by cumulative impacts associated with the proposed Project were screened and then excluded from further consideration (Table 5-1). Environmental resources that could be affected by cumulative impacts were analyzed further. The criteria used to assess and identify cumulatively affected resources followed the methodology presented in the CEQ's *Considering Cumulative Effects* (1997).

Step 2: The geographic scope for the cumulative impacts analysis was determined based on the geographic area affected or influenced by the proposed Project and alternatives. In general, the geographic scope should be consistent with the terrestrial or aquatic processes that could reasonably be affected. The temporal scope was established based on the timeframe of the proposed Project and the past, present, and RFFAs that were identified and evaluated.

Considering Cumulative Effects (CEQ 1997)

Step 1: Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals.

Step 2: Establish the geographic scope for the analysis.

Step 3: Establish the time frame for the analysis.

Step 4: Identify other actions affecting the resources, ecosystems, and human communities of concern.

Step 3: Past, present, and RFFAs that fell within both the geographic and temporal scopes were identified and evaluated.

Step 4: Cumulative impacts were evaluated together with the direct impacts of each alternative—including the No Action Alternative, which serves as a baseline. The range of actions considered in the cumulative impacts analysis included all connected and similar actions that could cumulatively contribute to identified Project-related impacts. Criteria used in identifying cumulatively affected resources included whether (1) the resource is especially vulnerable to incremental impacts; (2) other actions in the same geographic area may result in similar impacts on the resource; (3) impacts have been historically important for the resource; and (4) cumulative impact concerns have been previously analyzed and identified (USEPA 1999). A review of the past, present, and RFFAs in combination with the proposed Project determines whether projects in the resource-specific study areas for cumulative impacts could result in similar impacts on the resource.

5.3 Screening for Cumulative Impacts

Each resource area was researched, reviewed, and evaluated to determine whether Project-related impacts on that resource in concert with other past, present, and RFFAs would result in the potential for cumulative impacts. This screening revealed that Project-related impacts in several resource categories addressed in the EIS have the potential to contribute in more than a minor way to cumulative impacts. Other resource areas were determined unlikely to be cumulatively affected or to potentially contribute to

cumulative impacts in only a minor way. The resource areas determined to have the potential for more than minor cumulative impacts were carried forward for further consideration and analysis. The rationale for these conclusions is presented in Table 5-1.

Table 5-1 Screening of Cumulative Impacts by Resource Area

Resource Area	Potential to Contribute to Cumulative Impacts in More Than a Minor Way?	Rationale
Geology and soils	Yes	The proposed Project and alternatives would contribute to the cumulative extraction of gold ore resources in the Carolina Slate Belt and would contribute to an irreversible cumulative reduction in the regional amount of gold and other mineral resources available in the future. The proposed Project and alternatives would result in localized impacts on soil resources that, in addition to other projects, may result in minor cumulative impacts on soil resources.
Surface water hydrology and water quality	Yes	The water quality impacts of the proposed Project and alternatives have the potential to interact with other known past, present and projected future water quality conditions in the upper Little Lynches River.
Wetlands and other waters of the United States	Yes	The direct and indirect impacts of the proposed Project and alternatives would contribute to minor and moderate cumulative impacts on historical losses of forested wetlands at the national level and in South Carolina, respectively.
Aquatic resources	Yes	Impacts of the proposed Project and alternatives on aquatic resources may interact with other past and present activities in the Little Lynches River watershed to adversely affect habitat and water quality. In particular, cumulative impacts may occur on species that are geographically limited, sensitive, or of high conservation priority.
Socioeconomics and environmental justice	Yes	Analysis of the four-county socioeconomic study area indicates that the proposed Project and alternatives would, when combined with other regional economic activity, cause a cumulatively beneficial economic effect within the study area. The proposed Project and alternatives would not adversely affect environmental justice communities and likely would contribute in a beneficial way to future cumulative environment justice impacts.
Air quality	Yes	The combination of the proposed Project and past, present, and RFFAs could result in an increase in criteria pollutants, fugitive emissions, greenhouse gases, and toxic and hazardous air pollutants. These increases could cause some standards to be exceeded, resulting in minor cumulative impacts.
Groundwater hydrology and water quality	No	No other reasonably foreseeable future actions were identified that would interact with groundwater levels or groundwater quality impacts resulting from the proposed Project or the Modified Project Alternative to produce synergistic or additive effects in the study area. The proposed Project and alternatives would contribute to a minor loss in the cumulative groundwater availability in the Piedmont ecoregion of South Carolina.

Table 5-1 Screening of Cumulative Impacts by Resource Area (Continued)

Resource Area	Potential to Contribute to Cumulative Impacts in More Than a Minor Way?	Rationale
Water supply and floodplains	No	The proposed Project and alternatives would result in a small beneficial reduction of flood elevations in regulated floodplains. Because the identified RFFAs do not include any substantial reasonably foreseeable changes in floodplain flood elevations, other than general growth and urbanization development, cumulative impacts on flood elevations would be minor. Water supplies in the study area are primarily from private and municipal water systems serving the study area, and water sources for these systems would not be affected by the proposed Project or the Modified Project Alternative. Consequently, no cumulative impacts are expected.
Terrestrial resources	No	The permanent conversion of forested lands to other land covers under the proposed Project and the Modified Project Alterative, in combination with other RFFAs, would contribute to cumulative impacts. Because of the small area of forested land that would be converted at the Project site relative to regional forest resources, this potential cumulative impact would be minor. Impacts of the proposed Project on terrestrial resources would be localized and temporary. When combined with other RFFAs, Project-related impacts generally are not expected to result in cumulative impacts on terrestrial resources. Localized impacts on one state-listed plant species (*Nestronia umbellula*) would cause a minor cumulative impact on the species at a regional level.
Federally listed species	No	Because no federally listed species or their critical habitats are present in the study area, there would be no impacts on any federally listed species or their critical habitat present. Consequently, neither the proposed Project nor the Modified Project Alternative would cumulative affect federally listed species.
Transportation	No	The small incremental increase in local traffic generated by the Haile Gold Mine Project combined with other past, present and RFFAs is not expected to exceed the level of service requirements for roads and highways in the vicinity of the proposed Project. As such, adverse cumulative impacts are unlikely to occur.
Cultural resources	No	Project-related impacts on cultural resources would be minor and would be mitigated through implementation of a Cultural Resources Management Plan in coordination with the South Carolina State Historic Preservation Office. The presence of cultural resources on other potential development sites is unknown and cannot be evaluated.
Visual resources and aesthetics	No	No other reasonably foreseeable future actions were identified that would interact with the localized visual impacts of the proposed Project or the Modified Project Alternative to produce synergistic or additive cumulative effects in the study area.
Recreation resources	No	Potential impacts of the Project and the Modified Project Alternative on recreation use would be minor and no reasonably foreseeable projects or activities were found in the study area with the potential produce synergistic or additive cumulative effects on recreation resources.

Table 5-1 Screening of Cumulative Impacts by Resource Area (Continued)

Resource Area	Potential to Contribute to Cumulative Impacts in More Than a Minor Way?	Rationale
Land Use	No	The identified RFFAs do not include any substantial changes in types of land use other than general growth and urbanization development. No projects or activities were found that would interact with the proposed Project or Modified Project Alternative to produce cumulative impacts on land use.
Noise and vibration	No	The impact of the Project and the Modified Project Alternative on noise and vibration would be localized and minor; no other projects or activities were found that would interact with Project-related impacts to produce cumulative impacts on noise and vibration.
Health and safety	No	The impact of the Project and the Modified Project Alternative on health and safety would be minor. Because of the adequacy of emergency response in the region and because other RFFAs were not found that would interact with Project-related impacts on human health and safety, cumulative impacts on human health and safety are not anticipated.
Hazardous materials and waste	No	The hazardous materials used by and the hazardous waste generated by the proposed Project would be handled in accordance with appropriate regulatory standards and Haile's proposed plans. Other RFFAs would be subject to the same regulatory standards and are not expected to interact with the proposed Project in a way that would result in cumulative impacts related to hazardous materials and waste.

5.4 Geographic and Temporal Scope

A cumulative impacts analysis requires expanding the geographic area of the study beyond that of the proposed Project and expanding the temporal limits to consider past, present, and future actions that may affect the resources of concern. Individual geographic boundaries (study areas) were established in Chapter 3 for each resource area evaluated in the EIS. By their nature, impacts on groundwater and wetlands are subregional, occurring in the general vicinity and watershed of the Project area. Socioeconomic and air quality impacts are more regional and thus required an expanded study area to assess cumulative impacts. For the analysis of cumulative impacts, the geographic scope was expanded to include a 60-mile radius around the Project area (Figure 5-1). This distance includes the two regional population centers of Charlotte, North Carolina and Columbia, South Carolina. This geographic scope would include potential upwind air emission sources that may affect air quality impacts in the immediate Project vicinity. The 60-mile radius includes the following counties: Cabarrus, Gaston, Anson, Richmond, Montgomery, Mecklenburg, Stanly, Scotland, and Union Counties in North Carolina; and Chester, Lancaster, Union, York, Cherokee, Fairfield, Newberry, Lexington, Richland, Calhoun, Sumter, Lee, Clarendon, Kershaw, Florence, Darlington, Dillon, Marlboro, and Chesterfield Counties in South Carolina.

For the temporal scope, a 20-year time frame was selected. The active mining and initial reclamation phase of the proposed mine would last for 15 years. Following completion of mining, reclamation and closure activities would continue. The longest planned activity involves filling the pit lakes, which would continue for a number of years beyond completion of mining activities. Monitoring and maintenance of individual facility closures, such as Johnny's PAG and the TSF, would continue for up to 30 years. Extending the temporal scope of the cumulative impacts analysis much beyond the active mining and initial reclamation period would involve projecting the existence of new projects and programs more than 20 years into the future. Such projections would be speculative and beyond a reasonable timeframe.

5.5 Identification of Past, Present, and Reasonably Foreseeable Future Actions

Relevant projects, plans, and programs that could interact with the proposed Project or the alternatives were identified during the environmental analysis for the specific resource areas. To identify RFFAs, a general literature search was conducted, several sources were reviewed, and agencies were contacted. The sources and agency contacts included, but were not limited to:

- Kershaw Economic Development Office
- South Carolina Department of Commerce
- North Carolina Department of Commerce
- U.S. Fish and Wildlife Service, South Carolina Field Office
- Haile Gold Mine Scoping Report
- Kershaw News Era
- Lancaster News Era
- South Carolina Statewide Transportation Improvement Program
- USACE Permit Records

Table 5-2 provides a summary of potential plans, programs, and projects obtained from the above sources. Appendix O contains more detailed descriptions of the projects that were identified. Figure 5-1 illustrates the locations of the past, present, and RFFAs in relation to the Haile Gold Mine Project. A review of these actions indicates that cumulative impacts would result primarily from changes to general regional economic drivers, regional mining activity, urban and industrial development, agriculture and forestry, and transportation and roadways.

Table 5-2 Past, Present, and Reasonably Foreseeable Future Actions in the Study Area for Cumulative Impacts

Project	Key Potential Cumulative Impacts
South Carolina	
Ridgeway Mine	Regional mining activity
Brewer Mine	Regional mining activity
Interstate 73	Regional transportation project
PDM US	Urban and industrial development, general regional economic drivers
DLS Retreading	General regional economic drivers, urban and industrial development, transportation and roadways
Carolina Heelsplitter Conservation Bank	Agriculture and forestry
Red Ventures	General regional economic drivers, urban and industrial development, transportation and roadways
Thomas & Betts Corporation	General regional economic drivers, urban and industrial development, transportation and roadways
Avtec, Inc.	General regional economic drivers, urban and industrial development, transportation and roadways
Owen Steel Company, Inc.	General regional economic drivers, urban and industrial development, transportation and roadways
Constantia Hueck Foils, LLC	General regional economic drivers, urban and industrial development, transportation and roadways
2AM Group	General regional economic drivers, urban and industrial development, transportation and roadways
AQT Solar	General regional economic drivers, urban and industrial development, transportation and roadways
Continental Tire the Americas	General regional economic drivers, urban and industrial development, transportation and roadways
INVISTA	General regional economic drivers, urban and industrial development, transportation and roadways
Angus-Palm	General regional economic drivers, urban and industrial development, transportation and roadways
Caliber Funding	General regional economic drivers, urban and industrial development, transportation and roadways
McCall Farms, Inc.	General regional economic drivers, urban and industrial development, transportation and roadways
Excel	General regional economic drivers, urban and industrial development, transportation and roadways
Silcotech North America, Inc.	General regional economic drivers, urban and industrial development, transportation and roadways
HARTMANN USA, Inc. Expansion	General regional economic drivers, urban and industrial development, transportation and roadways
Jones-Hamilton Co.	General regional economic drivers, urban and industrial development, transportation and roadways
Haddon House Food Products, Inc.	General regional economic drivers, urban and industrial development, transportation and roadways
Fancy Pokket Corporation	General regional economic drivers, urban and industrial development, transportation and roadways

Table 5-2 Past, Present, and Reasonably Foreseeable Future Actions in the Study Area for Cumulative Impacts (Continued)

Project	Key Potential Cumulative Impacts
South Carolina (Continued)	
Lancaster County Air-Rail Business Park	General regional economic drivers, urban and industrial development, transportation and roadways
Element Electronics	General regional economic drivers, urban and industrial development, transportation and roadways
Time Warner Cable	General regional economic drivers, urban and industrial development, transportation and roadways
North Carolina	
XPO Logistics	General regional economic drivers, urban and industrial development, transportation and roadways
InVue Security Products, Inc.	General regional economic drivers, urban and industrial development, transportation and roadways
United Technologies Corporation	General regional economic drivers, urban and industrial development, transportation and roadways
MetLife, Inc.	General regional economic drivers, urban and industrial development, transportation and roadways
Otto Environmental Systems North America, Inc.	General regional economic drivers, urban and industrial development, transportation and roadways
Infinisource Holdings, Inc.	General regional economic drivers, urban and industrial development, transportation and roadways
FerroFab, Inc.	General regional economic drivers, urban and industrial development, transportation and roadways
FCC, LCC	General regional economic drivers, urban and industrial development, transportation and roadways
CLT Packaging USA	General regional economic drivers, urban and industrial development, transportation and roadways
Midway Aircraft Instrument Corporation	General regional economic drivers, urban and industrial development, transportation and roadways
AREVA	General regional economic drivers, urban and industrial development, transportation and roadways
JELD-WEN	General regional economic drivers, urban and industrial development, transportation and roadways
Beardow-Adams, Inc.	General regional economic drivers, urban and industrial development, transportation and roadways
GrowGreen Power, Inc.	Agriculture and forestry
Owens Corning	General regional economic drivers, urban and industrial development, transportation and roadways

Sources: Charlotte Business Journal 2013; The Conservation Fund 2010; Lancaster Business Journal 2013; Lancaster SC Works 2013a, 2013b; NCDC 2011a, 2011c, 2011d, 2012a, 2012b, 2012c, 2012d, 2012e, 2012f, 2013a, 2013b, 2013c, 2013d, 2013e; SCDC 2010, 2011a, 2011b, 2012a, 2012b, 2012c, 2012d, 2012e, 2013a, 2013b, 2013c, 2013d, 2013e, 2013f, 2013g, 2013h, 2013i, 2013j, 2013k, 2013l; Red Ventures 2013; Palmetto Power 2013.

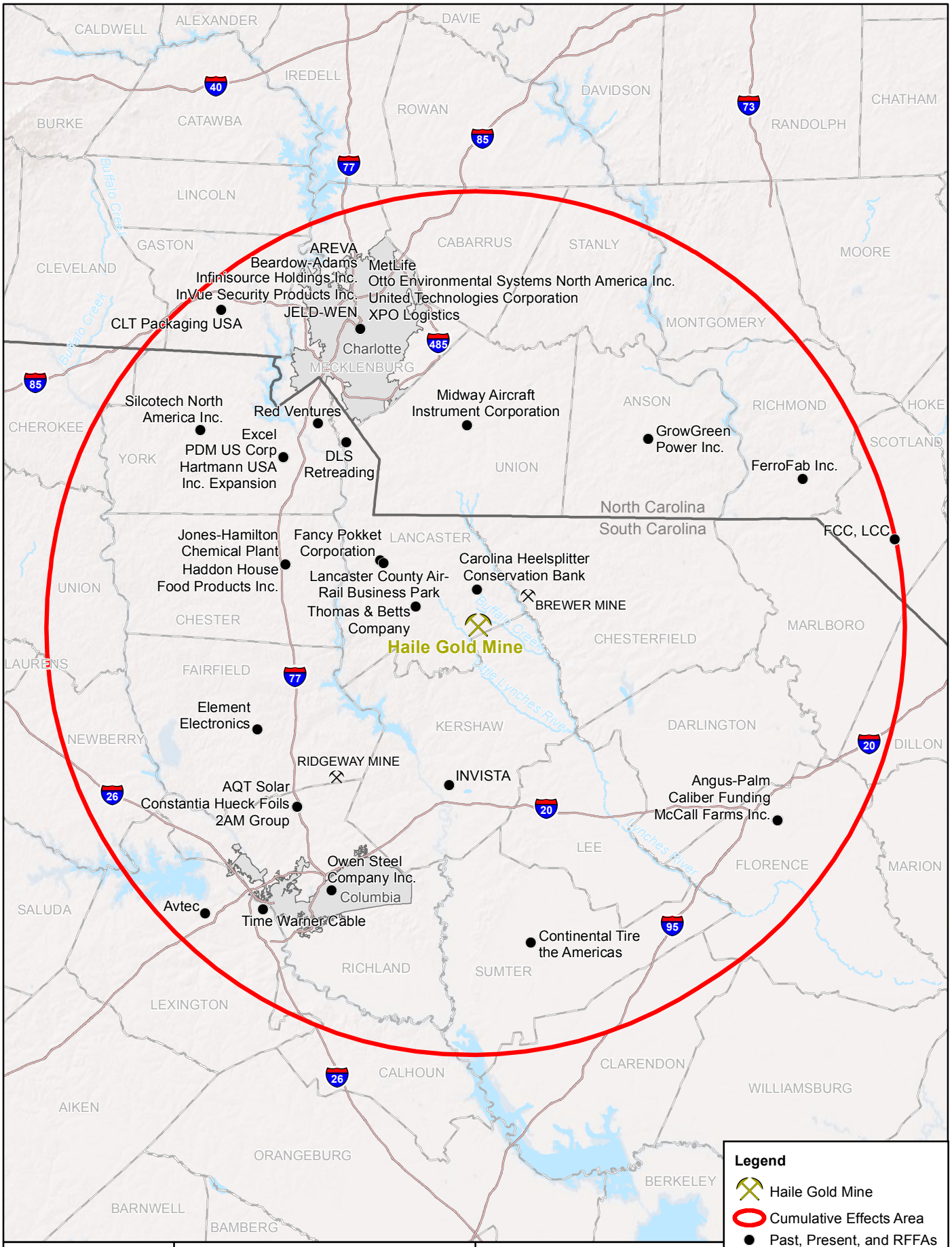

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Figure 5-1

Locations of Actions Considered in the Cumulative Impact Analysis

5.6 Assessment of Cumulative Impacts

The proposed Project and alternatives, in combination with the past, present, and RFFAs identified in Table 5-2, could result in cumulative impacts from changes to general regional economic drivers, mining, urban and industrial development, agriculture and forestry, and transportation and roadways, as discussed below. Each resource area with the potential to result in more than minor cumulative impacts (Table 5-1) was further considered with regard to the past, present and RFFAs identified in Table 5-2. These resources are geology and soils, surface hydrology and water quality, aquatic resources, wetlands and Waters of the U.S., socioeconomics and environmental justice, and air quality.

General Regional Economic Drivers

The economies of both South Carolina and North Carolina are transitioning from labor-intensive industries to knowledge-based and service-related industries. This represents the region's long-term shift from labor-intensive product production to a more capital-intensive production that requires fewer and more highly skilled workers. South Carolina is expecting to see an increase in transportation and machinery manufacturing and technical service jobs; jobs in textile and apparel manufacturing are anticipated to continue to decline (SCDC 2010a). In North Carolina, the largest industry sectors are currently government, health care and social assistance, retail trade, and manufacturing—these industries account for greater than 55 percent of the employment in the state (NCDC 2011b).

Regional Mining Activity

The study area for cumulative impacts is located within the Carolina Slate Belt of northern South Carolina (Figure 1-2), where gold and other minerals were mined intermittently from 1827 until 2010. The most noteworthy gold-producing mines in the area included the Haile Gold Mine, Ridgeway Mine, and Brewer Mine. Between 1951 and 2009, mining for other products occurred near the historical Haile mine pits. Exploration for gold resumed off and on between 1973 and 1985 by the Cyprus Exploration Company. Open-pit mining was resumed by the Piedmont Mining Company whereby a total of 85,000 ounces of gold was produced between 1985 and 1992 using open-pit heap leaching. In 1992, gold mining ended, but further exploration continued, with estimated reserves of 780,000 ounces. Because of unfavorable economic conditions, mining did not resume, and the mined areas underwent reclamation; monitoring of reclamation activities is presently ongoing.

The largest (historical) deposits of gold include Haile Gold Mine (approximately 4.2 million ounces), Ridgeway Mine (approximately 1.5 million ounces) and Brewer Mine (approximately 0.25 million ounces) (USGS 2012). The presence of mineral deposits that have been mined in the past indicates the potential for future mining in the region. More specifically, re-opening closed mines based on a more favorable price of gold would indicate the potential for future mining. However, expansion of existing mines would be limited by land conditions, resource availability, and environmental constraints (ERC 2011). Some of the historic mines have been closed and are under remediation. Furthermore, no feasibility studies quantifying a mineral reserve, a first step to future mining, were identified during this cumulative impacts analysis. Therefore, while the gold-bearing resources are known to occur in the region, cumulative impacts resulting from other mining operations are speculative.

Urban and Industrial Development

Business ventures under consideration and listed as possible RFFAs in South Carolina within the study area for cumulative impacts include industrial manufacturers; marketing and technology firms; steel fabricators; agricultural expansions; energy developers; and communications, internet, and television service providers. In addition, several industries are entering the market or expanding established markets,

including supply chain management; chemical, silicone, electronics, and other product manufacturing. New and expanding industry activity also is expected within the study area for cumulative impacts in North Carolina. These developments include manufacturers of metals, plastics, and automotive components; insurance companies; and energy providers. Available information for these companies is provided in Appendix O.

Agriculture and Forestry

Forested lands cover two-thirds of the total area in South Carolina (SCDA 2011, as cited in ERC 2011). The first record of the timber industry dates back to 1670, which coincides with the establishment of Charleston as the colony's first permanent settlement. Poor forestry management practices historically led to a decline in South Carolina's timber industry. Beginning in the 1930's, however, reforestation, timber management, and sustained yield improved the region's timber stock. South Carolina's forests now contain 21.5 billion cubic feet of wood, more than at any time in the past century. The state's forests, both hardwood and softwood, are growing more wood than is being harvested. The present net annual softwood growth is 817 million cubic feet per year, the highest ever recorded. Furthermore, net annual hardwood growth rates have steadily increased, with a present annual growth of 387 million cubic feet per year, approaching the highest growth rate recorded by the state (SCFC 2006, as cited in ERC 2011). The ecologic and economic trends of the timber industry appear to be stable at present (ERC 2011). Historical land use practices in the Project area and vicinity include timber harvest. The trend of increased timber growth, production, and export throughout the state is expected to continue into the future (ERC 2011).

Transportation and Roadways

Historically, much of Lancaster County lacked a major roadway system. The region's economic need for industrial development by way of product export gave rise to development of the current well developed regional roadway system. Presently, major highways include US 521, Highway 9, and US 601 which connect the north, central and southern portions of Lancaster County to all major points in the region (ERC 2011). The South Carolina Statewide Transportation Improvement Program (STIP) covers all federally funded improvements that are expected to occur within a 6-year period (currently through 2019). The STIP is updated every 3 years and is revised on a continual basis to reflect the latest program and project information (SCDOT 2013).

5.6.1 Geology and Soils

The proposed Project would result in an increase in the historical extraction of gold ore resources in the Carolina Slate Belt in combination with past mining activity, and would contribute to an irreversible cumulative reduction in the regional amount of gold and other mineral resources. Although the gold-bearing resources are known to occur in the region, evaluating cumulative impacts that may result from future mining operations would be speculative. The estimated gold resource at Haile totals approximately 4.8 million ounces (USGS 2012).

5.6.2 Surface Water Hydrology and Water Quality

The water quality conditions and trends of the upper Little Lynches River and its tributaries were fully described in Section 3.4, "Surface Water Hydrology and Water Quality." Notably, the upper Little Lynches River and tributaries have historically experienced water quality degradation, and trends between 1999 and 2003 showed mostly improving water quality conditions. More recently, Horton Creek (Station PD-335) and Little Lynches River (Station PD-006) were included on the State's approved 2010 and draft 2012 Section 303(d) lists of impaired waterbodies because of excessive levels of fecal coliform (Altman 2012). In 2004, Haile Gold Mine Creek was listed as impaired for aquatic life use because of low pH

levels. It was removed from the State's 303(d) list of impaired waters in 2004 because, based on an assessment performed by Water Management Consultants (2003), the State deemed that the low pH was caused by natural conditions.

Total maximum daily loads (TMDLs) for fecal coliform, due to runoff from pastureland, were developed (Altman 2012) and approved for Hanging Rock Creek and Lick Creek, both of which are within the upper Little Lynches River watershed. To meet the recreational use standard, the needed reductions in current fecal coliform loading from pastureland were estimated to be 84 percent and 64 percent, respectively (SCDHEC 2007). The Little Lynches River at US 601, immediately adjacent the Project area is currently listed as impaired for recreational use due to exceedances of the fecal coliform criteria (SCDHEC 2012). This segment previously was listed as impaired for aquatic life use because of exceedances of the copper criteria, but the impairment listing was removed in 2008 when the copper criteria were attained. Segments of the Little Lynches River upstream and downstream of the segment at US 601 are listed as biologically impaired for aquatic life. (SCDHEC 2012b).

Water quality trends between 1999 and 2003 indicate generally improving water quality conditions. Of four stations that were not supporting or partially supporting their designated uses, all four improved from not supporting to partially supporting and from partially supporting to fully supporting (see Section 3.4, "Surface Water Hydrology and Water Quality").

Within the watershed context of the upper Little Lynches River, the proposed Project and the alternatives have the potential to contribute incrementally to cumulative water quality degradation. This potential incremental impact would likely be small for most parameters. Specifically, mining activities would be unlikely to contribute to cumulative increases in fecal coliform, as mining does not produce loadings of fecal coliform and the reduction of forested areas may reduce fecal loadings from wildlife. Further, the mine would be connected to the Town of Kershaw sewage treatment plant, which has the existing capacity to accommodate the proposed Project's sanitary waste.

The proposed Project and alternatives have the potential to contribute additional loadings of nutrients, and at times low flows, would contribute indirectly to additional biological oxygen demand downstream in the Little Lynches River. However, this would be expected to be a minor contribution to cumulative nutrient and biological oxygen demand loadings in the upper Little Lynches River watershed.

Changes in surface water quality from the proposed Project have the potential to interact with other past, present and RFFAs and contribute to reductions in water quality conditions in the upper Little Lynches River. Because of the recent improving trend in water quality in the basin and because the identified RFFAs do not include any substantial changes in types of land use other than the general growth and urbanization development discussed above, only minor cumulative impacts on water quality would be expected to occur as a result of the proposed Project and alternatives.

5.6.3 Aquatic Resources

Many of the aquatic resources of the streams, wetlands, and lakes potentially affected by the proposed Project and its alternatives are common and geographically widespread, with generally healthy regional populations that are not considered to be at risk, threatened, or high priority conservation resources. For these aquatic resources, the proposed Project and its alternatives are not expected to interact with the RFFAs to produce more than minor cumulative impacts. These include many species of stream and riverine fish and macroinvertebrates, and common and widely distributed amphibian and reptile populations. It is recognized however, that there is a paucity of information on many species, particularly regarding current population trends or distributions.

Other less common, geographically limited, or more sensitive aquatic and aquatic-dependent species could experience more than minor cumulative impacts. Included in this category are certain fishes, freshwater mussel species, and amphibians. Although no federally listed species were found within the study area and thus would not be cumulatively affected, a number of fish species were found in the study area that are rated as the highest or high conservation priority by the SCDNR. These included the Sandhills chub, American eel, greenhead shiner, Piedmont darter, and yellowbelly slider (Table 5-3).

As described in Section 4.7, "Aquatic Resources," existing stream populations of Sandhills chub in Haile Gold Mine Creek and upper Camp Branch Creek would be considerably affected, as middle Haile Gold Mine Creek would be excavated and upper Haile Gold Mine Creek would be completely fragmented and isolated from downstream segments for many years. Both of these stream segments support abundant Sandhills chub. These impacts, together with flow reductions, higher stream temperatures, and potential water quality degradation, are expected to result in the loss of Sandhills chub from upper Haile Gold Mine Creek; lower Haile Gold Mine Creek may become marginally acceptable or uninhabitable by Sandhills chub, as may upper Camp Branch Creek.

Considering Sandhills chub within the broader geographic area, the impacts of the proposed Project together with the potential impacts of the RFFAs, would result in cumulative impacts that are likely to be minor. The Sandhills chub has a current National Status of N3N4 (N3-Vulnerable, N4-Apparently Secure); and the South Carolina state status is S2, or imperiled (NatureServe 2012). In 1991, the Sandhills chub was proposed to be added to the list of protected species in South Carolina; however, it was found to be more abundant than previously believed (USFWS 1991). From surveys completed by Rohde and Arndt (1991), the Sandhills chub was found in more locations than previously known and its general population was thought to be underestimated because they are difficult to collect. Rohde and Arndt (1991) concluded that although the current populations do not appear to be in jeopardy, segments of the population could become locally extirpated because of habitat degradation from stream impoundments in the region. Any additional impacts on headwater streams used by the Sandhills chub within the cumulative effects area could further reduce known populations and could lead to the species being considered for state or federal listing. Given the population status of Sandhills chub throughout its range, when regional development and RFFAs are considered, cumulative impacts on Sandhills chub would be minor for the time period considered. The incremental impact of the proposed Project would be long term, but these impacts would be ameliorated over time as the habitat of the affected streams would gradually improve following reclamation and closure of the mine.

Conclusions regarding cumulative impacts on other SCDNR highest or high conservation priority species such as the greenhead shiner, Piedmont darter, and yellowbelly slider would be similar to the conclusions about cumulative impacts for the Sandhills chub. The incremental impacts of the proposed Project and its alternatives would be less on these other species as they were not found to inhabit Haile Gold Mine Creek; therefore, cumulative impacts also would be less.

Based on a petition filed in 2010 to extend federal protection to the American eel, the USFWS is currently completing a more extensive status review of the species (USFWS 2011). Juvenile and adult American eel were found in the Little Lynches River, but not within any of the other potentially affected tributaries. As described in Section 4.7, "Aquatic Resources," based on the existing distribution of American eel in the upper Little Lynches River, the status of the species population, and activities associated with the RFFAs, cumulative impacts on American eel would be minor. The results of the status review of the American eel are not available for consideration in this EIS.

Table 5-3 South Carolina High and Highest Priority Aquatic Species Occurring or Potentially Occurring in the Study Area

Organism Type	Common Name	Scientific Name	South Carolina Priority Species Conservation Status	Potential for Occurrence in the Study Area
Fish	American eel	*Anguilla rostrata*	Highest	Observed
Fish	Sandhills chub	*Semotilus lumbee*	Highest	Observed
Fish	Broadtail madtom	*Noturus* spp. c.f. *insignis*	Highest	Potential
Fish	Thinlip chub	*Cyprinella* spp. c.f. *zanema*	Highest	Potential
Amphibian	Carolina gopher frog	*Lithobates capito capito*	Highest	Potential
Amphibian	Pine-barrens treefrog	*Hyla andersoni*	Highest	Potential
Amphibian	Tiger salamander	*Ambystoma tigrinum*	Highest	Potential
Reptile	Coral snake	*Micrurus fulvius*	Highest	Potential
Reptile	Southern hognose snake	*Heterodon simus*	Highest	Potential
Mussel	Carolina creekshell	*Villosa vaughaniana*	Highest	Potential
Mussel	Creeper	*Strophitus undulates*	Highest	Potential
Fish	Greenhead shiner	*Notropis chlorocephalus*	High	Observed
Fish	Piedmont darter	*Percina crassa*	High	Observed
Fish	Quillback	*Carpiodes cyprinus*	High	Potential
Fish	Seagreen darter	*Etheostoma thalassinum*	High	Potential
Amphibian	Four-toed salamander	*Hemidactylium scutatum*	High	Potential
Amphibian	Upland chorus frog	*Pseudacris triseriata*	High	Potential
Reptile	Black swamp snake	*Seminatrix pygaea*	High	Potential
Reptile	Florida cooter	*Pseudemys floridana*	High	Potential
Reptile	Pine snake	*Pituophis melanoleucus melanoleucus*	High	Potential
Reptile	River cooter	*Pseudemys concinna*	High	Potential
Reptile	Spiny softshell turtle	*Apalone spinifera*	High	Potential
Reptile	Striped mud turtle	*Kinosternon baurii*	High	Potential
Reptile	Yellowbelly slider	*Trachemys scripta scripta*	High	Observed
Mussel	Rayed pink fatmucket/Eastern lampshell	*Lampsilis splendida/radiata*	High	Potential

As with other aquatic species, the main cause for decline (and in some cases endangerment) in freshwater mussel populations is cumulative habitat alteration and destruction (Neves 1999). Besides changes to their habitat, any reductions in the species diversity and abundance of the host fish species could contribute to reduced species richness in mussel populations (Neves 1999). Although freshwater mussels were not found within the Project boundary (as discussed in Section 3.7), a few common species were observed in the Little Lynches River. In Section 4.7, the populations in the Little Lynches River and Buffalo Creek were predicted to have few stressors; therefore, the mussel populations should remain

largely unaffected. When regional development and the RFFAs are considered, the cumulative impacts on regional populations of freshwater mussels should be minor.

A total of 147 amphibians are known to live within the southeastern United States, making it the most diverse region in the nation for this group (Dodd 1997). Since the mid-1980s, herpetologists have been concerned about apparent global declines in amphibian populations (Wake 2003). Recent research has implicated several factors in population declines, including: habitat destruction and alteration, climate change, chemical contaminants, diseases, parasites, invasive species, and commercial overexploitation (Semlitsch 2003). In a review of the literature regarding the declines of individual southeastern species, Dodd (1997) found that habitat alteration and loss were the most commonly implicated factors.

Insufficient information is available in the study area to adequately determine the potential impacts of the proposed Project and its alternatives on specific amphibian species. However, given the large potential direct and indirect impacts on wetlands and streams in the study area, and the dependence of amphibian species on these habitats for important parts of their life cycles, the impacts on amphibian populations could be more than minor given the extent of impacts on streams and wetlands.

5.6.4 Wetlands and Other Waters of the United States

Historically, the majority of South Carolina's wetlands were in the eastern half of the state, with relatively few in the Piedmont ecoregion (Dahl 1999). The severe erosion of farmland soil and abandonment of farmland during the Great Depression led to sedimentation of an unknown amount of Piedmont wetlands (SCDNR 2005). In 1989, wetlands made up 21 percent of the state's land area, but less than 5 percent of the state's wetlands were located in the Haile Gold Mine study area (Dahl 1999). Hydroelectric projects may have caused greater wetland impacts than other past activities, but actual acreages of previous wetland removal resulting from hydroelectric projects are not known for the geographic area being considered here. Currently, many wetlands in the geographic area of interest primarily are associated with creeks and rivers.

Nationally, between 2004 and 2009, forested wetlands declined by an estimated 633,100 acres (Dahl 2011). Forested wetlands experienced the largest change in area of any wetland type and reversed a trend where area had increased in the previous two eras of monitoring (Dahl 2011). Forty-one percent of all freshwater vegetated wetland losses nationally were forested wetlands in the southeastern states of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Arkansas. Much of this was the result of change to other wetland types, such as freshwater shrub or emergent wetlands, resulting from clear cutting associated with silviculture (Dahl 2011).

Losses of forested wetlands resulting from the proposed Project and its alternatives would result in a minor to moderate incremental cumulative effect on forested wetlands nationally and in the Piedmont ecoregion of South Carolina, respectively.

5.6.5 Socioeconomics and Environmental Justice

The economic analysis presented in Section 4.10, "Socioeconomics and Environmental Justice" is inherently a cumulative analysis that includes a four-county study area encompassing Lancaster, Kershaw, Richland, and York Counties. A statewide economic impacts analysis for South Carolina also was conducted. Regional economic impacts would include direct benefits as a result of the proposed Project and additional economic benefits in the local economy, based on linkages among industries and households. Although no specific data on RFFAs are available to reliably predict future economic conditions, it is likely that the addition of the projects identified in Table 5-2 (and discussed further in Appendix O) would contribute to an increase in jobs and associated economic benefits to the region.

5.6.6 Air Quality

The SCDHEC operates several air quality monitoring stations throughout the state (SCDHEC 2012b). Review of data from these stations (see Section 3.16, "Air Quality") indicates that the air quality in the region is generally good and that no federal standards have been exceeded during the monitoring period (2008–2010). However, the combination of the proposed Project and past, present, and RFFAs could result in an increase in criteria pollutants, fugitive emissions, GHGs, and TAPs and HAPs that could cause some standards to be exceeded. Air quality modeling of pollutants (Section 4.16, "Air Quality") indicates that emissions associated with the Haile Gold Mine would be below major source thresholds. Assessing future air quality in the study area for cumulative impacts is speculative because no specific air quality emissions data on RFFAs are available to reliably predict future conditions.

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