

**CUMULATIVE IMPACTS ANALYSIS
OHIO COUNTY, KENTUCKY
Warden Waste Site**

Introduction

This document will use terminology following current EIS guidance. An impact, or effect, means the change or modification to an environmental resource brought about by an outside action. Impacts can, and will, vary in significance, magnitude, and duration. Impacts may also be beneficial or adverse depending on the action and resource affected. For this analysis, short-term impacts are those with effects evident for a few years, generally less than the lifetime of the project (e.g. ground clearing activities). Long-term impacts generally would be those with effects extending beyond the lifetime of the project (i.e. beyond reclamation). Impact magnitude will be defined as follows: major impacts could cause significant change, stress, or depletion to an environmental resource, potentially resulting in irretrievable loss; moderate impacts could cause some change in a resource, generally with readily apparent effects; minor impacts are those that are detectable but slight; negligible impacts are those at the lower limit of detection causing insignificant change or stress to resources; and no impact applies to a level at which no discernable or measurable impacts are observed. In cases where quantitative resource evaluation was not possible, analyses were based on best available information and professional judgment. (Office of Surface Mining, 2006).

The proposed project area, also referred to as Warden Waste Site, has a footprint of 309.8 acres. The cumulative impact analysis has been expanded to consider the 12-digit HUC watersheds containing the site; the "Review Area" now refers to Headwaters of Elk Creek-Green River, HUC 051100030505 (35.7 mi²) and Nelson Creek-Green River, HUC 051100030504 (32.1 mi²) (Exhibit 1). Few data, other than basic census counts, are available prior to the previous few decades. As a result, much of the discussion of past impacts is qualitative. Current and future impacts are based upon the best available data for resources of concern, but still involve a degree of speculation. Cumulative impacts were considered based upon present-day baseline conditions defined. The future time boundary of the analysis is determined by the release of project areas from agency oversight. The estimated lifetime of the project is fifteen years, and an additional five years for reclamation and bond release of the mine areas will be assessed. Therefore, the cumulative impacts analysis will focus on a period of earliest available data for each resource to twenty years after mining begins, and will refer to this timeframe as the "Review Period" for the remainder of the document.

Baseline Conditions

Landuse data were extracted from the NRCS National Landcover Database 2006 raster dataset. Rasters were converted to polygon shapefiles in ArcGIS 9.3.1, clipped to the Review Area extents, and totals of each landcover were tabulated. Landcover classifications were then spot-checked against USDA NAIP 2010 aerial imagery and found to be accurate. These data show significant manipulation of the landscape by land-use changes (Exhibit 2). Much of the review area has been cleared of trees and developed for agriculture and coal mining, but large forested areas remain. Forest still covers 42.9% of the Review Area (19,053 acres), and is concentrated in areas of higher-relief, as well as along main stream channels and larger tributaries. Agricultural lands

represent 37.9% of the Review Area landcover, occupying 16,820 acres. These farmlands mostly were established in the 19th century, while remaining landuses generally reflect more recent land development. Developed areas predominantly consist of roadway (3.4%, or 1,506 acres), whereas others are considered to be mostly medium to low-intensity. Open water and undeveloped grassland represent other minor landcovers (6.3%, or 2,784 acres), and often are the result of anthropogenic land manipulation (e.g. previous and current mining operations) (NLCD, 2006). Wetlands, both natural and manmade, represent 8.4% (3,721 acres) of the Review Area; the remaining 1.1% is a combination of developed, scrub/shrub, and barren land surfaces.

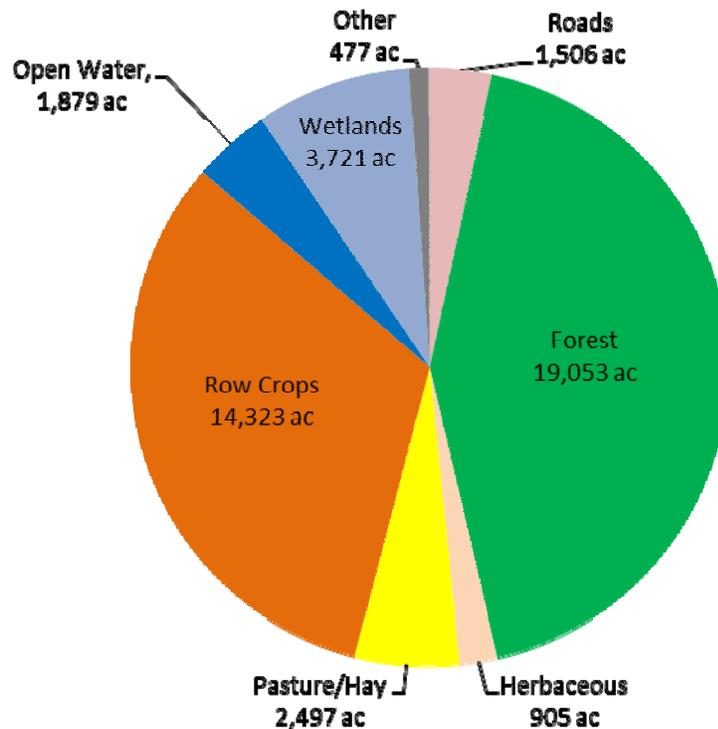


Figure 1. Review Area landcover totals. Data extracted from USGS NLCD 2006 dataset and 2010 NAIP aerial imagery.

Agriculture and coal mining have been important to the economy of the region, and remain a significant source of employment and revenue; of the 120 Kentucky counties, Ohio ranks 8th in popcorn production, and 20th in both corn and soybean production. Furthermore, they are the 5th highest broiler (and other meat-type chickens) producer in the state (US Department of Agriculture, 2007). As a result, cultivated agricultural land occupies 32.3% of the Review Area (14,323 acres), and pasture makes up 5.6% (2,497 acres). In terms of mining, Ohio is one of 21 counties located within the Western Coal Field of Kentucky, a region that produced over 40,771 thousand tons of coal in 2011; Ohio County contributed to 5% (or 5,528 thousand tons) of the state's total coal production (Kentucky Coal Facts, 2011). Within the Review Area there are 9,345.7 acres of previously-mined land, whereas active underground and surface mining occupies a total of 3,668.8 acres over eight sites (Exhibit 3). Lastly, two sites are under active reclamation and 51 have been fully reclaimed.

Agriculture and mine development of the landscape, coupled with the richness of hydric soils and floodplains, has resulted in significant historic wetland impacts. Overall loss of wetlands was estimated following Indiana Department of Environmental Management methodology; hydric soil extent is used as a proxy for historic wetland extent and is then compared to current wetland area (IDEM, 2008). For this CIA, an intersect analysis of hydric soil map units versus NWI wetland polygons (excluding Cowardin classifications representing open water) was run in ArcGIS 9.3.1. Results were checked against aerial photos and hydric soil extent and were found to be unsatisfactory in some areas; some areas were identified within the current (undisturbed) extent of hydric soil that possessed distinct hydrologic indicators as described in the USACE Eastern Mountains and Piedmont Regional Supplement Wetland Delineation Manual. These areas were included in subsequent spatial analyses as “likely” wetland areas. Revised results suggest of potentially 17,693 acres of wetland in the Review Area, approximately 3,271 acres remain, a loss of approximately 79% (Exhibit 4). This total is in line with the approximately 80%-85% loss estimated for the state as a whole. Most losses occurred during agricultural development early in the history of the county, but continued even after passage of the Clean Water Act, declining by approximately 1.8% of the remaining area annually (Dahl and Johnson, 1991). From 1998 to 2006, declines have been approximately 0.5% for marshes (~0.08% annually), but increases of 1.1% (~0.2% annually) have been seen in forested wetlands as scrub-shrub areas mature. Relatively large overall wetland increases are inflated by construction of ponds, and may mask an overall loss of wetland function (Dahl, 2006). Estimated remaining wetland area is primarily palustrine forested, with minor contributions from palustrine scrub-shrub and emergent (Table 1).

Table 1. Baseline wetland resources in Review Area.

Cowardin Classification	Number of Water Bodies	Acreage*
Palustrine Forested	159	3,365
Palustrine Scrub-Shrub	4	23
Palustrine Emergent	18	334
Riverine Fringe	3	435
Lake Fringe	3	31
Pond Fringe	154	652
Total:	341	4,840

**Note all fringe wetland classifications excluded from spatial analyses and impact estimates*

This analysis was extended to quantify wetland loss due to agriculture and mining practices, the dominant agents of land-use change in the Review Area. The extent extracted from the NLCE 2006 dataset was checked against 2010 NAIP aerial imagery and manually corrected when necessary. The resulting layer was in a second intersect analysis versus original wetland extent, whose results suggest 2,681 acres of wetland have been impacted by mining, while 10,085 acres have been impacted by agriculture, a nearly fivefold difference in magnitude.

Streams have also been impacted. Examination of the NHD dataset (USGS, 2012), topographic maps (USGS 1951, 1953, 1973, 1982), and aerial photos (USGS, 2010) show significant stream channelization in the heavily farmed areas of the Review Area (Exhibit 5); however, streams within higher-relief areas or forest blocks appear to have relatively natural channel morphologies. An intersect analysis similar to that run for wetlands, but using the NHD dataset suggests that 46,762 linear feet of intermittent stream and 110,320 feet of perennial stream have been modified by mining activities. Agricultural activities may have affected 42,508 feet of intermittent stream and 130,185 feet of perennial stream. Impacts from these two major drivers of landuse change are comparable for streams; the disproportionately large wetland impact due to agriculture is due to the tendency for wetlands and fertile soils to occupy the same geomorphic position.

Overall water quality is difficult to assess within the Review Area, as EPA maintains no STORET monitoring sites within the watershed (EPA, 2013). The only KDOW monitored stream segment is the 22.5 mile section of the Green River flowing through the Review Area. It fully attains its designated uses of warmwater aquatic habitat, primary and secondary recreational contact, fish consumption, and domestic water supply (EPPC, 2012). However, it is likely that Review Area streams subject to significant anthropogenic pressure show the same impairments as streams assessed within the proposed permit area, namely elevated conductivity, sedimentation, and limited in-stream habitat.

Table 2. Baseline stream data.

HUC 12	Stream Type	Number of Reaches	Length (ft)
Elk Creek-Green River	Intermittent	3	21,949
	Perennial	175	363,542
Nelson Creek-Green River	Intermittent	29	125,313
	Perennial	93	195,992
Total		300	706,796

Future Actions

Estimates and projections of future development follow methods discussed in the Final Programmatic Environmental Impact Statement on Mountaintop Mining/Valley Fills in Appalachia issued by EPA 28 October 2005. Even though this method of mining is not utilized in Western Kentucky, the projection method is still applicable. In this method, coal mine permit information for the previous ten years was used to determine a rate of impact for that time period. Assuming this rate will continue at this level in the future, cumulative impacts were then extrapolated from the data set. This method was used in the current cumulative impacts analysis and was further applied to other potentially significant agents of change in the Review Area.

The economic impact of agriculture has been essentially static in the Review Area in recent decades. While market value for agricultural products has increased, this likely is keeping pace with overall economic inflation. The amount of farmland in the region has increased slightly since 1987, while the total number of farms has decreased slightly (USDA, 1997 & 2002). Therefore, crop production is expected to remain relatively static, and future projections therefore assume no net expansion of agricultural land over the

review period. However, use of existing agricultural land may become more intensive, which may be seen in the consolidation of agricultural lands mentioned above.

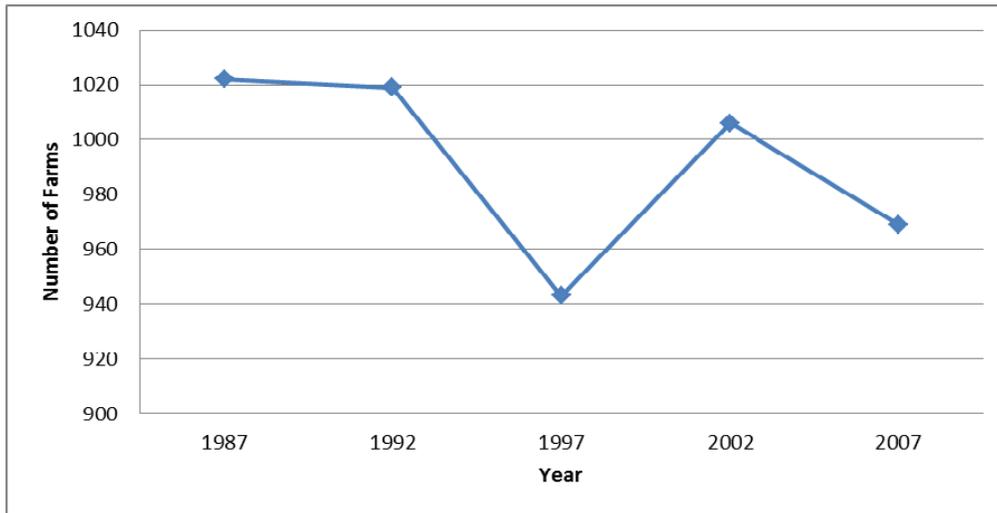


Figure 2. Number of Ohio County farms, 1987-2002.

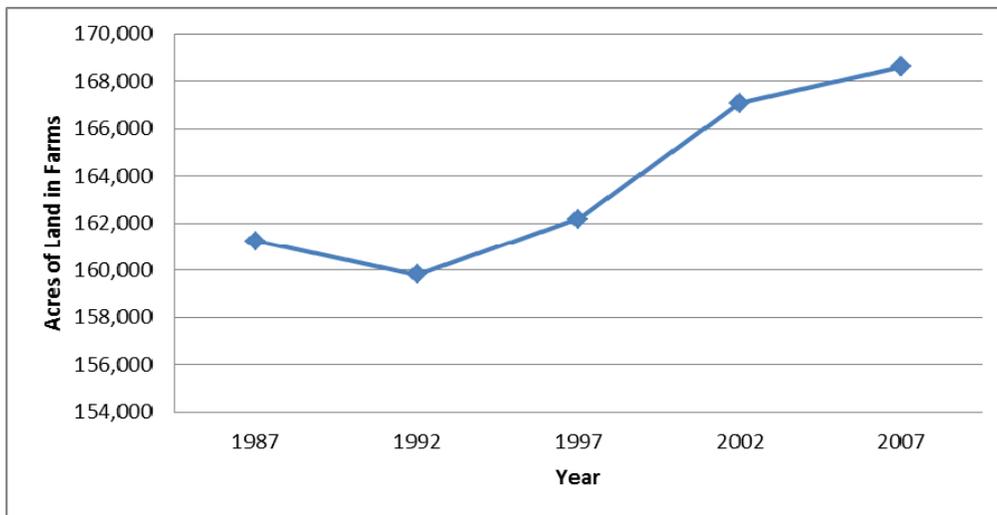


Figure 3: Land in farms for Ohio County, 1987-2007.

Residential and commercial development is unlikely to expand significantly within the Review Area; soil data suggest this development will be constrained to areas outside of much of the Impact Area, as most soils within are moderately, to very, limited for construction by flooding and shallow saturation zones (NRCS, 2013). Current agricultural and mining practices, coupled with a large coal reserve (approximately 580 acres) will likely hinder further development. Additionally, population growth in Ohio County is low (0.39%) and projected to plateau during the Review Period (Figure 4) (KSDC, 2013). In summation, physical limitations and the lack of any historical and current commercial development within the Review Area indicate negligible growth.

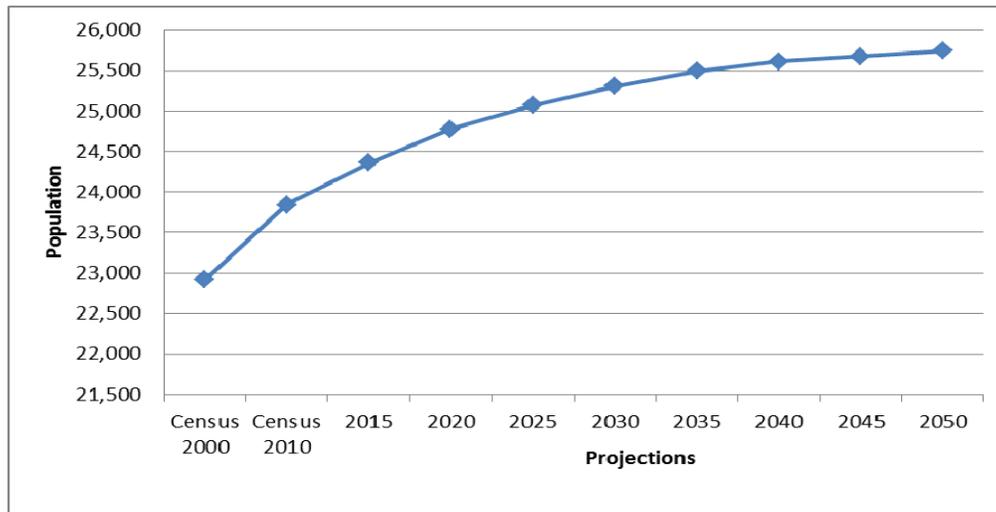


Figure 4: Ohio County population projections through 2050.

The current project will impact 4.036 acres of wetland, representing 0.11% of the documented wetland area in the Review Area. Additionally, 9,543 linear feet of intermittent stream and 18,518 linear feet of ephemeral stream will be impacted. A more appropriate comparison may be that the impacts represent 1.4% of the designated blueline streams in the Review Area. Compensatory mitigation will occur off-site on adjacent lands at approved mitigation ratios. A more diverse, cohesive wetland block will be created to offset the impacts to wetlands within the permit boundary. The mitigation area will provide a larger wetland area and will provide higher ecological function and value than what is currently present on-site. Mitigation will create or restore 12.1 acres of forested wetland within the adjacent watershed. Mitigation for the existing incised, heavily sediment laden, streams with limited riparian zones will also be accomplished off-site by enhancement, restoration, and preservation of streams in the same adjacent watershed. Mitigation will be accomplished by providing an ecological lift to off-site streams to compensate for 9,543 linear feet of intermittent stream and 9,259 linear feet of ephemeral stream. All mitigation areas will be protected in perpetuity by conservation easements.

Historically, agricultural lands in the Review Area have been protected. Agriculture is not expected to expand significantly during the review period, but farmland may be utilized more intensively with consolidation of smaller farms. As nearly all of the Review Area is rural and sparsely populated, residential or commercial development of existing farmland is expected to be minor. Mining will impact only six acres of cropland; stockpiling of prime farmland top soils and restoration of this area to pre-mining production levels are required by Kentucky reclamation regulations (405 KAR 16:020; 16:040; 16:200). Impacts to agricultural lands are therefore expected to be negligible.

References

- Council on Environmental Quality. 1997. Considering Cumulative Effects Under the National Environmental Policy Act. Executive Office of the President, Washington, D.C. 64 pp.
- Dahl, T.E. and C.E. Johnson. 1991. Status and Trends of Wetlands in the Conterminous United States, mid-1970's to mid-1980's. U.S. Fish and Wildlife Service, Washington, D.C. 28 pp.
- Dahl, T.E. 2006. Status and Trends of Wetlands in the Conterminous United States, 1998-2004. U.S. Fish and Wildlife Service, Washington, D.C. 112 pp.
- Environmental Quality Commission. 1992. The State of Kentucky's Environment. Kentucky Environmental Quality Commission, Frankfort, KY. 337 pp.
- _____. 1994. The State of Kentucky's Environment. Kentucky Environmental Quality Commission, Frankfort, KY. 171 pp.
- Energy and Environment Cabinet. 2012. Digitized Mined Out Areas. <<http://minemaps.ky.gov/html/Downloads.htm>>
- Environmental Protection Agency. 1999. Consideration of Cumulative Impacts in EPA Review of NEPA Documents. USEPA Office of Federal Activities. EPA 315-R-99-002. 22 pp.
- Environmental and Public Protection Cabinet. 2012. Kentucky Watershed Viewer. <<http://eppcmaps.ky.gov/website/watershed/viewer.htm>>
- Indiana Division of Environmental Management. 2008. Indiana's Wetland Resources. <<http://www.in.gov/idem/4406.htm>>
- Kentucky Administrative Regulations. 405 KAR 1:250 Prime Farmland.
- _____. 405 KAR 16:200 Revegetation.
- _____. 405 KAR 16:210 Post mining Landuse Capability
- Kentucky Coal Facts, 12th Edition, 2011
<<http://www.kentuckycoal.org/index.cfm?pageToken=coalFacts>>
- Kentucky Mining Information System. 2012.
<<http://minemaps.ky.gov/MineSearch.aspx>>
- Kentucky State Data Center. 2013. Demographic Data-Projections.
<<http://ksdc.louisville.edu/>>
- Kentucky Surface Mining Information System. 2012.
<<http://www.minepermits.ky.gov/sminformationsystem/>>

Office of Surface Mining. 2006. Black Mesa Project Draft Environmental Impact Statement. <<http://www.wrcc.osmre.gov/WR/BlackMesaDraftEIS.htm>>

U.S. Department of Agriculture. 1997. The Census of Agriculture. <<http://www.agcensus.usda.gov/index.asp>>

_____. National Landcover Dataset, 2006. < <http://www.mrlc.gov/>>

_____. 2002. The Census of Agriculture. <<http://www.agcensus.usda.gov/index.asp>>

_____. 2010. National Agricultural Imagery Database. < <http://datagateway.nrcs.usda.gov/>>

U. S. Geological Survey. 1951. Topographic Quadrangle Maps of the United States: Topographic Map of the South Union Quadrangle. U.S. Geological Survey, Washington, D.C.

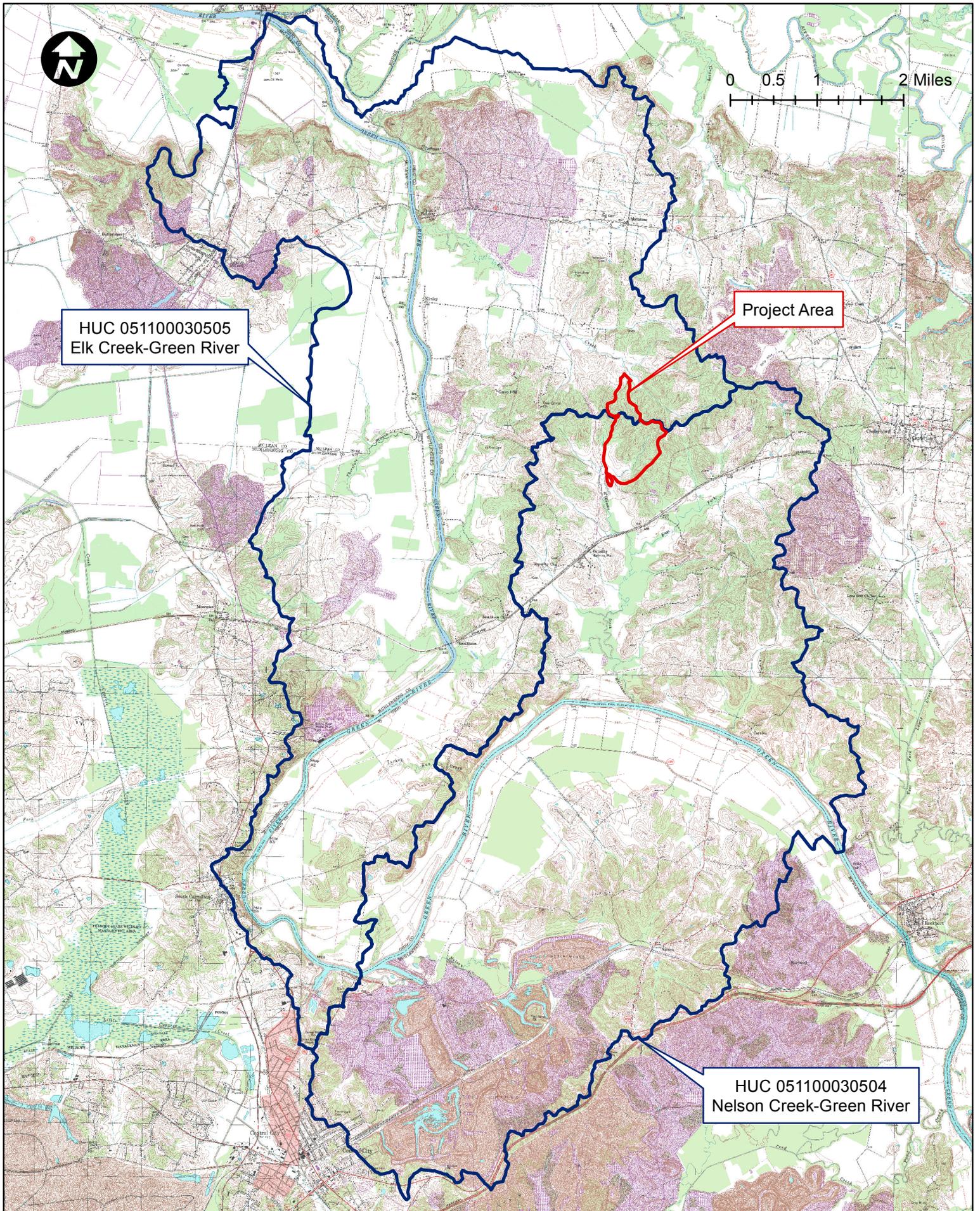
_____. 1953. Topographic Quadrangle Maps of the United States: Topographic Map of the Quality Quadrangle. U.S. Geological Survey, Washington, D.C.

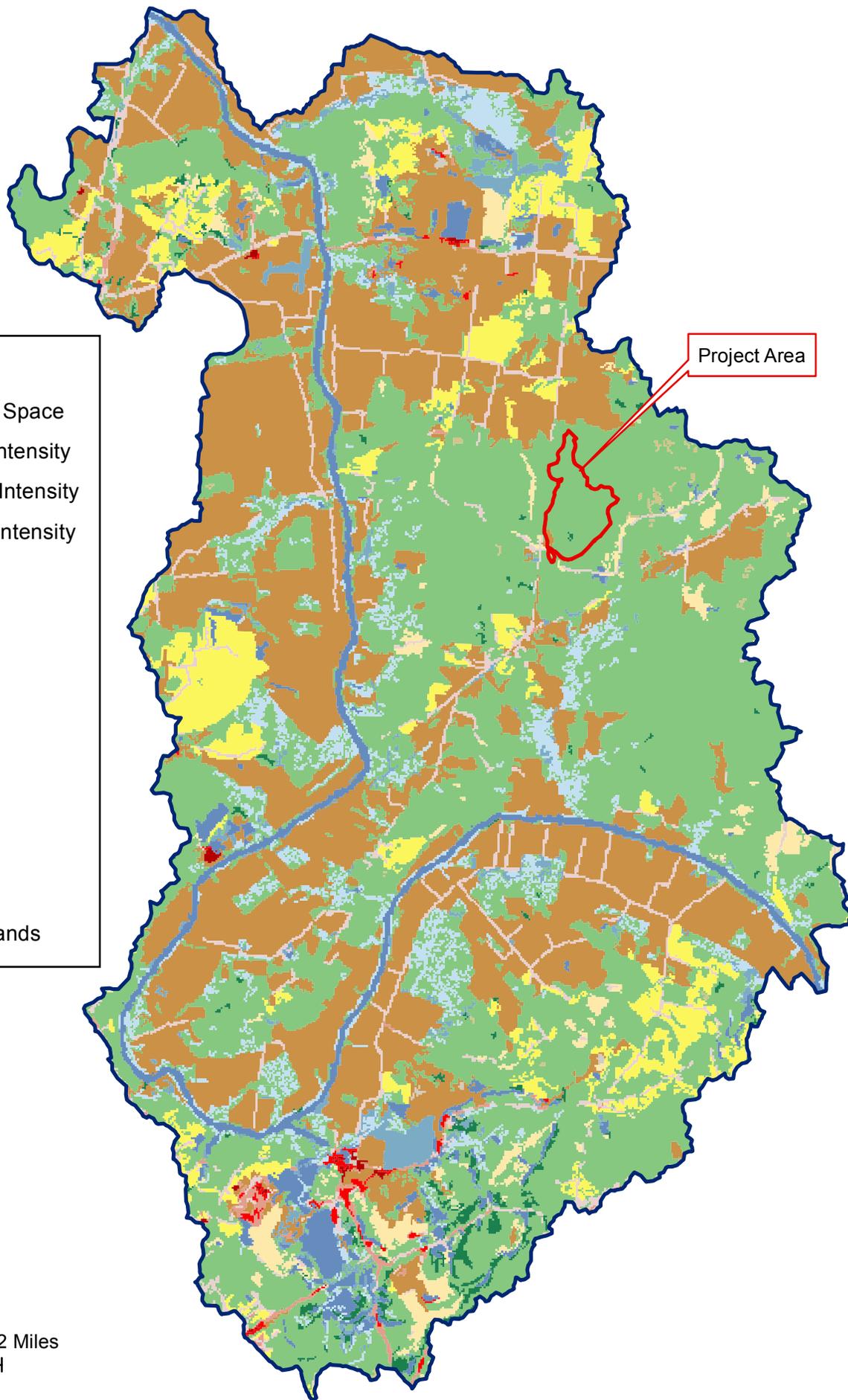
_____. 1973. Topographic Quadrangle Maps of the United States: Topographic Map of the Sugar Grove. U.S. Geological Survey, Washington, D.C.

_____. 1982. Topographic Quadrangle Maps of the United States: Topographic Map of the Homer Quadrangle. U.S. Geological Survey, Washington, D.C.

_____. 2012. National Hydrographic Dataset. <<http://nhd.usgs.gov/>>

Watts, A.L. 2003. West Kentucky's Economy Shows Modest Growth. <http://www.kltprc.net/foresight/Chpt_72.htm>





-  Open Water
-  Developed, Open Space
-  Developed, Low Intensity
-  Developed, Med. Intensity
-  Developed, High Intensity
-  Barren Land
-  Deciduous Forest
-  Evergreen Forest
-  Mixed Forest
-  Scrub/Shrub
-  Herbaceous
-  Pasture/Hay
-  Row Crops
-  Woody Wetlands
-  Herbaceous Wetlands

