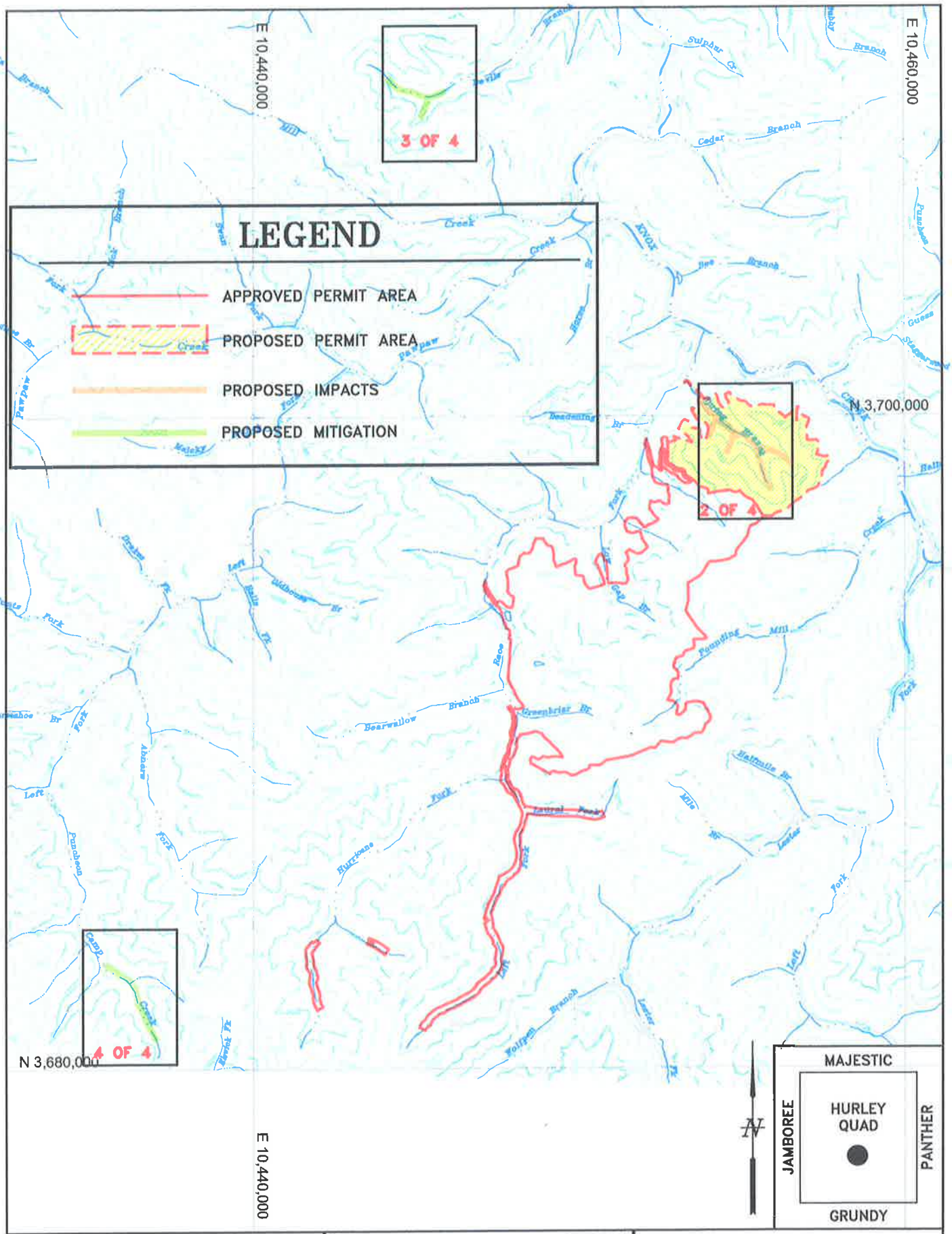

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PROJECT NO. 09-409J2	FILE NAME LOCATION.DWG	SHEET NO. 1 OF 4

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Abingdon, Virginia

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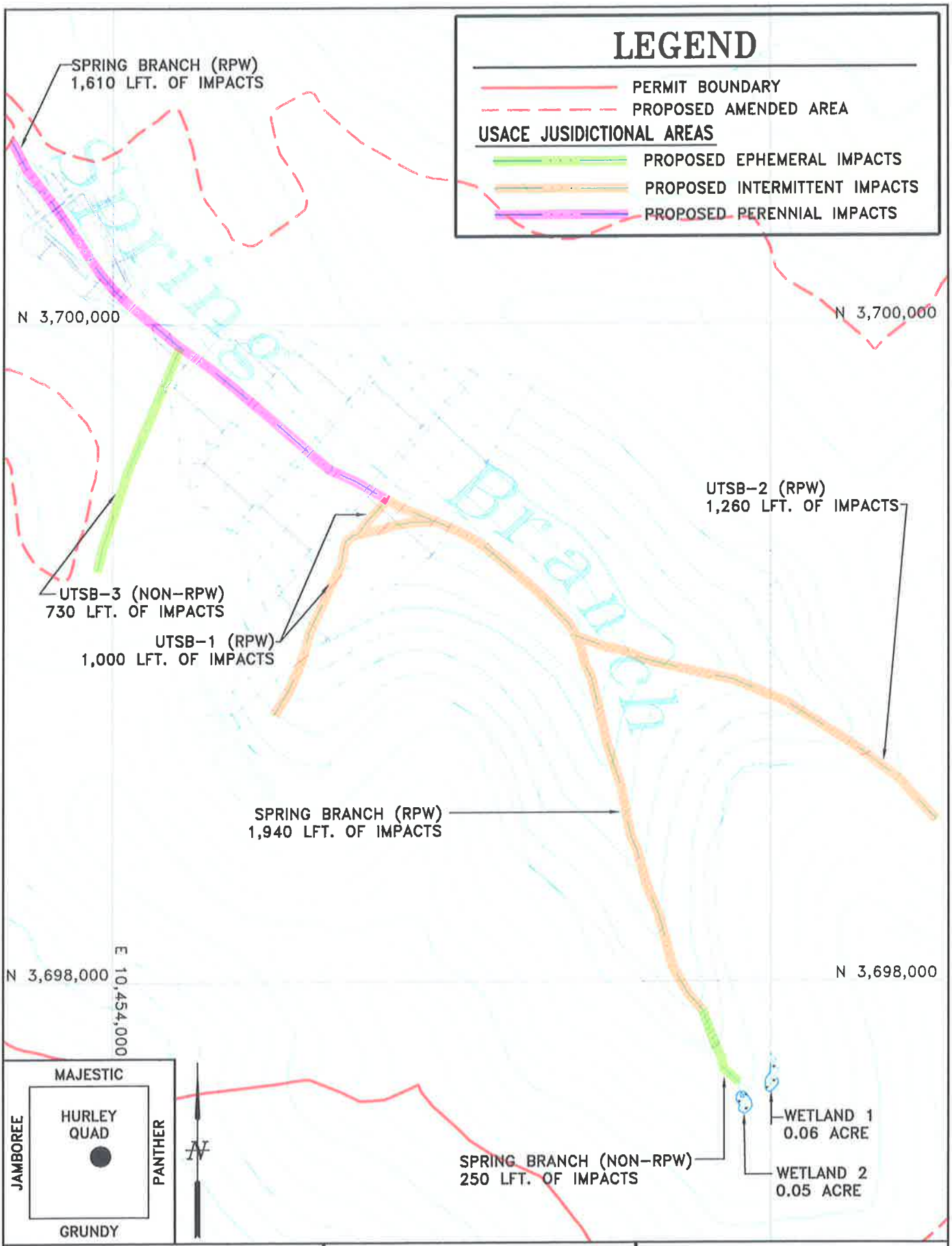
VDMLR P.N. 1101995

SPRING BRANCH SURFACE MINE
LOCATION MAP



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CHECKED TRB	SCALE 1" = 400'	
PROJECT NO. 09-409J2	FILE NAME IMPACTS.DWG	SHEET NO. 2 OF 4

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Abingdon, Virginia

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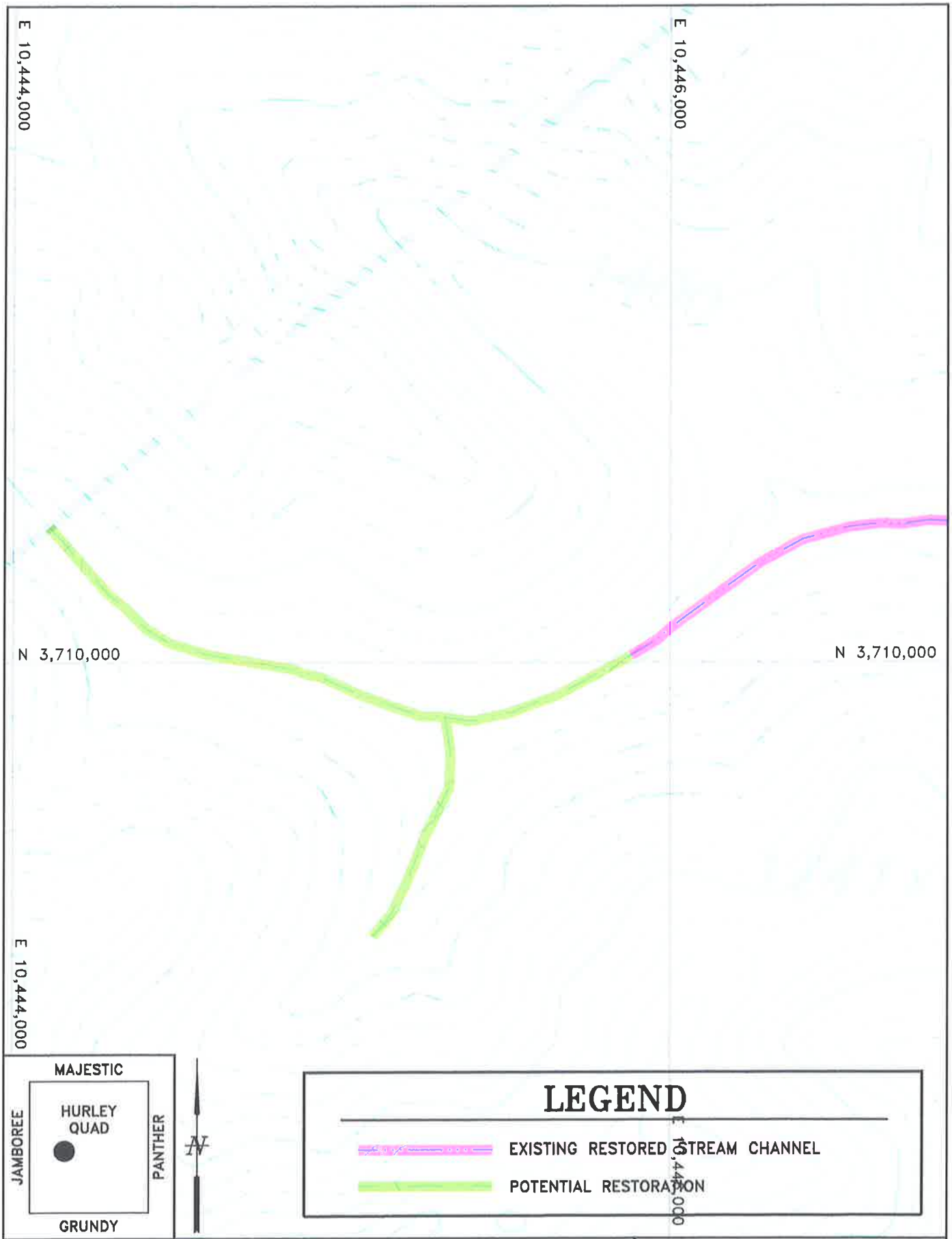
VDMLR P.N. 1101995

SPRING BRANCH SURFACE MINE
IMPACTS MAP



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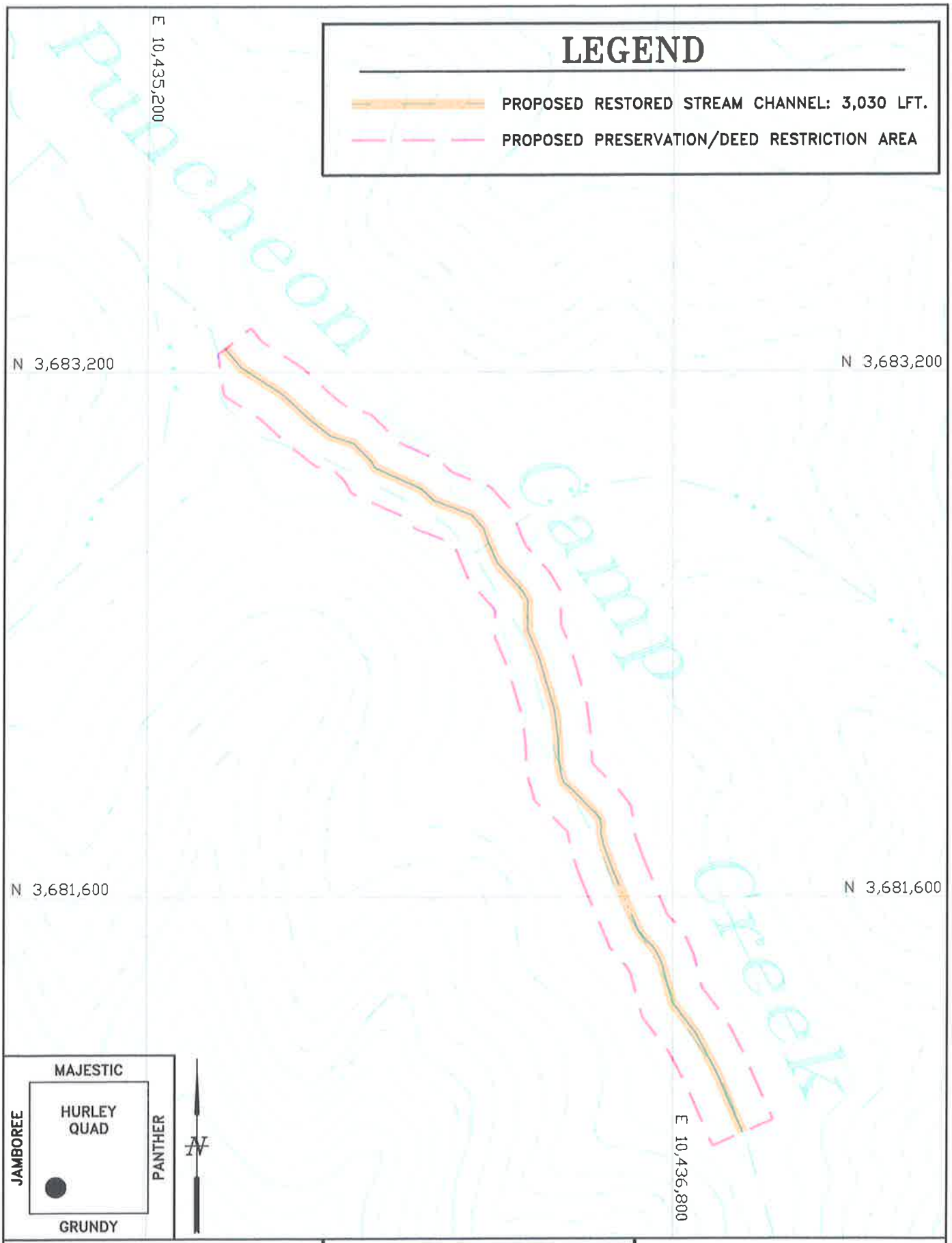
PROJECT NO. 09-409J2	FILE NAME DEVILS BRANCH MITIGATION.DWG	SHEET NO. 3 OF 4

D.R. ALLEN & ASSOCIATES, P.C.
Civil • Environmental • Mining
Abingdon, Virginia

CLINTWOOD ELKHORN MINING COMPANY
VDMLR P.N. 1101995

SPRING BRANCH SURFACE MINE
OFFSITE MITIGATION MAP
(DEVILS BRANCH)



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PROJECT NO. 09-409J2	FILE NAME PUNCHEON CAMP MITIGATION.DWG	SHEET NO. 4 OF 4

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Civil • Environmental • Mining
Abingdon, Virginia

CLINTWOOD ELKHORN MINING COMPANY
VDMLR P.N. 1101995

SPRING BRANCH SURFACE MINE
OFFSITE MITIGATION MAP
(PUNCHEON CAMP CREEK)

D.R. ALLEN & ASSOCIATES, P. C.

Civil • Environmental • Mining

CLINTWOOD ELKHORN MINING COMPANY

LAUREL BRANCH SURFACE MINE
SPRING BRANCH AMENDMENT

USACE PROJECT NO. NAO-2011-00900
VDMLR PERMIT NO. 1101995
VDMLR APPLICATION NO. 1005420

FINAL COMPENSATORY MITIGATION PLAN

AUGUST, 2012
DRA PROJECT NO. 09-409J2
USACE Copy

P.O. Box 573, Abingdon, VA 24212-0573 - (276) 676-2612 - Fax (276) 676-3026

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- *Exhibit D - Eastern Kentucky Stream Assessment Protocol (EKSAP)*

* *Information provided in this document is based on data collected by others. D.R. Allen & Associates, P.C., can make no warranty or guarantee as to its accuracy.*

COMPENSATORY MITIGATION PLAN

OBJECTIVES

Mitigation Type

Stream mitigation proposed herein is permittee-responsible on-site re-establishment and off-site rehabilitation. Off-site rehabilitation is proposed to offset temporal loss of aquatic resource function, and will be conducted in advance of or concurrent with proposed impacts. Wetland mitigation consists of on-site establishment. No mitigation banks or in-lieu fee programs are currently operational within the Tug Fork HUC 8 watershed of the proposed impact area. Therefore, the options for compensatory mitigation for the proposed project are limited to permittee-responsible mitigation. All project impacts and compensatory mitigation are located within the Tug Fork watershed HUC 8 (05070201).

Compensation Resource Type/Quantity and Methods

In order to offset impacts from the proposed Spring Branch project area a combination of stream restoration and establishment and wetland establishment will be used. Stream restoration will include both re-establishment and rehabilitation. The table provided in Exhibit B provides a summary of the mitigation type and quantity proposed by this mitigation plan. The proposed compensation methods include stream restoration using Natural Stream Design (Rosgen 1996). Stream stability and functionality will be fostered through the use of in-stream habitat structures, native herbaceous and woody vegetation, and establishment of stable channel dimension, pattern, and profile. Wetlands will be constructed in areas appropriate for their establishment, i.e. flooplains along streams, etc.

Functional Assessment

"Functions" are defined as "*the physical, chemical, and biological processes that occur in ecosystems*" (33 CFR 332.2). The suites of functions provided by the impacted streams are those typical of the region, and include habitat for various life stages and taxa of aquatic organisms as well as nutrient processing associated with those organisms, in addition to water, sediment and organic matter transport.

OBJECTIVES - cont.

According to the supplementary information for the Compensatory Mitigation Final Rule (Final Rule), "stream and river restoration can lead to species recovery, improved…water quality, and new areas for wildlife habitat and recreational activities." Therefore, the proposed stream restoration should compensate for the functions lost in the stream impact reaches through enhancement of instream biotic habitat with subsequent improvements in nutrient cycling, reduction of the sediment input by vertical and lateral instability in degraded reaches, and improving sediment processing via optimized morphological hydraulics.

The impacted wetlands are resultant of pre-SMCRA mining, and are located in unnatural landscape positions on the pre-SMCRA mine bench. The impacted wetlands do not directly abut jurisdictional streams; therefore, their functional contribution to the watershed is minimal. The goal of the wetland mitigation is to establish the following functions:

- Trap sediment from the watershed, thereby reducing degradation of the substrate that provides habitat for aquatic organisms
- Moderation of storm flows to the downstream system, thereby reducing downstream flooding and degradation of aquatic organisms and damages to downstream communities
- To provide detritus
- To provide habitat to a wide variety of aquatic and terrestrial species
- To foster to uptake and sequestration of carbon and metals

The proposed establishment of wetlands below the proposed fills and adjacent to the restored stream channels fully compensates for the loss of the minimal functions provided by the impacted accidental wetlands. Functional Assessments for streams using the Eastern Kentucky Stream Assessment Protocol (EKSAP) are included in Exhibit D of this document. Wetlands are compensated for at a 1:1 ratio.

SITE SELECTION

One of the mitigation rule's primary considerations for permittee responsible mitigation is the preference for on-site mitigation, and one of the factors for mitigation site selection is the practicability of

SITE SELECTION - cont.

accomplishing ecologically self-sustaining mitigation. The preference for on-site mitigation where practicable, and the self-sustainability factor severely limit compensation alternatives in the immediate area of the proposed impacts. As described in the permit application, the proposed mining activity involves the unavoidable permanent disposal of excess spoil in hollow fills. While the size of these fills has been limited to the extent practicable, they will still result in some permanent stream loss. Consequently, on-site compensatory stream mitigation alternatives are limited to re-establishment within the proposed pond sites.

Several factors were considered when choosing the proposed mitigation sites. Among those factors was the preference for onsite mitigation, as noted above. The primary concern was to be able to provide for a self-sustaining successful mitigation project. Of importance was flow regime and landscape position. The site should exhibit the expected flow regime for the proposed stream type (i.e. intermittent, perennial, ephemeral), and should be located in a landscape position that will support a stream or wetland over time. The restored stream channels below the fills will be restored to their previous positions in the watershed, where the flow regime will remain unchanged. These factors were evaluated for both on-site and off-site mitigation. Once the amount of available on-site mitigation was determined, an evaluation was made as to any additional mitigation required off-site.

Keeping off-site mitigation within the HUC 8 watershed where the impacts occur was of primary importance. Typically, the applicant looks for sites that need mitigation where ownership and control of the property are already established. In the coalfields, sites such as old mines never subjected to more modern mitigation techniques are prime targets of opportunity. Generally a "worst first" approach is considered. This approach provides for the most ecological lift and enhancement to the watershed over time.

In the Devils Branch watershed, historic pre-SMCRA and regulated mining has resulted in significant impacts to Devils Branch, a tributary to Knox Creek. The proposed mitigation would restore all of the headwaters of Devils Branch upstream of a restoration reach that was constructed in 2008. The goal of the proposed restoration is to establish a proper dimension, pattern and profile to provide a self-sustaining stream functioning as a natural system. A deed restriction would be recorded to provide long-term protection for the proposed restoration.

SITE SELECTION - cont.

In the Puncheon Camp Creek watershed, historic logging activity as well as spoiled outslopes and major sediment loads from a pre-SMCRA mine bench have resulted in a highly unstable stream that contributes significant amounts of sediment to downstream reaches. The goal of the proposed restoration is to provide a proper dimension, pattern, and profile, as well as to stabilize the raw, eroding banks and bed in the proposed reaches. A deed restriction would also be enacted to provide long-term protection for this mitigation site.

The goal of Natural Stream restoration is the establishment of stable stream channels. Rather than describing a changeless, immobile state; "stability" refers to the dynamic equilibrium exhibited by streams that transport their watershed's water discharge and sediment load while varying within a describable range of parameters. If restored stream channels achieve stability and are not re-disturbed, they are by definition self-sustaining.

The practicability of stream restoration practices has been proven by existing compensation projects. Also, since the mining projects are designed to maximize coal extraction, the possibility of a future mine project re-disturbing the mitigation site is minimized. The linear footage of stream restoration is presented in the Summary of Aquatic Resources Impacts and Mitigation Measures. The locations of the proposed restored stream channels and wetlands are depicted on the Mitigation Maps.

Current Trends in Habitat Loss or Conversion

Knox Creek is listed on Virginia's 303(d) list of impaired streams. A TMDL is approved for the stream. The stream is listed as impaired for the state's General Standard (benthic) and *E. coli*. Stream restoration is considered a valuable part of the plans to address, in particular, the sedimentation deficiencies of the watershed. The TMDL was a primary factor in providing on-site and off-site mitigation within the same or adjacent watershed. Although stream restoration will not remove the bacterial pollution source from the watershed, it may act to reduce sedimentation and improve aquatic habitat within the watershed.

Cumulative Impacts of Past Development Activities

Residential development and associated infrastructure is substantial within the Knox Creek watershed. In addition to direct impacts from mining, forestry, and natural gas extraction

activities, the construction of residences, roads, and rail facilities in close proximity to streams resulted in severe stream instability problems that are still extant. The relocation and channelization of these streams was extensive, and severe vertical instability in the upper reaches and equally severe lateral instability in the lower reaches is prevalent.

Current Development Trends

While mining is still taking place within the watershed, improved regulation since the advent of the Surface Mining Control and Reclamation Act (SMCRA) and the recent TMDL limit the effects of mining or development to the stream. New development is not prevalent within this watershed.

Presence and Needs of Sensitive Species

Spring Branch is a tributary to Knox Creek, which is potentially inhabited by two state T&E species. Minimizing and reducing sediment within this watershed is necessary to maintain habitat for the species. The miles of eroding streambank within the Knox Creek contribute a significant amount of sediment annually and the proposed offsite mitigation should incrementally tally reduce this impact.

Site Conditions that Favor or Hinder Mitigation Success

A primary factor in selecting particular mitigation sites includes conditions that favor long-term success. There needed to be a reasonable level of certainty that any sites in a headwater position would remain undisturbed in the future, and there needed to be enough physical space to correct the stream dimension, pattern, and profile deficiencies that were invariably being exhibited.

Mitigation sites were chosen on-site and off-site. On-site mitigation will restore functions upon reclamation, while off-site mitigation will provide off-sets for temporal loss. All mitigation sites have a reasonable level of certainty of success.

Chronic Environmental Problems

As previously discussed, sedimentation from streambank erosion is a chronic environmental problem within the watershed. Stream restoration can help alleviate this chronic

SITE SELECTION - cont.

problem within the restoration reaches. Incremental improvements to individual stream reaches provide a cumulative benefit to the watershed as a whole.

SITE PROTECTION

The applicant is currently working with the property owners to reach an agreement concerning site protection. The proposed compensatory mitigation sites will be jurisdictional waters of the U.S. Therefore, the sites will be afforded the same level of protection of any jurisdictional waters, and a USACE permit will be required prior to fill or dredging activities. These sites will be in much better functional condition after mitigation activities, and any future impacts will require compensation for a much higher quality resource than would exist if mitigation does not take place.

BASELINE INFORMATION

The type, linear feet, and/or acreage of aquatic resources that will be impacted and restored as a part of the proposed mitigation plan, are shown on the Summary of Aquatic Resource Impacts and Mitigation Measures (see Exhibit A). Baseline information for on-site resources is contained in Appendix F of the joint permit application.

DETERMINATION OF CREDITS

Eastern Kentucky Stream Assessment Protocol

The Eastern Kentucky Stream Assessment Protocol (EKSAP) was used to determine if the proposed natural stream channel restoration fully mitigated for the proposed impacts within the mine site. The Pre-Impact Ecological Integrity Indices (EII's) and Ecological Integrity Units (EIU's) for the proposed impacted streams were calculated using data collected at each stream reach.

The EII calculations and the EIU outputs have been summarized on both a project and sub-watershed basis. The analyses are contained in Exhibit D.

MITIGATION WORK PLAN

Geographic Boundaries

All of the impacts and mitigation measures are located within the Knox Creek basin, Tug Fork watershed, HUC 05070201. The locations and boundaries of the proposed stream channels, wetlands, and riparian areas are depicted on the Mitigation Maps.

Design

Stream channels to be constructed will be designed in accordance with the fluvial geomorphological principles contained in Rosgen, 1996. Cross-sectional area and discharge for the channels were determined using existing stream cross-sections or regional curves. Key design parameters were obtained by using both dimensionless ratios from a reference reach located on a similar valley type and from published data. All design dimensions are found on the Restored Stream Channel Details drawing.

The stream deficiencies to be addressed by this restoration include restoring the dimension, pattern, and profile of the existing streams, all of which have been altered by historic channelization. The stream dimensions will be corrected by the establishment of a channel of the proper cross-sectional area and width/depth ratio that has access to the floodplain.

Generally, the type of proposed stream channel was chosen by determining the stable form expected for the existing or anticipated valley type, slopes, and material. Type A2 and B2/3 channels are proposed. Step-pool structures and cross vanes will be utilized to aid in energy dissipation, as well as to provide grade control, habitat, and sediment transport.

Construction Methods

Generally, the stream channels will be constructed using heavy equipment to shape the proper channel dimension, pattern and profile and to place stone to create the cross-vane, j-hook and step-pool structures, as appropriate. Where practicable, the new channel will be constructed in the dry. Native material will be used to line the new channels, where available. Otherwise, the riffles will be lined with properly sized cobble or gravel, according to design specifications.

Jurisdictional wetlands will be created within the floodplain of the restored stream channels below hollow fills and at a sediment pond (see the Mitigation Map for locations).

MITIGATION WORK PLAN - cont.

Timing/Sequencing

On-Site

On-site mitigation will be constructed as soon as the specific areas are available for mitigation and as contemporaneously as possible with reclamation. Mitigation sites located in the area of the sediment ponds cannot be constructed until ponds are removed. Sediment ponds cannot be removed for two years following establishment of successful herbaceous cover.

As discussed in the Baseline Information portion of this section, impacts must occur prior to mitigation. In areas associated with VDMLR sediment ponds, restored stream channels will be constructed during pond removal operations. VDMLR sediment ponds must remain in place for at least two years after establishment of an herbaceous cover in the watershed. To the extent practicable, CEMC will attempt to gain VDMLR approval to remove sediment ponds after the two year revegetation period and construct the restored stream channels and wetlands in the next construction season following VDMLR approval of pond removal.

During backfilling and regrading operations, the valley floors shall be reasonably constructed to grades necessary to accommodate the proposed structures. Sufficient durable, non-acid/toxic sandstone shot rock will be stockpiled and later used for construction. Temporary ditches will be used to convey flows through completed areas until the restored stream channels are constructed.

Off-Site

Stream mitigation is proposed in Devils Branch, a tributary to Knox Creek. Stream mitigation is also proposed in Puncheon Camp Creek, a tributary to Pawpaw Creek, which drains to Knox Creek. The proposed plan will restore the streams using natural stream design techniques and implement a diverse riparian habitat comprised of native trees and shrubs. Off-site mitigation in Devils Branch and Puncheon Camp Creek will be constructed prior to or concurrent with impacts.

MITIGATION WORK PLAN - cont.

Sources of Water

Water sources for the restored stream channels and wetlands will be runoff from rainfall events, ground waters originating from within the permit area and groundwaters originating from upstream undisturbed areas.

The Mitigation Maps depict the location of restored stream channels and wetlands relative to upland areas and receiving streams. As depicted by the Mitigation Maps, the continuum between upland areas of the watershed and receiving streams is being maintained or restored.

The VDMLR permit requires the site to be restored to its approximate original contour (AOC). Restoration of the site to AOC will restore the continuum between the restored stream channels and uplands areas.

Vegetation Establishment

Reclamation of areas impacted by 404 discharges must be accomplished in substantial compliance with the Forestry Reclamation Approach (Burger et al. 2005). Variances from the recommendation to leave 4 feet of uncompacted fill may be needed to achieve stability of constructed stream features such as bank full benches, etc. The composition of tree species must be modified to include appropriate species for planting in riparian zones. All riparian zones must be seeded immediately on completion of construction using a mix for herbaceous cover that is compatible with and will promote tree growth. Light grading to knock the tops off dump piles is required instead of end dumping of soil/spoil with no grading; however grading should be kept to a minimum to encourage/support tree growth.

Herbaceous seeding of the riparian areas and near-bank zones will take place upon completion of or concurrently with stream channel construction. Planting of woody species, along with live stake and brush mattress installation, where appropriate, will take place during the first dormant season following construction of each compensation site. In addition, native woody vegetation, as practicable, will be transplanted during construction to supplement the plantings.

MITIGATION WORK PLAN - cont.

Herbaceous wetland seeds, plants, and tubers will be planted upon completion of wetland construction. Woody species will be planted during the first dormant season following wetland construction.

A minimum of five (5) woody species must be included in the wildlife trees planted in reclamation of areas impacted by 404 discharges. Species selection will be based on suitability to the specific area being planted (reclamation of upland hollow fill versus reclamation of riparian zones). Planting schedules are included on the Revegetation Details.

Invasive Species Control

Invasive species are not proposed for use in the compensation sites. However, should invasive species become established and prevent the attainment of the success criteria, invasive species control through physical or chemical measures will be conducted in consultation with the appropriate agencies.

Grading Plan

Grading within the stream compensation sites will entail the establishment of a proper stream and valley cross-section and profile as site-specifically appropriate. The grading plan for the wetland area is depicted on the Mitigation Map.

Soil Management

Topsoil or a topsoil substitute will be used to provide a conducive growth medium in the riparian and wetland areas.

Erosion Control Measures

Erosion control measures in the compensation areas will include construction in the dry, silt fence, and straw bale barriers, as appropriate.

MAINTENANCE PLAN

The monitoring period for the proposed compensatory mitigation extends for 10 years after construction or until the restoration has achieved stability, and can consequently be considered self-sustaining. During this monitoring period, the compensation sites will be walked yearly, and instabilities will be corrected as necessary.

MONITORING AND PERFORMANCE STANDARDS

Duration and Reporting

Performance monitoring will begin in the fall or spring following completion of construction. Monitoring activities shall occur during the growing season, and at least once during the 1st, 2nd, 3rd, 4th, 5th, 7th and 10th growing seasons following completion of construction. Performance monitoring will be conducted in the same season and, to the extent practicable, after similar climatic events. Monitoring reports will be submitted following completion of construction on a schedule for years 1-5, 7, and 10 (see Exhibit **C**). Annual status reports for all compensatory mitigation sites required by this permit will be provided to the Corps by 31 December of each year.

Off-Site Mitigation monitoring reports will be submitted following completion of construction on a schedule for years 1-5, 7, and 10 (see Exhibit C). A final, thorough evaluation is expected for year 10.

Within 90 days of completion of construction of On-Site compensatory mitigation the permittee must provide as-built drawings for the newly constructed waters. Any deviations from the approved plans will be noted and accompanied by supporting documentation of why the change is necessary and meets or exceeds the previously approved design criteria.

The permittee will be responsible for the monitoring program. Performance standards monitored will be indicators that demonstrate the mitigation is developing or has developed. If, during construction, a need to modify the project design is identified, the permittee must promptly notify the Corps by either telephone or electronic mail. A written request will be provided, including a detailed assessment that the site project has been demonstrated as functionally mature and self-sustaining to complete and end required compensatory mitigation monitoring.

Contents of monitoring reports are to include, but not limited to a plan view map of the mitigation site indicating the location and number of the photo points. Monitoring photographs are to include the same naming convention as shown on the plan view map and include the date the photograph was taken. Additionally, the photos will be named and numbered (including a latitude and longitude coordinate). These photos should be cross-referenced to those which were included

in the As-Built Information. All photos are to display the date of which the photo was taken. Photographs are to be reported/evaluated as time-series.

All sampling locations (surface water quality, benthic macroinvertebrates, and fisheries) are to be depicted on the aforementioned plan view map. Include a comparative analysis of each of the previous submittal of monitoring reports, including but not limited to vegetative buffers, benthic macroinvertebrates, water quality, and stream function and form. Data summaries should be depicted as tabular data for each of the previous year's reporting.

Streams

As outlined in the Goals and Objectives portion of this section, the goal of stream mitigation is to reestablish the function of drift and, to the extent practicable, benthic macro-invertebrate habitat. This goal shall be met when the restored stream channels are determined to be stable. Because the restored stream channels were designed in accordance with fluvial geomorphological principles, stable stream channels should provide adequate aquatic habitat. Stream stability will be determined by performing Level III and Level IV analysis, in accordance with Rosgen (1996).

In order to determine the success of the proposed restored stream channels, all of the restored stream channels will be walked yearly. Any areas that are potentially unstable will be noted. If deemed necessary CEMC will repair any unstable areas.

In addition, the approximate location monitored for baseline data will be monitored annually to determine the success of the restoration. During the 1st monitoring event, a permanent bench mark and permanent points for riffle and pool cross section will be established. By comparing the pre-existing stream condition with the restored channel it should provide a good opportunity to monitor the success of the restoration.

During each monitoring event, the riffle and pool cross sections and the longitudinal profile of each reach will be measured and documented. Channel material classification will be performed on each reach utilizing the "pebble count" method developed by Wolman (1954). Pebble counts will be conducted yearly during the monitoring period.

MONITORING AND PERFORMANCE STANDARDS - cont.

In order to monitor the biological recovery of the streams over time, biological sampling will be conducted at the proposed monitoring location annually. The benthic macro-invertebrate population will be sampled in each reach and habitat quality will be assessed using RBP protocol. Sampling will be conducted in the fall or early spring in order to obtain the best benthos assemblages. If fish are observed in any of the representative reaches, then their presence will be documented, and the population will be sampled using RBP protocol.

EKSAP

The Eastern Kentucky Stream Assessment Protocol (EKSAP) will be used to monitor the condition of the streams during the project and the restored stream channel (RSC) reaches after construction. The EKSAP is also utilized as the performance standard to encompass biological, chemical and physical habitat parameters. Measured parameters include water chemistry, macroinvertebrate assemblage, and RBP habitat scores for both impacted stream reaches and mitigation sites.

RSCs are monitored using the EKSAP, and an overall EII score of 0.53 is used to predict full compensatory mitigation. This score reflects the assumption of a 500 µs/cm conductivity value and a RBP habitat score of 167, or fully supporting. A conductivity of 500 µs/cm generates a sub-index of 0.1, the lowest possible value for the model. The RBP score of 167 generates a sub-index of 1.0. Although a sub-index value for macroinvertebrates is not expressly predicted, the default value is 0.53, an average of the two predicted sub-indices. So, while all three parameters (i.e., water chemistry, biological habitat, and physical habitat) are monitored and reported, only the overall EKSAP EII is maintained as the performance standard due to the inability to predict a macroinvertebrate score.

One exception to the 0.53 EII prediction is the Devils Branch restoration reach. The restoration is proposed in the extreme headwaters of the watershed, and no upstream influence or disturbance is anticipated. Therefore, the conductivity is expected to remain the same. The current conductivity of ~200 µs/cm generates an overall EII of 0.88 for the restored Devils Branch Mitigation Site.

MONITORING AND PERFORMANCE STANDARDS - cont.

Each RSC reach is monitored for a period of 10 years per the terms of the CMP. If at that time the RSC has not achieved the predicted criteria, the liability period will be extended until the USACE determines that the criteria are met. This is further addressed in the adaptive management plan.

Wetlands

Created wetlands will be evaluated per the Eastern Mountains and Piedmont Regional Supplement (Supplement) to the 1987 Wetlands Delineation Manual. Created wetlands will be deemed successful when the indicators for hydrophytic vegetation, hydric soils, and hydrology are found during a routine wetland determination as established in the Supplement. The routine wetland determination will be conducted during each year of the monitoring period and the data provided to the Corps on an annual basis. Each wetland mitigation site is expected to meet the definition of a wetland by the end of the monitoring liability period (i.e., year 10).

For hydrophytic vegetation, indicator 1 (rapid test for hydrophytic vegetation), indicator 2 (dominance test), and indicator 3 (prevalence index) will be applied in sequence to establish the presence of hydrophytic vegetation. Since native wetland plant species will be planted immediately following construction of the wetland mitigation sites, it is presumed that only indicators 1 and 2 will be used in most cases. The specific procedures are detailed in Chapter 2 (Hydrophytic Vegetation Indicators) of the Supplement. In addition, a minimum of five native vegetative species will be maintained.

A hydric soil is defined as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (USDA Soil Conservation Service 1994). Chapter 3 (Hydric Soil Indicators) of the Supplement presents indicators that are designed to help identify hydric soils in the Eastern Mountains and Piedmont Region. These hydric soil indicators will be evaluated in every case to determine the presence of a hydric soil. The Supplement also provides guidance for identifying hydric soils that lack indicators in Chapter 5 (Difficult Wetland Situations in the Eastern Mountains and Piedmont Region). In particular, the Supplement states that… "recently developed wetlands may lack hydric

soil indicators because insufficient time has passed for their development." The created wetlands fall into this category and may lack sufficient indicators for classification during the monitoring period. Therefore, if no indicators are noted, but the soils are thought to meet the definition of a hydric soil, the procedure outlined on page 132 of the Supplement will be used to establish the presence of developing hydric soils.

The created wetlands will be established in areas that have favorable hydrology for the development and persistence of wetlands. Indicators established in Chapter 4 (Wetland Hydrology Indicators) of the Supplement will be used to determine the presence of wetland hydrology. Wetland hydrology indicators provide evidence that the site has a continuing wetland hydrologic regime and that hydric soils and hydrophytic vegetation are not relicts of a past hydrologic regime. As described in Chapter 4, one primary indicator from any group is sufficient to conclude that wetland hydrology is present. In the absence of a primary indicator, two or more secondary indicators from any group are required to conclude that wetland hydrology is present. The indicators are listed in table 10 and described subsequently in Chapter 4 of the Supplement.

Areas that have hydrophytic vegetation and hydric soils generally have wetland hydrology unless the hydrologic regime has changed due to natural events or human activities (National Research Council 1995). The U.S. Army Corps of Engineers (2005) provides a technical standard for monitoring hydrology on problematic sites. This standard requires 14 or more consecutive days of flooding or ponding, or a water table 12 in. (30 cm) or less below the soil surface, during the growing season at a minimum frequency of 5 years in 10 (50 percent or higher probability) (National Research Council 1995). If wetland hydrology indicators are lacking at a site, further investigation may be necessary. The procedures outlined on page 136 of the Supplement will be used where wetlands periodically lack indicators.

A monitoring schedule for the mitigation areas is included as Exhibit C.

LONG TERM MANAGEMENT PLAN

According to 33 CFR 332.7(b), long-term management is required for compensatory mitigation projects that are not self-sustaining. The proposed projects are designed to be self-sustaining once the success criteria are met. Natural hydrology and landscape position will support the proposed projects, so pumps or other engineering features will not be needed. Therefore, long-term management (beyond the success monitoring) is not proposed.

ADAPTIVE MANAGEMENT PLAN

If unforeseen site conditions prevent the compensatory mitigation projects from being constructed as proposed, the permittee will notify the appropriate agencies and seek approval for significant modifications. Insignificant changes will be reflected in the as-built surveys. If the performance criteria outlined above are not met at any time during the monitoring period, the permittee must provide the Corps with a proposal detailing corrective actions and/or maintenance actions proposed (if any) and an implementation schedule for those actions. The permittee shall implement the necessary corrective measures following review and approval/modification of those measures by the Corps. Upon completion of the corrective measures, the permittee shall provide a written summary of the work to the Corps. Additional remedial actions may be required if the corrective measures do not result in satisfaction of performance criteria during the next subsequent growing season. Should the permittee fail to take corrective action, the Corps may use the performance bond to fund the corrective actions or require alternative compensatory mitigation. The permittee shall assume all liability for accomplishing corrective work for any action permitted by the Corps, should the Corps determine that the compensatory mitigation has not been completed satisfactorily. Remedial work may include (but is not limited to) retrofitting instream structures, regrading and/or replanting the mitigation site.

The appropriate agencies will also be notified if, during the course of the performance monitoring period, the projects are found to not be progressing towards meeting the success criteria. After evaluation of the deficiencies, appropriate measures will be determined and taken. Depending on the severity of the particular deficiency, appropriate measures may include site or design modifications and revisions to maintenance or monitoring requirements. Performance standards may be revised to account for these

measures. Agency approval would be required to address any deficiency or amend monitoring and/or performance requirements.

Potential deficiencies could include: eradicating invasive species; replanting riparian or wetland areas to achieve the target species diversity; or, stability correction following catastrophic events. If for some reason the projected EIUs are not met for any mitigation area, alternative mitigation credit must be obtained.

Per 33 CFR 332.7(c)4, Performance standards will be revised if natural disasters compromise the compensatory mitigation projects.

FINANCIAL ASSURANCES

CEMC provides financial assurances to the VDMLR through a performance bond. The performance bond is made payable to the VDMLR and conditioned upon the faithful performance of all the requirements of the Virginia Coal Surface Mining Control and Reclamation Act of 1979 (Chapter 19(§45.1-226 et seq.) of Title 45.1 of the Code of Virginia), the permit, and the reclamation plan. All mitigation sites for the proposed mine would be held on a specific bond increment. Performance bond liability is for the duration of the surface coal mining reclamation operation and until the monitoring liability is released by the USACE.

The VDMLR releases bond after it determines that all reclamation obligations have been fulfilled. In the case of the mitigation, bond may be reduced or released once the project has been demonstrated to functionally mature and self-sustaining in accordance with the performance standards.

CEMC will ensure that the Corps' Mitigation Plan is incorporated in the VDMLR permit. Incorporation of the Corps' Mitigation into the VDMLR permit makes the Corps' Mitigation a condition of the VDMLR permit.

EXHIBIT A

Aquatic Resource Summary

Summary of Proposed Impacts to Jurisdictional Waters
Clintwood Elkhorn Mining Company
Laurel Branch Surface Mine (Spring Branch Amendment)
USACE Project No. NAO-2011-00900
VDMLR Permit No. 1101995: VDMLR Application No. 1005420

TOTAL PROJECT SUMMARY

IMPACTS

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	1,610.0	611.8	-	-
Intermittent	4,200	1,691.2	-	-
Ephemeral	980.0	-	-	-
Emergent	-	-	0.11	-
Forested	-	-	-	-
TOTALS	**6,790**	**2,303.0**	**0.11**	**0.00**

MITIGATION

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	710.0	376.3	-	-
Intermittent	5,760	2,182.8	-	-
Ephemeral†		-	-	-
Emergent	-	-	0.11	-
Forested	-	-	-	-
TOTALS	**6,470**	**2,559.1**	**0.11**	

TYPE OF IMPACT

Waters	Streams (LFt.)	Wetlands (Ac.)	
		Jurisdictional	Isolated*
Filled	5,400	-	-
Innundated	380.0	-	-
Excavated	1,010	0.11	0.00
Indirect	-	-	-
Culvert	-	-	-
TOTALS	**6,790**	**0.11**	**0.00**

Fill in Corps Jurisdictional Area by Subwatershed	
Spring Branch	87,120 Cyds.
UTSB-1	11,640
UTSB-2	3,780
UTSB-3	1,825
Total	104,365 Cyds.

Sub-Watershed Drainage Areas	
Spring Branch	196 Acres
UTSB-1	23 Acres
UTSB-2	22 Acres
UTSB-3	17 Acres

†Greater than 980 LFt. of ephemeral channel associated with hollow fill ditches will be constructed to mitigate ephemeral impacts.

Summary of Proposed Impacts to Jurisdictional Waters
Clintwood Elkhorn Mining Company
Laurel Branch Surface Mine (Spring Branch Amendment)
USACE Project No. NAO-2011-00900
VDMLR Permit No. 1101995: VDMLR Application No. 1005420

Spring Branch Subwatershed

IMPACTS

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	1,610.0	611.8	-	-
Intermittent	1,940	-	-	-
Ephemeral	250.0	-	-	-
Emergent	-	-	0.011	-
Forested	-	-	-	-
TOTALS	**3,800**	**611.8**	**0.11**	**0.00**

MITIGATION

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	710.0	376.6	-	-
Intermittent	-	-	-	-
Ephemeral	-	-	-	-
Emergent	-	-	-	-
Forested	-	-	-	-
TOTALS	**710**	**376.6**	**0.00**	**0.00**

Spring Branch Subwatershed

Type of Impact	Streams (LFt.)	Wetlands (Ac.)	
		Jurisdictional	Isolated
Filled	3,290	-	-
Inundated	380.0	-	-
Excavated	130	0.11	-
Indirect	-	-	-
Culvert		-	-
TOTALS	**3,800**	**0.11**	**0.00**

Summary of Proposed Impacts to Jurisdictional Waters
Clintwood Elkhorn Mining Company
Laurel Branch Surface Mine (Spring Branch Amendment)
USACE Project No. NAO-2011-00900
VDMLR Permit No. 1101995: VDMLR Application No. 1005420

PROJECT SUMMARY BY SUB-WATERSHED

UTSB-1 Subwatershed

IMPACTS

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	-	-	-	-
Intermittent	1,000	-	-	-
Ephemeral	-	-	-	-
Emergent	-	-	-	-
Forested	-	-	-	-
TOTALS	**1,000**	**0.0**	**0.00**	**0.00**

MITIGATION

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	-	-	-	-
Intermittent	-	-	-	-
Ephemeral	-	-	-	-
Emergent	-	-	-	-
Forested	-	-	-	-
TOTALS	**0**	**0.0**		

UTSB-1 Subwatershed

Type of Impact	Streams (LFt.)	Wetlands (Ac.)	
		Jurisdictional	Isolated
Filled	1,000.0	-	-
Inundated	-	-	-
Excavated	-	-	-
Indirect	-	-	-
Culvert	-	-	-
TOTALS	**1,000**	**0.00**	

Summary of Proposed Impacts to Jurisdictional Waters
Clintwood Elkhorn Mining Company
Laurel Branch Surface Mine (Spring Branch Amendment)
USACE Project No. NAO-2011-00900
VDMLR Permit No. 1101995: VDMLR Application No. 1005420

PROJECT SUMMARY BY SUB-WATERSHED

UTSB-2 Subwatershed

IMPACTS

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	-	-	-	-
Intermittent	1,260	-	-	-
Ephemeral	-	-	-	-
Emergent	-	-	-	-
Forested	-	-	-	-
TOTALS	**1,260**	**0.0**	**0.00**	

MITIGATION

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	-	-	-	-
Intermittent	-	-	-	-
Ephemeral	-	-	-	-
Emergent	-	-	-	-
Forested	-	-	-	-
TOTALS	**0**			

UTSB-2 Subwatershed

Type of Impact	Streams (LFt.)	Wetlands (Ac.)	
		Jurisdictional	Isolated
Filled	970.0	-	-
Inundated	-	-	-
Excavated	290	-	-
Indirect	-	-	-
Culvert	-	-	-
TOTALS	**1,260**	**0.00**	

Summary of Proposed Impacts to Jurisdictional Waters
Clintwood Elkhorn Mining Company
Laurel Branch Surface Mine (Spring Branch Amendment)
USACE Project No. NAO-2011-00900
VDMLR Permit No. 1101995: VDMLR Application No. 1005420

PROJECT SUMMARY BY SUB-WATERSHED

UTSB-3 Subwatershed

IMPACTS

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	-	-	-	-
Intermittent	-	-	-	-
Ephemeral	730	-	-	-
Emergent	-	-	-	-
Forested	-	-	-	-
TOTALS	**730**	**0.0**	**0.00**	

MITIGATION

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	-	-	-	-
Intermittent	-	-	-	-
Ephemeral	-	-	-	-
Emergent	-	-	-	-
Forested	-	-	-	-
TOTALS	**0**			

UTSB-3 Subwatershed

Type of Impact	Streams (LFt.)	Wetlands (Ac.)	
		Jurisdictional	Isolated
Filled	140.0	-	-
Inundated	-	-	-
Excavated	590	-	-
Indirect	-	-	-
Culvert	-	-	-
TOTALS	**730**	**0.00**	

Summary of Proposed Impacts to Jurisdictional Waters
Clintwood Elkhorn Mining Company
Laurel Branch Surface Mine (Spring Branch Amendment)
USACE Project No. NAO-2011-00900
VDMLR Permit No. 1101995: VDMLR Application No. 1005420

PROJECT SUMMARY BY SUB-WATERSHED

Devils Branch Subwatershed

IMPACTS

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	-	-	-	-
Intermittent	-	-	-	-
Ephemeral	-	-	-	-
Emergent	-	-	-	-
Forested	-	-	-	-
TOTALS	**0**	**0.0**	**0.00**	

MITIGATION

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	-	-	-	-
Intermittent	2,730	1,092.0	-	-
Ephemeral	-	-	-	-
Emergent	-	-	-	-
Forested	-	-	-	-
TOTALS	**2,730**	**1,092.0**		

Summary of Proposed Impacts to Jurisdictional Waters
Clintwood Elkhorn Mining Company
Laurel Branch Surface Mine (Spring Branch Amendment)
USACE Project No. NAO-2011-00900
VDMLR Permit No. 1101995: VDMLR Application No. 1005420

PROJECT SUMMARY BY SUB-WATERSHED

Puncheon Camp Creek Subwatershed

IMPACTS

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	-	-	-	-
Intermittent	-	-	-	-
Ephemeral	-	-	-	-
Emergent	-	-	-	-
Forested	-	-	-	-
TOTALS	**0**	**0.0**	**0.00**	

MITIGATION

Waters	Stream		Wetlands (Ac.)	
	LFt.	EIUs	Jurisdictional	Isolated
Perennial	-	-	-	-
Intermittent	3,030	1,605.9	-	-
Ephemeral	-	-	-	-
Emergent	-	-	-	-
Forested	-	-	-	-
TOTALS	**3,030**	**1,605.9**		

EXHIBIT B

Compensatory Mitigation Summary

Compensatory Mitigation Summary
Clintwood Elkhorn Mining Company
Laurel Branch Surface Mine (Spring Branch Amendment)
USACE Project No. NAO-2011-00900
VDMLR Permit No. 1005420; VDMLR Application No. 1005420

RSC	Establishment	Re-Establishment	Rehabilitation	TOTAL
Spring Branch	-	710	-	710
Devils Branch	-	-	2,730	2,730
Puncheon Camp Creek	-	-	3,030	3,030
Jurisdictional Wetlands	0.11	-	-	0.11
STREAM TOTAL (LFt.)	**-**	**710**	**5,760**	**6,470**
WETLAND TOTAL (Ac.)	**0.11**			**0.11**

EXHIBIT C

Mitigation Monitoring Schedule

SPRING BRANCH AMENDMENT MITIGATION MONITORING SCHEDULE

YEARLY MONITORING REQUIREMENTS FOR RESTORED STREAM CHANNELS

NUMBERS REPRESENT YEAR AN ITEM NEEDS TO BE CONDUCTED

STREAM NAME	HABITAT ASSESSMENT	PHOTOS	X-SECTS & LONG PRO SURVEYS	PEBBLE COUNT	RIPARIAN ZONE SURVEYS (VEGETATION)	BENTHIC MACRO-INVERTEBRATE SAMPLES	WATER CHEMISTRY SAMPLES
Spring Branch	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**
Devils Branch	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**
Puncheon Camp Creek	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**	**1-5, 7, 10**

EXHIBIT D

Eastern Kentucky Stream Assessment Protocol (EKSAP)

Eastern Kentucky Stream Assessment Protocol Analysis for Stream Impacts and Mitigation Proposed by the Spring Branch Surface Mine

Prepared by D.R. Allen & Associates, P.C.
August 1, 2012

Introduction

The Eastern Kentucky Stream Assessment Protocol was used in order to assess ecological impacts and required mitigation for the proposed Spring Branch Surface Mine. The Spring Branch Surface Mine proposes to impact approximately 1,610 LFt. of perennial, 4200 LFt. of intermittent and 980 LFt. of ephemeral stream channels which will require a mixture of on-site and off-site mitigation. EKSAP was originally developed by USACE Louisville District for use in headwater streams in the coalfields of east Kentucky. However, because east Kentucky lies within the same eco-region as Virginia's coalfields the USACE Norfolk District began applying the model to all 404 permits for coal mining around 2003 (Poore 2004). This assessment does not apply to ephemeral streams.

Methodology

EKSAP is a model that uses conductivity, EPA's RBP habitat score and benthic macroinvertebrate data to calculate the Ecological Integrity Index (EII) of a stream (Sparks 2003). The EII value is multiplied by the linear feet of proposed stream impacts to calculate the number of Environmental Integrity Units (EIUs) that must be replaced as mitigation (EII x LFt. of impacts = EIU). The Norfolk district has traditionally required a 1:1 ratio for replacement of EIU's, e.g. if proposed stream impacts are 100 EIU then the proposed mitigation must replace 100 EIU. Replacement of EIU's may be accomplished through, stream restoration, creation, enhancement or preservation.

The Pre-Impact EII and EIU for the proposed impacted streams were calculated using data collected at each ABS station within the impact area. Depending on the results of the macroinvertebrate collection the Habitat + Conductivity or Habitat + Conductivity + MBI form of the model was used. For ABS locations which failed to yield at least 100 organisms, +/- 10%, the Habitat + Conductivity form of the model was applied. The more robust form of the model (MBI + Habitat + Conductivity) was used on ABS locations which met the minimum macroinvertebrate sub-sample requirements of Barbour 1999.

The Habitat + Conductivity version of the model was used to predict the Mitigation EIU's generated by the mitigation plan. We feel it reasonable to assume that, if properly constructed, the total habitat score for intermittent restored channels should be 167, which is classified as fully supporting biotic integrity. While the proposed riparian corridor will enhance the functions of the restored streams, we scored these categories low due to the time required for the development of a mature vegetative cover.

Discussion

The EKSAP model was used with spring 2012 sampling events contained in Appendix F of the individual permit application. Biological Assessment Stations ABS-3, 4 and 10 were used to conduct the EKSAP analysis onsite.

Due to the existing conductivities observed, we assumed a worst case scenario post mining conductivity of at least 500 umhos/cm for the restored channels within the mining area. A conductivity of 500 umhos/cm generates a conductivity sub-index value of 0.1, which is the lowest sub-index value generated by the model. The off-site mitigation, located in Devils Branch and Puncheon Camp Creek, is within the same HUC 8 as the impacts. The proposed mitigation sites have been disturbed by past mining and historic logging operations. Both sites are characterized by sedimentation and unstable banks. The model generated a habitat and conductivity sub-index of 0.48 at Devils Branch and a 0.17 at Puncheon Camp Creek. The EKSAP evaluation and photographs are provided in this document.

The EII calculations and the EIU outputs have been summarized on both a project basis. That summary immediately follows and precedes the model output. As an overall total, the mitigation proposed would result in a gain of EIU's.

References

Barbour MT, Gerritsen J, Snyder BD, Stribling JB. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish, second edition. Washington: Environmental Protection Agency; Office of Water. Report nr EPA 841-B-99-002.

Poore, Annette. Surface Coal Mining in Southwestern Virginia. Aquatic Resource News, A Regulatory Newsletter. 2004 (3)2.

Sparks, Jerry. James Townsend. Todd Hagman. Darvin Messer. Stream Assessment Protocol for Headwater Streams in the Eastern Kentucky Coalfield Region. Aquatic Resource News, A Regulatory Newsletter. 2003 (2)1.

Comparison of Ecological Integrity Indices (EII) and Units (EIU)

(Pre-Impact and Restoration Conditions)

Clintwood Elkhorn Mining Company
Spring Branch Surface Mine - Alternative 3
USACE Project No. Pending
VDMLR Permit No. 1101995; VDMLR Application No. 1005420

	EII*	Stream Length (LFt.)	Stream Type	EIU
Spring Branch				
Pre-Impact:	0.38	3,550	Perennial	-1,349.0
Restoration:	0.53	710	Perennial	376.3
				-972.7
UTSB-1				
Pre-Impact:	0.45	1,000	Intermittent	-450.0
Restoration:	0.53		Intermittent	0.0
				-450.0
UTSB-2				
Pre-Impact:	0.40	1,260	Intermittent	-504.0
Restoration:	0.53		Intermittent	0.0
				-504.0
Puncheon Camp Creek				
Restoration:	0.36	3030	Intermittent	**1090.8**
				1090.8
Devils Branch				
Restoration:	0.40	2730	Intermittent	**1092.0**
				1092.0

Project Totals:		**EIU**
Project Losses:		2,303.0
Project Gains:		2,559.1
	Net Loss =	-
	Net Gain =	**256.1**

* - Pre-Impact and Restoration EII Calculations immediately follow this summary.

DRA/CEMC, 09-409J2, 08-15-12

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (VERSION 2002.6)
****(Genus/species Level Taxonomy - Riffle Only Sample)****

Project ID:	**CEMC Spring Branch**
Stream/Reach:	**Spring Branch (ABS-10)**
Assessment Objectives:	**To determine the ecological integrity of Spring Branch**

0.38	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.27	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>>

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units
RBP Habitat Parameters		
1. Epifaunal Substrate	8	no units (0-20)
2. Embeddedness	8	no units (0-20)
3. Velocity/Depth Regime	11	no units (0-20)
4. Sediment Deposition	8	no units (0-20)
5. Channel Flow Status	13	no units (0-20)
6. Channel Alteration	15	no units (0-20)
7. Freq. Of Riffles (bends)	13	no units (0-20)
8. Bank stability (both combined)	5	no units (0-20)
9. Veg. Protection (both combined)	12	no units (0-20)
10. Riparian Width (both combined)	9	no units (0-20)
Total Habitat Score	102	no units
Habitat Integrity		**Subindex** 0.12
Macroinvertebrate Data - *Genus/species Level*		
11. Genus/species Taxa Richness	16	# of taxa sampled
12. Genus/species EPT Richness	10	# of EPT species sampled
13. % Ephemeroptera	26.82	% Mayflies (0-100)
14. % Chironomidae & Oligochaeta	17.21	% Midges & Worms (0-100)
15. % Clingers	14.56	% Clingers (0-100)
16. mHBI	3.96	no units
Macroinvertebrate Bioassessment	47.24	no units 0.61
Conductivity	359	microMHOs 0.42

Insert Photo Here

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (VERSION 2002.6)
****(Genus/species Level Taxonomy - Riffle Only Sample)****

Project ID:	**CEMC Spring Branch**
Stream/Reach:	**UTSB-1 (BAS-3)**
Assessment Objectives:	**To determine the ecological integrity of UTSB-1**

0.45	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.43	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>>

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units
RBP Habitat Parameters		
1. Epifaunal Substrate	8	no units (0-20)
2. Embeddedness	8	no units (0-20)
3. Velocity/Depth Regime	8	no units (0-20)
4. Sediment Deposition	8	no units (0-20)
5. Channel Flow Status	10	no units (0-20)
6. Channel Alteration	16	no units (0-20)
7. Freq. Of Riffles (bends)	16	no units (0-20)
8. Bank stability (both combined)	12	no units (0-20)
9. Veg. Protection (both combined)	14	no units (0-20)
10. Riparian Width (both combined)	12	no units (0-20)
Total Habitat Score	112	no units
Habitat Integrity		**SubIndex** 0.22
Macroinvertebrate Data - *Genus/species Level*		
11. Genus/species Taxa Richness	10	# of taxa sampled
12. Genus/species EPT Richness	7	# of EPT species sampled
13. % Ephemeroptera	4.48	% Mayflies (0-100)
14. % Chironomidae & Oligochaeta	16.5	% Midges & Worms (0-100)
15. % Clingers	13.79	% Clingers (0-100)
16. mHBI	3.41	no units
Macroinvertebrate Bioassessment	39.38	no units 0.50
Conductivity	279	microMHOs 0.63

Insert Photo Here

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (VERSION 2002.6)
(Genus/species Level Taxonomy - Riffle Only Sample)

Project ID:	CEMC Spring Branch
Stream/Reach:	UTSB-2 (ABS-4)
Assessment Objectives:	To determine the ecological integrity of UTSB-2

0.40	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.33	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>>

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units
RBP Habitat Parameters		
1. Epifaunal Substrate	8	no units (0-20)
2. Embeddedness	8	no units (0-20)
3. Velocity/Depth Regime	8	no units (0-20)
4. Sediment Deposition	6	no units (0-20)
5. Channel Flow Status	8	no units (0-20)
6. Channel Alteration	15	no units (0-20)
7. Freq. Of Riffles (bends)	11	no units (0-20)
8. Bank stability (both combined)	12	no units (0-20)
9. Veg. Protection (both combined)	16	no units (0-20)
10. Riparian Width (both combined)	14	no units (0-20)
Total Habitat Score	104	no units
Habitat Integrity		Subindex 0.14
Macroinvertebrate Data - *Genus/species Level*		
11. Genus/species Taxa Richness	14	# of taxa sampled
12. Genus/species EPT Richness	11	# of EPT species sampled
13. % Ephemeroptera	5.3	% Mayflies (0-100)
14. % Chironomidae & Oligochaeta	25.25	% Midges & Worms (0-100)
15. % Clingers	9	% Clingers (0-100)
16. mHBI	3.23	no units
Macroinvertebrate Bioassessment	41.06	no units 0.53
Conductivity	315	microMHOs 0.53

Insert Photo Here

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (VERSION 2002.6)
****(Genus/species Level Taxonomy - Riffle Only Sample)****

Project ID:	**Puncheon Camp Ck.**
Stream/Reach:	**Restoration Reach - Green Tract**
Assessment Objectives:	**To determine the existing ecological integrity of Puncheon Camp Ck.**

NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.17	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>>

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units
RBP Habitat Parameters		
1. Epifaunal Substrate	12	no units (0-20)
2. Embeddedness	8	no units (0-20)
3. Velocity/Depth Regime	12	no units (0-20)
4. Sediment Deposition	8	no units (0-20)
5. Channel Flow Status	14	no units (0-20)
6. Channel Alteration	16	no units (0-20)
7. Freq. Of Riffles (bends)	8	no units (0-20)
8. Bank stability (both combined)	9	no units (0-20)
9. Veg. Protection (both combined)	10	no units (0-20)
10. Riparian Width (both combined)	16	no units (0-20)
Total Habitat Score	113	no units
Habitat Integrity		
Macroinvertebrate Data - *Genus/species Level*		
11. Genus/species Taxa Richness		# of taxa sampled
12. Genus/species EPT Richness		# of EPT species sampled
13. % Ephemeroptera		% Mayflies (0-100)
14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)
15. % Clingers		% Clingers (0-100)
16. mHBI		no units
Macroinvertebrate Bioassessment		no units
Conductivity	508	microMHOs

	Subindex
Habitat Integrity	0.23
Macroinvertebrate Bioassessment	NA
Conductivity	0.10

Insert Photo Here

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)
(Family Level Taxonomy - Riffle Only Sample)

Project ID:	09-409J2
Stream/Reach:	Devils Branch
Assessment Objectives:	To determine the existing Ecological Integrity of Devils Branch

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.48	Ecological Integrity Index (Habitat Integrity + Conductivity)

Variables	Measure	Units
Enter quantitative or categorical measure from Field Data Sheet in shaded cells		
RBP Habitat Parameters		
1. Epifaunal Substrate	12	no units (0-20)
2. Embeddedness	10	no units (0-20)
3. Velocity/Depth Regime	8	no units (0-20)
4. Sediment Deposition	10	no units (0-20)
5. Channel Flow Status	10	no units (0-20)
6. Channel Alteration	8	no units (0-20)
7. Freq. Of Riffles (bends)	8	no units (0-20)
8. Bank stability (both combined)	10	no units (0-20)
9. Veg. Protection (both combined)	10	no units (0-20)
10. Riparian Width (both combined)	16	no units (0-20)
Total Habitat Score	102	no units
Habitat Integrity Index		Subindex: 0.12
Macroinvertebrate Data - Family Level (Riffle Only)		
11. Family Taxa Richness		# of taxa sampled
12. Family EPT Richness		# of EPT species sampled
13. % Ephemeroptera		% Mayflies (0-100)
14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)
16. mFBI		no units
Macroinvertebrate Bioassessment		no units: NA
Conductivity	203	microMHOs: 0.85

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)
(Family Level Taxonomy - Riffle Only Sample)

Project ID:	09-409J2
Stream/Reach:	Devils Branch
Assessment Objectives:	To predict the Ecological Integrity of RSC-Devils Branch

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.88	Ecological Integrity Index (Habitat Integrity + Conductivity)

Variables	Measure	Units	Subindex
Enter quantitative or categoncal measure from Field Data Sheet in shaded cells			
RBP Habitat Parameters			
1. Epifaunal Substrate	16	no units (0-20)	
2. Embeddedness	16	no units (0-20)	
3. Velocity/Depth Regime	18	no units (0-20)	
4. Sediment Deposition	16	no units (0-20)	
5. Channel Flow Status	16	no units (0-20)	
6. Channel Alteration	17	no units (0-20)	
7. Freq. Of Riffles (bends)	18	no units (0-20)	
8. Bank stability (both combined)	16	no units (0-20)	
9. Veg. Protection (both combined)	16	no units (0-20)	
10. Riparian Width (both combined)	16	no units (0-20)	
Total Habitat Score	165	no units	
Habitat Integrity Index			0.92
Macroinvertebrate Data - Family Level (Riffle Only)			
11. Family Taxa Richness		# of taxa sampled	
12. Family EPT Richness		# of EPT species sampled	
13. % Ephemeroptera		% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)	
16. mFBI		no units	
Macroinvertebrate Bioassessment		no units	NA
Conductivity	203	microMHOs	0.85