Arkansas

Best Management Practices

for Natural Gas Pipeline Construction and Maintenance Activities in the Fayetteville Shale Area – Upper Little Red River Watershed

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These guidelines were developed in cooperation and partnership with

Arkansas Game and Fish Commission

Bureau of Land Management

The Nature Conservancy

U. S. Fish and Wildlife Service

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Arkansas Best Management Practices for Natural Gas Pipeline Construction and Maintenance Activities in the Fayetteville Shale Area

Upper Little Red River Watershed

FOREWARD

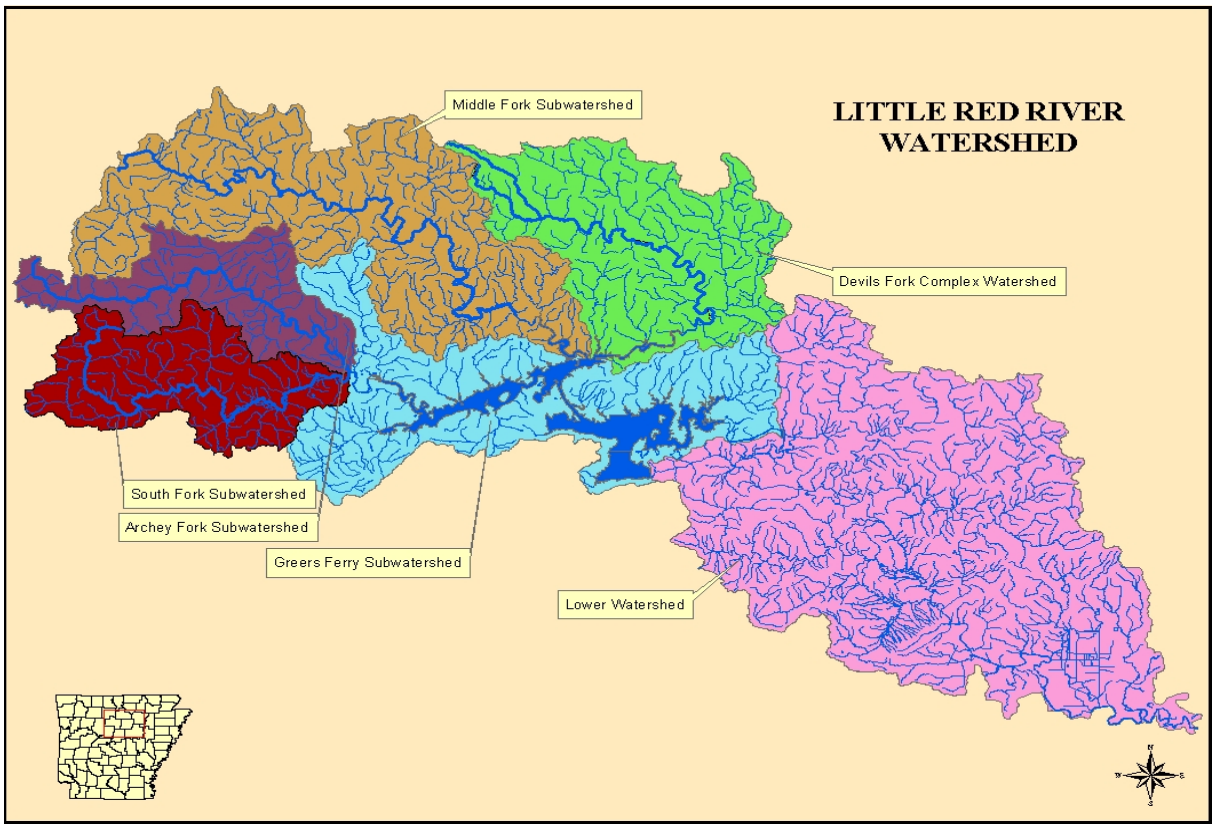
In April, 2007, a multi-agency work group developed the *Best Management Practices for Fayetteville Shale Natural Gas Activities* in an effort to ensure all Arkansans benefit from the additional energy and the conservation of important public resources such as wildlife, rare plants, clean air and water, and aesthetic values while achieving the goals of state and federal laws that protect these resources. These voluntary best management practices (BMPs) received wide spread support from state and federal agencies, non-governmental organizations, and several energy corporations operating in the Fayetteville Shale Area of Arkansas. At that time, the working group did not envision the complexity and severity of erosion and sedimentation issues that would soon emerge from construction and maintenance of pipelines (herein defined as all flow lines, gathering lines, and non-interstate pipelines) in the Fayetteville Shale Area, particularly the central portion of the area that is comprised of steeper slopes than areas to the east. The western portion of the area is largely undeveloped at this time due to lack of existing infrastructure and large tracts of public ownership (i.e., Ozark National Forest and state-owned Wildlife Management Areas). However, as activities progress westward, and continue to expand around the centers of current natural gas development activities in the Fayetteville Shale similar problems may arise due to a similarity in soils, geology, and topography. Thus, our initial attempt to provide adequate BMPs to protect these aquatic natural resources fell short in addressing impacts associated with pipeline construction and maintenance activities.

This document focuses primarily on the most ecologically sensitive watershed impacted thus far, the forks of the upper Little Red River, by providing slope based BMPs developed by the U.S. Fish and Wildlife Service in cooperation with numerous partners. While these BMPs were developed to address threats associated with pipeline activities in the upper Little Red River watershed, we encourage all regulatory agencies and energy or energy-support corporations and contractors to not only adopt these BMPs in this watershed but to expand the scope of these practices to all watersheds with ongoing or planned natural gas development activities in Arkansas. This document lays the ground work and principles, based on the best available science, to significantly reduce erosion and sedimentation and the subsequent detrimental effects of this contaminant on our aquatic natural resources (i.e., fish, mussels, aquatic macroinvertebrates, and water quality).

INTRODUCTION

The Importance of Upper Little Red River Watershed

The forks of the upper Little Red River located in Cleburne, Pope, Searcy, Stone, and Van Buren counties, Arkansas (Figure 1), are recognized by the Arkansas Department of Environmental Quality as Extraordinary Resource and Ecologically Sensitive water bodies. The federally endangered speckled pocketbook (a freshwater mussel) and federal candidate yellowcheek darter (a riffle fish) are endemic to Little Red River watershed (occur nowhere else in the world). Significant erosion and sedimentation issues associated with pipeline (herein defined as all flow lines, gathering lines, and non-interstate pipelines) construction and maintenance was first documented during 2008 as natural gas development activities expanded into the watershed (Arkansas Department of Environmental Quality 2008-2009, complaints and notices of violation; U.S. Army Corps of Engineers 2008, complaints).



Excessive sedimentation has been implicated in the decline of freshwater mussel and fish populations for decades. Even short periods of exposure, can result in lethal or sublethal effects. Specific biological impacts include reduced reproduction and recruitment, reduced feeding and respiratory efficiency from clogged gills, disrupted metabolic processes, reduced growth rates,

limited burrowing activity, and physical smothering of eggs, larvae, and adults. Studies indicate that excessive sediment level impacts are sublethal with detrimental effects not immediately apparent. Physical effects include altered suspended and bed material loads, and bed sediment composition associated with increased sediment production and run-off; clogged interstitial habitats and reduced interstitial flow rates and dissolved oxygen levels; changed channels in the form, position, and degree of stability; altered depth or width/depth ratio that affects light penetration and flow regime; aggraded (filling) or degraded (scouring) channels; and changed channel positions that dewater habitats formerly inhabited by the mussel and/or fish. Interstitial spaces in the substrate provide crucial habitat for juvenile mussels and benthic fishes. When clogged, interstitial flow rates and spaces are reduced, thus reducing available habitat for resting, feeding, and spawning for the speckled pocketbook and yellowcheek darter and the aquatic invertebrates they utilize for food. Sediment may act as a vector for delivering contaminants such as nutrients and pesticides to streams. Mussels can readily ingest contaminants adsorbed to silt particles during normal feeding activities. Indirect effects from erosion and excessive sediment transport reduce the amount of light available for photosynthesis and the production of foods. High turbidity levels also impacts sight-feeding fishes that serve as host for mussels to complete their life cycle.

The Endangered Species Act (ESA) is of concern for all natural gas companies operating in the upper Little Red River watershed, but especially pipeline companies, because of the potential adverse impacts to receiving waters from discharges of sediment that results in increased turbidity, total suspended solids, and sedimentation.

Any of these impacts could be considered a "take" under the ESA. The term "take" applies to any activity that harasses, harms, kills, or injures a species listed under the ESA. Any act that modifies or degrades the habitat of an endangered species in a manner that significantly impairs essential behavioral patterns such as breeding, spawning, rearing, migrating, feeding or sheltering and results in death or injury is considered harmful. The stranding of listed species behind erosion and sediment control features or the impairment of their access into certain areas due to the presence of erosion and sediment control features could also be determined to be a take under the ESA.

The impacts from erosion and sedimentation can result in problems that affect public safety, public drinking water sources, and result in permanent pipeline damage, as well as environmental impacts. Uncontrolled erosion is costly; violates state and federal pollution laws (i.e., Clean Water Act and Arkansas Water and Air Pollution Control Act) and the ESA; and exposes developers, contractors, and landowners to legal liabilities.

Purpose of Pipeline Best Management Practices

This document is intended to describe best management practices (BMPs) for minimizing and/or alleviating environmental damage from natural gas pipelines crossing all streams regardless of

size in the upper Little Red River watershed. Specifically, this document provides slope-based practices for the following pipeline associated activities:

1. Pipeline route, construction, and maintenance planning;
2. Stream crossing construction methods;
3. Scheduling pipeline stream crossings and work on adjacent slopes;
4. Minimizing soil disturbance;
5. Minimizing and/or alleviating sediment discharges into streams;
6. Preventing alterations in stream hydrology and geomorphology;
7. Alleviating changes to the aquatic biota abundance and composition in streams;
8. Preserving water quality;
9. Restoring stream channels after open cut trenching operations; and
10. Provide a best available science-based approach.

Where applicable to pipelines, this document replaces BMPs specified in the *Arkansas Best Management Practices for Fayetteville Shale Natural Gas Activities*. This document does not replace current or future laws, rules, and regulations required by other state and federal regulatory agencies that have oversight authorities for pipeline construction and maintenance activities. It is the sole responsibility of companies and their employees and contractors to ensure compliance with state and federal regulatory requirements. This document does not include practices on the materials and techniques used to construct pipelines for structural integrity as those engineering issues that lie outside the scope of this document.

Construction of pipelines in the mountainous regions of Arkansas, specifically the upper Little Red River watershed, has the potential to create environmental damage to the streams they cross. This region of Arkansas hosts high quality fisheries, immense recreational opportunities, and is of enormous ecological value due to a high number of species that are endemic to the area's streams (i.e., speckled pocketbook and yellowcheek darter). Degradation of these streams and their tributaries from erosion and sedimentation associated with pipeline construction and maintenance has not only a significant impact on the ecology of these streams, but has the potential to degrade economic value of recreational resources (i.e., smallmouth bass and walleye fishing and canoeing). As previously discussed, sediment that is transported from pipelines and stream crossings adversely impact the physical, biological, and chemical components of the aquatic ecosystem.

Authority

This document was prepared in accordance with Service policy and authority provided by the Fish and Wildlife Coordination Act (16 US.C. 661) and the ESA of 1973, as amended (16 U.S.C. 1531 et seq.).

BEST MANAGEMENT PRACTICES (BMPs)

Table 1: Quick Reference Guide to BMPs

Pipeline Activity	Applicable BMPs	Page(s)
Planning Corridor Route	P1 – P13, EC1 – EC2	6 – 9
Mulching	EC3 – EC4, EC25	10 – 11, 22-23
Slope Break Installation/Maintenance	EC5 – EC10	11 – 13
Energy Dissipater Installation/Maintenance	EC11 – EC15	13 – 17
Silt Fence Installation/Maintenance	EC16	17 – 20
Trench Break Installation/Maintenance	EC17 – EC22	20 – 22
Permanent Erosion Control Installation/Maintenance	EC23, EC26 – EC27	22 – 24
Stream Crossings All	SC1 – SC3, SC6 – SC11, SM1 – SM6	25 – 32, 34 – 37
Stream Crossings Horizontal Directional Drill	SC4	25 – 26
Stream Crossings Bridges	SC5, SC7 – SC9	26 – 32
Stream Crossings Culvert	SC9(U)	29 – 31
Stream Crossings Open-cut Trench	SC13 – SC20	32 – 34
Seeps	SC12	32
Karst	K1 – K21*	Appendix 2
Minimizing Non-Sediment Related Exposure	NS1 – NS9	37 – 38
Restoration	R1 – R16	38 – 40
Environmental Compliance Inspector	Not Applicable	40 – 41, Appendix 3

* When karst BMPs contradict other BMPs, always use more conservative measure.

Pipeline Construction and Maintenance Planning

Communication and coordination with company divisions responsible for determining pipeline routes, securing easements, and those responsible for construction, maintenance, and reclamation activities is essential. The planning stage, before the company is committed to a route, is the most efficacious time for raising environmental issues, and it is reasonable for pipeline companies to give notice of plans at a time when communication can still be effective. This is especially true since pipeline companies typically prepare lists of landowners and acquire land along their proposed routes before applying for permits (if required by state and federal agencies).

Planning BMPs

P1. Initial pipeline route selection will include the following steps.

A. Use the slope maps for the upper Little Red River watershed (Appendix 1) to help select pipeline corridors that avoid steeper slopes and minimize stream crossings.

NOTE: These maps do not depict ephemeral streams, some intermittent streams, wetlands, or karst features (refer to Appendix 2 for a description and other information pertaining to karst features).

An ArcGIS shapefile containing all streams in the upper Little Red River watershed with a catchment area ≥ 5 acres is available upon request from the U.S. Fish and Wildlife Service Arkansas Ecological Services Field Office (FWS) (501) 513-4481.

B. Companies, landowners, and environmental compliance inspectors conduct field reconnaissance of pipeline corridors. Field reconnaissance by company personnel is imperative to maximizing erosion control and minimizing environmental damage. The Environmental Compliance Inspector Forms provided in Appendix 3 will be completed during this site inspection(s) and retained in company records.

C. Select the best pipeline corridor prioritizing route selection based on 1) environmental issues, 2) economics, and 3) landowners. These pipeline corridor considerations are listed by priority.

D. Send the FWS (attention: endangered species coordinator) a letter requesting an endangered species clearance. This letter should include a description of the

proposed activity, legal description and/or latitude and longitude, and a detailed map showing the exact location of proposed pipeline corridor, corridor adjustment, or maintenance activity (see Appendix 4 for template letter). Where agency recommendations differ, always follow the most conservative recommendations (always err on the side of the federally protected species) to ensure Endangered Species Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act compliance.

E. The FWS will send the company or company representative a response to the request for an endangered species clearance within 30 days upon receipt of the letter. The FWS will copy the appropriate state and federal regulatory agencies.

F. At this point, the company will adjust the pipeline corridor to address recommendations by the FWS and other state and federal agencies.

G. Secure appropriate state and federal permits.

P2. Based on P1C, evaluate the need and as necessary locate pipeline right-of-ways in areas that minimize environmental effects to the greatest extent possible, with consideration given to terrain and other applicable BMPs. Ensure that pipeline right-of-way does not intersect the convergence of multiple stream channels or drainages unless Horizontal Directional Drill (HDD) methods are planned.

P3. Avoid paralleling intermittent, perennial, and spring-fed stream channels whenever possible. If a pipeline must parallel such a stream channel, ensure that adequate forested or other native vegetative community buffers are maintained as follows and must take into account slope alterations along the right-of-way side slopes caused by construction activities: 1) slopes 0-15 percent require a 100 foot buffer; 2) slopes 16-30 percent require a 125 foot buffer; and 3) slopes greater than 30 percent require a 150 foot buffer; or install erosion containment methods as recommended by the Environmental Compliance Inspector and approved by FWS. The buffer width includes the area from the edge of the right-of-way boundary (or area of ground disturbance) to the edge of the stream bank or karst feature.

P4. Select erosion control measures appropriate for on the ground conditions including percent slope, length of slope, and soil type and erosive factor (refer to the Erosion Control measures below for more detail).

P5. Existing pipeline right-of-ways will be given strong consideration as the locations for additions to existing natural gas transmission facilities, including the joint use of existing right-of-ways by different kinds of utility services and other natural gas companies.

Acceptable deviations from existing right-of-way use include safety (requires justification), environmental effects, and lack of third party concurrence. The same construction standards laid out in this document will be applied for additions to existing pipelines.

P6. Keep pipeline right-of-way width to the minimum width necessary for pipeline construction based on pipe diameter specifications and safety. The right-of-way can generally be constructed with a width less than industry standards if slope, geology, soil type, erosive factor (see NRCS), and safety concerns are satisfied. For example, a 40 foot right-of-way may be constructed with 30-35 feet thereby minimizing the amount of disturbance in sensitive areas. Future and existing pipeline corridors may vary in width given these considerations, rather than being of uniform width.

P7. The time and method of clearing pipelines corridors will take into account matters of soil erosive factor, the protection of natural vegetation, and adjacent resources. Scheduling will reduce the amount of soil exposed and the duration of its exposure to wind, rain, and vehicle tracking. Scheduling will include the following BMPs.

A. Incorporate the use of a schedule or flow chart to layout the construction plan.

B. Work out the sequencing and time frame for the initiation and completion of tasks such as site clearing, grading, excavation, installing pipe, and reclamation.

C. Incorporate erosion and sediment control BMPs.

D. Avoid major clearing and grading activities when possible between November and May. Extra BMPs will be required during this period to protect the pipeline from erosion.

E. Prior to onset of rainfall, stabilize soil with erosion control measures below (installing temporary and permanent BMPs to prevent erosion). Continually monitor the forecast for rainfall. When rainfall is predicted, adjust the construction schedule to allow the implementation or maintenance of soil stabilization and sediment control BMPs on all disturbed areas prior to the onset of rain.

F. Plan to inspect and repair all erosion control measures after each rainfall event that results in overland runoff. Be prepared year round to deploy and maintain erosion control BMPs. Maintenance of BMPs is as important as their initial

placement.

P8. Reduce motorized access to essential vehicles and equipment only. Encourage private landowners to fence or gate access to pipelines, especially at stream crossings, to minimize soil disturbance.

P9. Avoid crossing springs, identifiable seeps, and other karst features. For unidentifiable seeps, ensure that erosion control measures are implemented and maintained once the seep is identifiable.

P10. Portions of the upper Little Red River watershed lie within the Karst Region of Arkansas. The FWS has developed BMPs specific to protecting natural resources (i.e., ground water, recharge zones, caves) associated with this ecologically and socially important region (Appendix 2). Be prepared to implement Karst BMPs when appropriate. When BMPs in this document contradict Karst BMPs, use the more conservative BMP (i.e., the BMP which makes greater effort to protect natural resources).

P11. Ensure that all employees and contractors are properly informed and trained on how to properly install and maintain erosion control BMPs. Companies should require all employees and contractors responsible for supervising the installation and maintenance of BMPs and those responsible for the actual installation and maintenance to receive training in proper installation and maintenance techniques. State and federal agencies and non-governmental organizations have the expertise to host semi-annual workshops to ensure employees and contractors are properly certified and/or trained to perform this activity.

P12. Determine appropriate species for revegetating right-of-ways, and plan to revegetate as soon as possible after construction using native vegetation whenever possible. State and federal natural resource agencies can assist with selection of appropriate species and provide advice and recommendations on seeding or planting.

P13. Environmental compliance inspector(s) will be present for all pipeline construction phases and as is required in this document to ensure maintenance of BMPs over time.

<u>Minimizing Soil Disturbance and Sediment Discharges During Construction</u>

Pipeline construction is a linear process in which different activities (i.e., clearing land, grading, trenching, placing pipe in the ground and welding segments, backfill, and restoration) are conducted at different stages. The initial clearing and grading activities may be separated from the backfill and restoration activities by many months and miles. As a result, bare erodible soil is exposed within a typical 50 to 75 foot right-of-way for long periods. It is this prolonged

exposure of bare erodible soils, especially in areas with steeper slopes that drain directly into streams, that increases the risk of sediment discharge to streams. One BMP or suite of BMPs does not fit every erosion problem that may arise during or after pipeline construction and maintenance activities.

For pipelines that require less than 10 days to clear, BMPs to reduce erosion and sedimentation will be installed within three days after land clearing is complete or prior to the onset of rainfall, whichever is shorter. If a pipeline requires more than 10 days to complete land clearing, BMPs must be installed in the segment that has already been cleared within 13 days of initial clearing or prior to the onset of rainfall, whichever is shorter. BMPs must be maintained throughout construction (post clearing) until restoration is complete. This includes installation of BMPs discussed below.

Erosion Control BMPs

EC1. Temporary erosion controls must be properly maintained throughout construction (on a daily basis) and reinstalled as necessary (such as after backfilling of the trench) until replaced with permanent erosion controls or restoration is complete.

EC2. If the pipeline right-of-way boundary slopes downhill towards the stream, spring, seep, or other karst feature buffer, ensure that the appropriate sediment barriers detailed below are properly installed and maintained along the tree line. All construction work around streams or other sensitive areas should have a back-up set of erosion control measures. Combinations of erosion controls below can be used along stream (i.e., silt fence parallel to stream banks protect the stream from sedimentation and as a back-up measure temporary mulch can be applied on disturbed areas prior to anticipated rain events).

EC3. Mulching is the use of vegetative fibers (i.e., straw, wood chips) to minimize rainfall impact, reduce suspended solids from runoff, protect topsoil and seeds from erosion, prevent moisture loss from the soil, and reduce seed consumption by birds. Wood chippers will be used to convert trees and branches less than 8 inches in diameter or larger when practicable to fine mulch (defined as material that does not prohibit seed germination). This erosion control measure can be used anywhere along the pipeline corridor, except material will not be placed in stream channels. This erosion control measure is intended to be used in conjunction with other erosion controls measures such as slope breaks and silt fences at stream crossings.

EC4. Mulching is strongly encouraged on steeper slopes, ≥ 15 percent, and areas with poor soils. Installation should occur within 3 days of initial right-of-way clearing, be maintained until 95 percent revegetated, and in other sensitive areas with < 15 percent

slopes used as prudent.

A. Mulches may require a binder, netting, or tacking depending on site specific conditions and material. Straw and hay should be anchored, while bark and wood chips map not require anchoring depending on site specific conditions. If using netting, it must be biodegradable.

B. Only "noxious weed free" straw mulch will be applied uniformly over the area to cover at least 95 percent of the ground surface at a rate of 2 tons/acre of straw, unless the local NRCS District Conservationist, landowner, or land managing agency approves otherwise in writing.

C. Areas where respread topsoil exhibits adequate cover (greater than 95 percent) of plant debris and coarse fragments, mulch rates may be reduced as determined by the NRCS District Conservationist and company inspector.

D. Continual maintenance is required to ensure that mulches provide effective erosion control.

E. Conduct inspections within 48 hours after a rainfall event of 0.5 inch in a 24 hour period or 0.25 inch rainfall event in 1 hour until vegetation is firmly established (95 percent revegetated).

NOTE: USEPA has determined mulching effectiveness varies according to the type of mulch. Soil loss reduction for different mulches (i.e., wheat straw, wood fibers and different binders or netting) ranges from 53 – 100 percent. Water velocity reductions range from 24 – 78 percent. The best soil loss and water velocity reduction rate occurred with 70 percent wheat straw and 30 percent coconut fiber.

Proper installation and maintenance of slope breaks, also known as grade breaks or water bars (EC5 – EC10).

EC5. Slope breaks are intended to intercept water concentrated and traveling down a disturbed slope and divert water off disturbed soil into stable, well-vegetated, or adjacent rocky areas. Refer to Illustrations 1A – 1C for typical slope break construction illustrations.

EC6. Slope breaks will be constructed of compacted native soil and installed at locations specified below.

EC7. Slope breaks will be oriented to direct water off the right-of-way.

A. Slope breaks will be constructed at a two to eight percent gradient across the slope (approximately 60 degree angle preferred).

B. Slope breaks will be a minimum 18 inches high from bottom of trough to top of slope break. Two feet will ensure greater sediment retention capacity. .

C. The trough will be a minimum five feet across the width of the right-of-way.

D. Each slope break will be a minimum 2 feet across the top.

E. Side slopes will be 2:1.

F. The outlet of the slope break must freely discharge all runoff off the disturbed right-of-way into a stable, well vegetated area that has a minimum vegetated buffer specified in BMP P3.

G. Do not allow runoff from up slope slope breaks to converge with down slope outlets.

H. Mulch slope break ridge and channel immediately upon slope break construction/maintenance. Seed as prudent during construction.

I. Straw bales or rock will be used as energy dissipaters in areas where existing vegetation is not sufficiently stable to prevent erosion or sediment from entering a stream, spring, seep, wetland, or other karst feature. The outlet end of the energy dissipater will be constructed lower than the slope break end. Energy dissipaters (see EC12 – EC18) will be keyed into the end of the slope break and extend a minimum of four feet beyond the slope break and extend from the corner upslope a minimum of six feet at a 90 degree angle ("L" shape) or "J" hook configuration. Provide enough area inside the "L" or "J" to capture and hold sediment. Periodic maintenance may be required until reclamation is complete and the right-of-way is fully revegetated.

J. Sediment basins may deviate from EC7I provided that they are designed to collect sediment and prevent sediment transport into sensitive areas. Specific design criteria for sediment basins are available from numerous sources on the internet. The following guidelines should be followed with maintenance of sediment traps:

1. Inspect within 48 hours of rainfall events exceeding 0.5 inch in a 24 hour period or 0.25 inch in 1 hour.

2. Remove sediment from basins when they are 50 percent full unless corridor is 95 percent revegetated.

3. Dispose of sediment away from sensitive areas or areas prone to erosion.

4. Make necessary repairs immediately.

K. Temporary slope drains convey runoff down the face of a cut or fill slope without causing erosion of side slopes at slope break outlets. These structures generally are not recommended since the slope drain outlet generally would discharge sediment into sensitive areas such as streams and floodplains. The FWS will review request to use these structures case by case.

EC8. The general spacing for temporary and permanent slope breaks is as follows:

A. No slope breaks are required on slopes less than 5 percent except when approaching a stream crossing, then slope breaks will be placed 100 feet apart. Do not outlet slope break into the stream.

B. For slopes of 5 to 10 percent, install slope breaks 75 feet apart.

C. For slopes of 11 to 20 percent, install slope breaks 50 feet apart.

D. For slopes greater than 20 percent, install slope breaks 25 feet apart.

E. Closer spacing of slope breaks will reduce maintenance requirements due to sediment building up at the foot.

F. If rills (channels) start to form between slope breaks, decrease distance between slope breaks until the spacing is adequate to control water volume and velocity without forming rills.

EC9. Slope breaks will not outlet runoff directly into a stream, seep, spring, wetland, or other karst feature. Ensure that slope breaks also do not create conduits (or channels) that direct sediment through the vegetated buffer and into the stream channel, spring, seep, wetland, or karst feature.

EC10. Slope breaks will be inspected and repaired <u>daily</u> in areas with active construction and vehicle or equipment traffic and within 48 hours following a 0.5 inch rainfall event in a 24 hour period or 0.25 inch rainfall event in 1 hour along the rest of the corridor with

bare erodible soils to maintain their effectiveness. Slope breaks worn down by heavy construction traffic or filled with sediment will be repaired immediately and the sediment will be spread on the disturbed ROW uphill of the water bar or other non-erosive areas.

Proper use and installation of energy dissipaters for erosion control (EC11 – EC15).

EC11. Never use straw bales for instream use or areas with channel flow. Straw bale sediment barriers can be installed at 1) the ends of grade breaks, 2) simultaneously with silt fences that parallel the tree line (right-of-way boundary) when the right-of-way slopes downward towards a stream, spring, seep, or other karst feature and is within vegetated buffers specified in BMP P3 and the slope is less than 10:1 (10 percent), and 3) at the ends of bridges. Refer to Illustration 2A – 2C for typical straw bale installation. Straw bale sediment barriers will consist of and be installed as follows:

A. Bales will be tightly abutted to one another.

B. The barrier will be one bale high.

C. Use only "noxious weed free" straw whenever possible.

D. Entrench straw bales into the ground to a depth of four inches except in saturated or extremely rocky soils. This will discourage underflow. Place parent material on upstream side of straw bales to prevent undermining. If the area behind the barrier has been disturbed or is naturally subject to erosion, the barrier will be back filled.

E. Ensure adequate bale to soil contact.

F. Anchor straw bales securely in place with two wooden stakes or steel rebar stakes driven through the tops of the bales. The stakes will penetrate the ground a distance of 1 foot unless rock or an impermeable layer is encountered. The first, center, and end bales of the barrier will have stakes driven vertically through the bale. Bales other than those located on the ends or center of the barrier, will have the first stake driven through the top of the bale at an angle so that the stake passes through the previously placed bale, in order to provide tight contact between bales. The second stake will be driven vertically through the top of the bale.

G. Maximum flow path to the barrier will be limited to 100 feet.

H. Where straw bales are used as a sediment barrier at the end of a bridge, they can be removed during the work day, provided it is not raining, and properly replaced at the end of each work day. If it is raining lightly (no noticeable runoff), straw bales can be removed temporarily to accommodate traffic flow, but must be replaced immediately upon exiting the stream crossing structure. These straw bales also must be entrenched four inches deep to minimize the likelihood that storm water will wash them onto the bridge or into the stream, thereby rendering them ineffective.

I. Straw bales will be checked and maintained daily in areas with active construction, weekly in areas with inactive construction, and within 48 hours of each 0.5 inch rainfall event in a 24 hour period or 0.25 inch rainfall event in 1 hour. Monitor for undermining or flow around. Inspect bale position to assure that they remain close together. Maintain straw bale barriers by replacing damaged bales and removing sediment load. When sediment load is greater than 40 percent behind the barrier, sediment will be removed and placed in an area where it will not re-enter the barrier or stream, spring, seep, or other karst features. If sediment behind straw bale barriers cannot be removed, a second row of bales will be installed upslope of the barrier. Structures will be repaired as necessary.

J. Where straw bales are used simultaneously with other sediment barriers, the straw bales will be installed on the down slope side of the other sediment barrier.

K. Structures will be removed only after final reclamation is complete and the right-of-way is fully revegetated.

EC12. Check dams are small sediment barriers but primarily energy dissipaters constructed of large rock (approximately 12 – 15 inches in diameter), gravel and sand bags weighing approximately 50 pounds, and in some instances other approved materials. Check dams are recommended for use in road ditches and in stream when dewatering the channel for open cut trenching across a stream channel. Refer to Illustration 3 for proper installation. Illustration 3 recommends a maximum rock size of 8 – 12 inches, but larger rock is generally required in the upper Little Red River watershed due to topography.

A. Installation of check dams in streams may require approval from appropriate regulatory agencies. Ensure proper permits are obtained prior to installation.

B. Check dams are TEMPORARY measures and are not substitutes for other sediment control measures, but are effective compliments to other measures.

C. Check dams used in a series should be spaced so that the base of the upstream dam is at the same elevation as the top of the next downstream dam.

D. Check dams must be built properly to ensure effectiveness. Do not dump the material into the channel because that may increase erosion.

E. Never create check dams greater than 3 feet tall.

F. The center of the check dam should be at least six inches lower than its edges.

G. Check dam stability is greater when implanting the rock six inches into the sides and bottom of the channel.

H. When installing a series of check dams, install outlet stabilization measures (see SC6) downstream of the final dam because this area is vulnerable to further erosion.

I. Check dams require frequent and extensive maintenance.

J. Remove check dams used in conjunction with pipeline construction or maintenance only after the contributing drainage area has been completely stabilized. Use vegetation or native stone to stabilize the area from which the dam material is removed.

K. Remove all accumulated sediment behind dams prior to removal (channel must be dewatered to prevent sediment transport downstream) and ensure proper channel contour and flow is restored within channel.

EC13. Fiber rolls are biodegradable fibers stuffed into photo-degradable open weave netting. They allow water to pass through the fibers and trap suspended sediment, increase infiltration rates and reduce erosion. Fiber rolls are not effective for high surface flows or long steep slopes. Their primary purpose is not sediment control, even though they do provide some removal. There may be some instances where fiber rolls may compliment other sediment control measures, but the effectiveness to compliment other BMPs should be carefully reviewed prior to use. The use of fiber rolls is not recommended as the primary defense against pipeline erosion.

EC14. Slope grading reduces erosion potential by decreasing runoff velocities, trapping sediment and allowing an increase in water infiltration into the soil.

A. In order to facilitate the long-term stabilization of vegetation, all pipeline slopes greater than 20 percent will have the surface roughened, stair-step graded or terraced. Surface roughening will benefit seeding, planting, and mulching.

B. Terracing is only applicable on gradual slopes (< 10 percent) with non-sandy soils. Any sort of terracing is usually permanent. Therefore, terracing will be designed based on site conditions and approved by a registered engineer.

C. Grade the pipeline right-of-way to restore pre-construction contours and leave the soil in proper condition for planting.

The limitations of slope grading include: 1) sloughing with certain soil types, 2) has limited effectiveness during intense rain events, 3) roughening is a temporary erosion control and will be used in conjunction with other erosion controls such as seeding and mulching, and 4) stair-step grading is not practical for sandy or very willow soils or steep slopes.

EC15. Sediment basins are generally only practically effective in removing sediment down to about the medium silt size fraction. Sediment laden runoff with smaller size fractions (fine silt and clay) may not be adequately treated. The FWS will review individual requests for use of sediment basins, but it generally has proven to be ineffective at sufficiently minimizing or eliminating sedimentation in streams when used in pipeline construction and maintenance activities in the upper Little Red River watershed and therefore is not recommended without prior approval.

Proper use, installation, and maintenance of silt fence for erosion control (EC16).

A silt fence is a filter fabric entrenched into the soil six inches. It is designed to intercept and detain sediment

EC16. Typical silt fence installation will be installed simultaneously with sand bags or wire mesh for support on the down slope side except where otherwise specified herein. Silt fences are generally in locations with sheet or overland flows. Silt fences are most effective when used in combination with other erosion controls (i.e., straw bales, sand bags, etc). Refer to illustration 4A – 4C for proper installation. This BMP will be utilized at the following locations.

A. The base of all slopes above roads, impoundments, streams, springs, seeps, wetlands, and other karst features.

B. At the down slope edge (boundary) of the right-of-way to protect sensitive areas by complimenting BMPs P3-4 and EC8.

C. Between topsoil/spoil stockpiles.

The silt fence will be constructed as follows:

D. Fabric used for the silt fence will be a "standard strength" geotextile, such as MIRAFI 100X or an equivalent. It will retain 85 percent of soil by weight, based on sieve analysis, but that is not finer than an equivalent opening size of 70.

E. The fabric will be cut from a continuous fabric roll.

F. The height of the fence will not exceed 24 inches.

G. Splices will only be done at posts and will consist of a minimum of six inches of overlap with both ends secured to the post.

H. Posts (wooden or metal) will be positioned a maximum 6 feet apart. A secondary, and often better alternative, is to reinforce the silt fence with wire mesh behind the fabric.

I. Posts will consist of two inch by two inch wooden stakes, or equivalent (i.e., metal "T" posts), of sufficient length to extend a minimum of 12 inches below the grade.

J. Fabric will be stapled or wired to posts a maximum of every nine inches. A minimum of 4 staples per stake.

K. Cross barriers (sand bags) will be a minimum of ⅓ and a maximum of ½ the height of the linear barrier. Maximum reach between cross barriers is 500 feet. Metal fences wired to metal "T" posts on the down slope side of the fence is an acceptable alternative to using sand bags. If metal fences are used, the fence should extend from the ground to the top of the silt fence.

The silt fence will be installed as specified by the manufacturer (when manufacturer recommendations are more conservative) or as follows:

L. Never install silt fences perpendicular to stream channels or anywhere flow is concentrated.

M. Never direct concentrated flows toward any silt fence.

N. Do not use silt fences below slopes subject to creep, slumping, or landslides.

O. A trench, six inches wide and six inches deep, will be excavated along the contour. Bottom of the silt fence will be keyed in a minimum of 6 inches below the surface. The post will be driven into the bottom of the trench on the downstream side of the filter fabric. The trench will be back filled and compacted, ensuring six inches of fence is buried within the trench.

P. In areas where terrain is too rocky for trenching, a six inch ground flap with rock or soil fill to hold it in place will be used. Ground flaps must be completely covered to prevent sediment transport under the silt fence.

Q. Silt fences placed at the top and bottom of slopes will be 10 feet below the crest or setback from the stream bank.

R. Silt fences will be placed at the toe of a slope and setback 3 feet from the toe of the slope.

S. Sand bags or metal fences (14 gauge with six inch mesh) will be placed down gradient from the toe of the slope to reinforce the sediment barrier.

T. Silt fences placed at the base of spoil or topsoil stockpiles will extend around the base of the piles in order to contain any sediment and/or prevent flow around the fence.

U. When installing silt fences parallel to stream banks, extend fence far enough off the right-of-way to prevent flow around the fence.

V. Turn the ends (last eight feet) of the silt fence upslope to prevent storm water from flowing around the ends.

W. Install along a level contour (maximum slope perpendicular to fence line will be 1:1), so water does not pond more than 1.5 feet at any point along the silt fence.

X. The maximum length of slope draining to any point along the silt fence will be 100 feet for slopes less than 2 percent; 75 feet for slopes two to five percent; 50 feet for slopes five to ten percent; 25 feet for slopes 10 – 20 percent; and 15 feet for slopes greater than 20 percent.

Y. If required, a 15 foot gap will be left in the silt fence to accommodate traffic on temporary construction roads or bridges. However, a section of silt fence or a driveable earthen berm tied into the adjacent silt fence will be used to close the gap at the end of each day and during a rainfall event. The silt fence used to close the gap must overlap the ends of the permanent silt fence for a minimum of two feet, and will be "keyed" into the ground the same as the filter fabric on either side of the gap.

Z. Check and maintain silt fences daily in areas with active construction, weekly in areas with inactive construction, and within 48 hours of each 0.5 inch rainfall event or 0.25 inch rainfall event in 1 hour. Repair structures as necessary. Adjust the depth of the anchor trench if undermined. Should inspector reveal sediment loading at or near 40 percent capacity, remove the sediment and place it in an area where it will not re-enter the silt fence, stream, wetland, spring, seep, or other karst features. Improperly installed silt fences are subject to failure from undercutting, overlapping, or collapsing.

AA. **The life span of silt fence fabric is generally six months.**

BB. Remove silt fence only after final reclamation and the right-of-way (tree line to tree line or any areas with bare erodible soils including areas between wind rows and tree line) is completely revegetated.

NOTE: USEPA reports that silt fences constructed of filter fabric that are properly installed and well maintained remove an average total suspended solids of 70 percent, sand removal of 80 – 90 percent, silt-loam removal of 50 – 80 percent, and silt-clay-loam removal of 0 – 20 percent. Removal rates are highly dependent on local conditions and installation/maintenance.

Proper location, installation, and maintenance of trench breaks (EC17 – EC22).

EC17. Trench breaks, or small dams, installed across the trench, to direct trench water to a stable, non-sensitive area will be installed in all trenches and maintained until the trench is closed. Refer to Illustration 5 for typical trench breaker construction.

EC17 A – D refer to the location of trench breaks.

A. Install trench breaks on slopes along the trench line where the natural drainage pattern, profile, and type of backfill material may result in loss of backfill material and alteration of the natural pattern.

B. At the base of slopes adjacent to streams, springs, seeps, wetlands, and other karst features.

C. On upland slopes at the same spacing as slope breaks and upslope of slope breaks.

D. Regardless of slope, install a trench break at the base of the slope 25 feet from a stream, spring, seep, or other karst feature.

EC17 E – H explain how to properly construct and install trench breaks.

E. Sack breaks will utilize open weave hemp or jute sacks filled to approximately 50 pounds of subsoil, sand or mixture of one part cement to six parts sand or subsoil as determined by company inspector.

F. Polyurethane foam breaks may be used in-lieu of sack breaks when approved by company inspector.

G. Do not use topsoil in trench breaks, except when replacing topsoil (top 12 inches on top of sack breaks).

H. Breaker spacing and configuration may be changed as directed by company since depth of ditch may vary with site conditions.

EC18. Once the trench is dug, the pipeline will be laid in the ground within 48 hours and back filled on slopes that drain directly into streams, springs, seeps, or other karst features. Rapid backfilling will facilitate rapid restoration. Exceptions for equipment breakdown, rainfall, or other unavoidable circumstances are acceptable, but may require additional erosion control measures.

EC19. To dispose of trench water without incurring serious turbidity and sedimentation damage to streams, springs, seeps, or other karst features, the trench water must be disposed of in areas not conducive to erosion, down slope runoff, or other sensitive areas.

EC20. Water used to clean the pipe is often laden with soils and can cause problems if allowed to run into streams. Redirect these fluids upland or to a stable area where sediment can settle out without being transported into sensitive areas.

EC21. Erosion controls such as silt fence will be placed around stock piled soils from the trench when the trench will remain open for more than two days or forecasted rainfall greater than 20 percent. Soil containment berms are to be used where instream trench spoil could re-enter the stream directly or indirectly and with simultaneous utilization of sediment barriers.

A. Material used for the containment berm will be a minimum of 10 feet from the water's edge. It will be kept to a height which remains stable during the construction period.

B. Care will be taken that the spoil pile does not overtop the containment berm.

C. As much riparian vegetation will be left intact as possible.

D. Staged movement of instream spoil may be required if quantities are excessive.

E. Care and attention will be taken to ensure spoil containment berms are maintained.

EC22. Full consideration of overall slope stability is required when selecting a spoil containment location.

Proper installation and maintenance of permanent erosion control measures (EC23 – EC27).

EC23. Remove temporary sediment barriers when replaced by permanent erosion control measures or when revegetation is successful (no bare erodible soils left in the pipeline right-of-way or other construction related areas).

EC24. Plow or rip severely compacted soils.

EC25. Hydro-mulching and hydro-seeding is a planting technique that employs wet slurry of seed, mulch fiber, fertilizer and water allowing for rapid plant growth on disturbed areas. This BMP takes 24-48 hours before it is effective as an erosion control measure, assuming that soil conditions are suitable for plant growth. Use the following guidelines for application.

A. When sprayed on the slope or ground, a continuous blanket will form that holds seeds in place and retains soil moisture.

B. Spread mulch over 100 percent of the exposed soils at a rate of 2 tons/acre of straw or its equivalent.

C. Increase this rate to 3 tons/acre within 150 feet of streams, springs, seeps, wetlands, and other karst features.

D. When applied, make sure that coverage is consistent and that all areas look the same.

E. Ensure that mulch is adequately anchored to minimize soil loss to wind and rain.

F. Hydraulic fiber mulches and/or tackifying agents are useful and necessary on steeper slopes. However, do not use liquid mulch binders within 150 feet of a stream, spring, seep, wetland, or other karst features. There are several types of mulches that are suitable for this BMP.

G. Mulching is required when 1) final grading and installation of permanent erosion control measures will not be completed in the area within 5 days after the trench in that area is backfilled; 2) construction or restoration activity is interrupted for a period of 3 days; and 3) when seeding cannot be completed due to seeding period restrictions.

EC26. Erosion control blankets (woven material made out of synthetic and natural materials such as jute, coconut fiber, straw, etc.) decrease soil compaction, protect disturbed soil from rain impact, increase water infiltration, and protects seed from runoff and moderate soil temperature to enhance vegetation growth. Erosion control blankets in conjunction with other erosion control measures (i.e., slope breaks, etc) will be used in the following circumstances.

EC26 A – E explain where to locate erosion control blankets.

A. Slopes steeper than 6.7:1 (15 percent).

B. Adjacent to streams, springs, seeps, and other karst features.

C. In areas where vegetation is slow to develop.

D. In areas where an effective means to control erosion is needed immediately.

E. Erosion control blankets should be used during construction as needed, but generally are used during pipeline reclamation.

EC26 F – H explain how to install erosion control blankets.

F. Erosion control blankets will be properly anchored with biodegradable stakes.

G. Periodic inspection within 48 hours after periods of rain exceeding 0.5 inch during a 24 hour period or 0.25 inch in 1 hour during the course of construction and as prudent following reclamation. Any failures will be repaired immediately. If a washout or breakage occurs, repair damage to the slope and then re-anchor or re-install.

H. The use of plastic results in 100 percent runoff, is easily vandalized, torn, and must be disposed of at a landfill. The use of plastic covers is discouraged regardless of application.

EC27. Permanent slope breaks will be constructed to the same spacing and design requirements as specified in EC5 – 10, except ridges, channels, and outlets must be non-erosive and stable.

Preventing Changes in Stream Morphology and Hydrology

Depending on the size, timing, and method of pipeline crossing, changes in stream morphology and hydrology can occur hundreds of feet or even miles from the crossing. Alteration of stream morphology has particularly significant impacts on the long-term health of fisheries, particularly mussels and sediment sensitive fishes and aquatic macroinvertebrates, because changes in the river channel at the point of a pipeline crossing can invoke associated changes (e.g., increased bed load movement, exacerbated channel migration, etc.) to other reaches of the river, both upstream and downstream. Stream crossing BMPs specified in this section minimize and/or help alleviate alterations to water quality, instream aquatic habitats, and stream morphology and hydrology.

There are two types of stream crossing methods used in the Fayetteville Shale area: 1) open cut trench, and 2) horizontal directional drill (HDD). HDD is more expensive initially and time consuming for the pipeline company, but has the least impact on the environment. For this reason, HDD is the best choice when crossing streams in watersheds that are extraordinary (as defined by the Arkansas Department of Environmental Quality) or ecologically sensitive (i.e.,

federally threatened and endangered aquatic or cave species and state species of greatest conservation need occur in the watershed).

Stream Crossing BMPs

SC1. Install and properly maintain erosion control BMPs on slopes approaching stream channels.

SC2. Every effort will be made to avoid construction and maintenance activities in streams during sunfish (i.e., green sunfish, basses, longear, bluegill, etc.) and yellowcheek darter spawning seasons (April – June).

SC3. Wet open cut trenching is not permissible in any stream channel.

SC4. Cross intermittent, losing, and perennial streams (see Appendix 6 – Definitions and Appendix 4 – K17) with HDD method. Leave a minimum 250 foot vegetated buffer extending from the top of each stream bank at perennial stream crossings. Lesser buffers will be reviewed on a case by case instance by the FWS and appropriate regulatory agencies. The Arkansas Oil and Gas Commission's Rule D-17 requires that a minimum 100 foot vegetative buffer remain intact at perennial stream crossings. No alteration of current vegetation in this 100 foot buffer strip is permissible. When HDD method is used to cross intermittent streams the same buffer as that used at perennial stream crossing will remain intact.

BMPs for HDD at Waterbody Crossing

A. Set up drilling equipment a minimum 250 feet from the edge of the stream bank. Lesser buffers will be reviewed on a case by case instance by the FWS and appropriate regulatory agencies. A minimum 100 feet from each stream bank is always required. Refer to Illustration 6 of a typical HDD at a water body crossing.

B. Ensure that only Bentonite based drilling mud is used. Do not allow the use of any additives to the drilling mud without the approval of the FWS, appropriate regulatory agencies, and company environmental compliance inspector.

C. Install suitable drilling mud tanks or sumps to prevent contamination of stream.

D. Install berms down slope from the drill entry and anticipated exit points to contain any release of drilling mud.

E. Account for and dispose of all drilling mud in accordance with the appropriate regulatory authority requirements.

SC5. If HDD is not being used to cross intermittent streams (requires FWS approval), schedule stream crossing work for dryer periods of the year (July – October), use temporary or permanent bridges to facilitate vehicle and equipment travel during construction (See SC9), follow EC1 – EC27 as appropriate.

Use of clean rock (must be of sufficient size to remain in place during normal peak storm events for that season) in stream channels with less than 10 percent slopes approaching the stream banks is permissible provided appropriate state and federal permits are acquired. This measure will reduce erodible materials left exposed during clearing and post trenching operations. Restore stream channel to natural contour and substrate composition upon final reclamation (stream channel should be dry during reclamation work). Ensure that the amount of riparian vegetation removed is minimized to the greatest extent possible (i.e., narrow right-of-way width at stream crossing).

SC6. Flumes are not recommended for use in the upper Little Red River watershed unless prior approval from the FWS AND appropriate regulatory agencies is granted.

SC7. Depressions that are not considered ephemeral streams may still act as conduits for sediment transport especially during wetter periods. Use appropriate discretion and BMPs to ensure that depressions do not become conduits for sediment transport from the right-of-way.

SC8. Cross all ephemeral streams (see Appendix 6; excludes depressions) with temporary bridges (See SC9), properly installed culverts (See SC9Q) with an earthen mound built up over the culvert to prevent damage, or other approved non-erodible materials.

Use of clean rock as described above in SC4 is permissible when crossing with temporary bridges.

SC9. Equipment will not be run through any stream channel. Use a bridge (permanent or temporary) [or culvert – see SC9U] across the stream for travel during construction and for equipment to work from during the dry open cut trenching of the stream bed.

BMPs for Portable, Temporary or Permanent Bridges and Culverts

A. The following bridges will be used for crossing ephemeral and intermittent streams in which HDD is not a viable option (considering P1C) (Illustrations 7 –

9). Portable water body bridges may consist of 1) span bridges (metal, hardwood, or combination), and 2) bridges with box or bottom-less box (preferred bottom-less box type) culverts.

B. Portable, temporary, or permanent bridges that cross streams must be non-erosive, structurally stable, not introduce or exacerbate flooding, and protect from sediment transport into the stream. *Placement of instream fill requires prior approval of requests for state and federal permits.*

C. Select crossing sites where erosion potential is low and side slope runoff will not spill into the crossing. Limit surface runoff by installing erosion controls. Secondary erosion controls down slope of the primary erosion controls may be necessary to avoid or minimize sediment transport into the stream.

D. Minimize clearing and excavation of stream banks, bed, and approach sections.

E. Dewater stream channel (divert water around right-of-way) while installing/removing bridges.

F. Plan work to minimize tracking sediment from equipment onto the bridge and approaches.

G. Hardwood plank bridges will consist of 2 layers of boards (large enough to support heavy equipment) tightly abutting each other from upstream to downstream ends or other FWS approved materials. Geotextile filter fabric will be placed in between the two planks and wrapped around the upstream and downstream ends and affixed to the top plank to prevent sediment loss from the bridge sides and seams between planks.

H. Bridge structure will be constructed at or above bank elevation to prevent entrapment of floating debris.

I. Bridge will be anchored and/or tied off to anchor blocks for stability.

J. No bridge footing, pier, or support should be used within the stream channel for streams less than 10 feet wide (measured bank to bank). Follow this BMP as prudent for safety at larger intermittent stream crossings.

K. Utilize approach fills of clean granular material, swamp mats, skids or other suitable materials to avoid cutting the banks.

L. Ensure adequate freeboard.

M. Ensure that fill material used does not spill into watercourse.

N. Construct sediment barriers across the entire construction right-of-way to prevent silt laden water and spoil from flowing back into water body. Barriers may be temporarily removed to allow construction activities but must be replaced by the end of each work day and during rain events that may coincide the work day. Silt fences used in conjunction with sand bags or wire mesh are the preferred sediment barrier, but hay bales may be used on the ends of the bridge provided they are properly staked. Adhere to Erosion Control BMPs for maintenance and installation of sediment barriers.

O. Construct crossing and encroachments to minimize stream channel scour.

P. Remove portable bridges within 14 days after permanent seeding unless otherwise directed by company representative or landowner. The structure is to be removed if there is more than one month between final grading and seeding and an alternative access to the construction right-of-way is available. Remove structures within one year from the date of installation or as specified above, whichever is the lesser time frame.

Q. Until final seeding is complete and vegetation fully established, maintain sediment barriers.

R. Dispose of any rock as directed by company inspector and landowner and/or contact state and federal agencies that might be able to use the rock for habitat improvement work.

S. Restore and stabilize stream bed and banks to approximate pre-construction conditions. Ensure that stream channel is dewatered during restoration work and erosion control BMPs properly installed until stream banks are 95 percent revegetated.

T. Ford crossings degrade water quality due to contact with vehicles and equipment and are not recommended for use on any stream crossing in the upper Little Red River watershed unless approved by the FWS. Exceptions may be granted for

crossings on bedrock or concrete, but all appropriate BMPs for water body crossings must be installed and maintained.

1. Approaches to these crossings must be stabilized to minimize sediment from being tracked into the stream. Approaches can be stabilized by placing geotextile filter fabric under medium to large diameter crushed rock (minimum 2 – 3 inches of aggregrate).

2. Width of approaches should be adequate to allow equipment and vehicle access and length should be ≥50 feet while limiting the amount of tracked materials that enter the stream.

3. Flare approach at stream crossing.

4. If road slope exceeds two percent, construct a 6 – 8 inch high ridge with 3:1 side slopes across the foundation approximately 15 feet from the stream to divert runoff into a stable area or sediment trap that is not prone to flooding.

5. Install drainage pipe under approach pad if needed to maintain proper road drainage.

Existing roads are excluded, but caution is advised since increased traffic may adversely affect federally protected species in the watershed. **Consult the FWS when in doubt.**

U. Culverts may be acceptable crossing methods on ephemeral streams but will cause erosion during installation, removal, and if not properly installed. Follow BMPs below for open cut trenches when installing and removing culverts. Sediment barriers must be installed and maintained until site reclamation is complete and area is 95 percent revegetated.

General culvert considerations:

1. Culverts (also known as stream cross pipes) need to be carefully installed in order to ensure that they function properly. Installation considerations include: inlet elevation, outlet elevation, grade, adequate compacted material cover, and inlet/outlet protection.

2. Routine maintenance is required to ensure that culverts are not plugged and that the area above and below the pipe is free of debris.

3. Culverts need to be sized properly depending on their location catchment area in order to be capable of handling storm events without plugging. The minimum diameter culvert to be used in any crossing is 24 inches. Total culvert width should equal at least 20 percent of the wetted channel width at low flow conditions, but preferably the cross sectional area of the pipe(s) should approach that of the existing channel. *Check with your local, state, and/or federal regulatory agencies about permit requirements***.**

4. Limit construction activity to periods of low flow in streams.

5. Culverts will be open-bottomed. If closed bottom culverts must be used, the slope will not be greater than 0.5 percent without baffles for water velocity control.

6. The culvert should fit into the existing channel without major excavation of the stream channel or without major approach fills.

7. Culverts should extend a minimum one foot beyond the upstream and downstream toe of the aggregate placed around the culvert.

8. Thoroughly dewater an installation site by diverting water around the right-of-way, install geotextile fabric on the streambed (for culvert that are not bottom-less) and stream banks (for all culverts) prior to placement of culvert and aggregate, install culvert in dry condition, and stabilize site using erosion control BMPs, before diverting the stream back into its bed.

9. Minimize natural channel changes and the amount of excavation or fill in the stream channel.

10. Consider alternative techniques such as the use of larger culverts embedding the bottom in the stream channel, multiple culverts, or the use of bottomless arch cross pipe which retains the natural stream bed and requires less cover.

11. Do not force streams to turn into and out of a culvert that goes straight across the pipeline. Instead, use longer pipes at an angle in line with the

natural flow of the stream.

12. Protecting inlets and outlets of culverts will prevent channel incision, erosion, and sedimentation. As with most channel design projects, depth of flow, roughness, gradient, side slopes, discharge rate and velocity will be considered in the outlet design.

    While there are five basic types of inlet protectors, large rock of sufficient size to withstand inlet water velocities are recommended to dissipate energy of concentrated storm events. Flows should be the same as the culvert or channel design flow, but never less than the peak five year flow for temporary structures planned for one rainy season, or the 25 year peak flow for temporary structures planned for two or three rainy seasons.

    Outlets generally consist of apron linings made of concrete, riprap, grouted riprap, or other structural materials. Riprap (medium to large rock) is usually the preferred energy dissipater and also serves as a sediment trap. Avoid outlets on slopes greater than 5 percent with drainage areas greater than one acre. **Outlet protection is required for all culverts.**

Inlet and outlet considerations for installation:

Properly installed inlet and outlet walls significantly improve the flow capacity of the stream culvert, prevent erosion around stream culvert installations, and visually identify culverts to protect them from traffic. The strength of rock walls come from the weight of the interwoven stacked stones and friction between the rock surfaces. Wall stability comes from tightly fitting the stones together and staggering the joints. Typical requirements include:

13. Rock of uniform thickness, flat on two or three sides that can be handled by one person. Native rocks of any size and shape can be used, but construction will be easier and faster with stones that have some flat sides. Pre-fabricated and cast-in-place concrete, concrete blocks, and molded plastic are environmentally acceptable materials.

14. First, excavate on either side of the cross pipe to make room for the wall. Typically, walls need to extend 2 – 3 times the diameter of the culvert. The base of the wall should be at least as low as the bottom of the culvert inlet. Push a large flat rock(s) under the culvert opening. This rock armors

the erosion prone earth at the culvert inlet.

15. More information on standards for pipes can be found at the American Society for Testing Materials or consult manufacturers for specific product recommendations. Technical bulletins on installation of pipes, headwalls, and endwalls can be found at www.dirtandgravelroads.org.

16. Install and maintain erosion control BMPs to prevent sediment transport from right-of-way into stream channel.

SC10. Where excavation involves native or established wetland/riparian vegetation, the top 6 – 12 inches or more of vegetation and topsoil including the vegetation and root mass will be carefully removed and stockpiled separately into a dedicated deposition area. After completion of site disturbance this vegetated material and its associated soils will be replaced as the surface material.

SC11. Stream crossing will be checked by environmental compliance inspector within one day following any rain event exceeding 0.5 inch in a 24 hour period or 0.25 inch in 1 hour. Check for blockage of stream channel, sediment build-up or trapped debris in culverts or under bridges. Check for erosion of abutments, slopes, channel scour, piping in the soil. Check for structural weakening of temporary stream crossings.

SC12. Seeps are common in the upper Little Red River watershed, but may not be evident until pipeline corridor clearing and prolonged periods of wet weather. French mattress is a structure commonly used under roads consisting of coarse rock wrapped in fabric through which water can freely pass. It is basically a French drain that is used similar to a culvert to allow water passage through road beds or in this case pipelines. This technique has not been tested on pipelines, but may help prevent erosion and keep segments of the pipeline corridor that are prone to seepage dry. This technique if applied to pipeline construction and maintenance may be useful in controlling erosion, but is currently recommended at the discretion of companies. Information on installation can be obtained at www.dirtandgravelroads.org (see technical bulletins).

BMPs for Open Cut Trenches at Water Body Crossing (Illustrations 10 – 11)

SC13. Implement BMPs for open cut trenching at stream crossings when HDD methods are not used for laying pipe.

SC14. Schedule crossing during low or no flow periods.

SC15. Divert all water flow around the pipeline right-of-way (no wet open cut trenching is permissible).

SC16. Construct upstream structure (dam) followed by downstream structure (dam). Water structures will be inspected by environmental compliance inspector.

SC17. Pump the water in the stream bed between the two rock check dams (within the work area or pipeline right-of-way) around the downstream dam prior to commencing with any instream work. The stream bed will be dry within the pipeline right-of-way when the open cut trench work begins in the stream bed.

SC18. Size pumps for diversion of entire stream flow. Adhere to the following guidelines for stream diversion.

A. Contractor will maintain 100 percent spare pumping capacity on site.

B. Pumps will be installed on polyethylene barriers for fuel/oil spill containment.

C. Pump intakes will be screened to prevent entrapment of fish.

D. Contractor will monitor pumps and water structures on a 24 hour basis until the crossing (pipe) installation is complete.

E. Should leakage at the dam structures occur, contractor will dewater between the structures through an appropriate filter and onto a well vegetated upland area.

F. No abnormally silt laden water (nothing more turbid than upstream conditions at that time) will be discharged into the stream.

G. Leave hard plugs at stream bank edge until just prior to pipe installation.

H. Complete construction of instream pipe section.

I. Weight pipe as necessary prior to commencement of instream activity.

J. Trench through water body as expediently as practical.

K. Install temporary soft plugs, if necessary, to control water flow and trench sloughing.

L. Maintain stream flow throughout crossing construction.

M. Lower pipe in trench, install trench plugs and backfill immediately.

N. Backfill with native material.

O. Remove as much sediment as possible from the stream channel that may have entered the channel during the open cut trench work.

P. Restore water body channel to approximate pre-construction profile and substrate.

Q. Restore stream banks to original condition and stabilize, as required.

R. Re-install silt fences and sand bags adjacent to each stream bank prior to restoring natural stream flow. Replace any erosion controls that may have been damaged during instream work.

S. Dismantle downstream structure (dam) and upstream structure (dam) after trench backfill and channel restoration. Remove rock check dams, preferably by hand.

T. Restore natural water flow.

SC19. Complete all in-stream activities within 24 hours.

SC20. No refueling of mobile equipment within 100 feet of stream, springs, seeps, wetlands, or other karst features.

Stream Morphology BMPs

SM1. Trees and other woody debris will never be piled in a stream channel during clearing or any other phase of construction. Naturally recruited large woody debris should not be removed either since these play a key role in aquatic ecosystem function.

SM2. Shore up banks with bioengineering methods.

SM3. If using stream bank riprap, structures will consist of a layer of stone underlain with approved geotextile filter fabric or a gravel filter blanket to protect and stabilize areas prone to erosion. Refer to Illustration 12 for design specifications.

A. Gravel filter blanket will meet the following specifications:

1. Permeability greater than that of the sub-grade soil.

2. If well graded gravel or sand-gravel layer is used, the layer will be a minimum of six inches thick and spread in a uniform layer over the subgrade.

3. If water turbulence could result in erosion of bank material between large rocks (as determined by a qualified hydrologist or stream geomorphologist).

4. A geotextile filter fabric will be used between the gravel layer and the riprap.

B. The geotextile filter fabric will be Permatex 4000 series or an equivalent meeting the following specifications:

1. Be commercial quality nonwoven fabric designed for riprap underlayment.

2. Be a minimum 20 mils in thickness.

3. Grab strength will be between 90 to 120 pounds.

4. Have a greater than four percent open area (U.S. standard sieve number 100 [0.15 mm]).

5. Have a density of 8 ounces per square yard.

C. The use of riprap will be limited to areas where flowing conditions prevent effective vegetative stabilization techniques. Placement of riprap may be limited by permitting authorities.

D. Riprap will have the following specifications:

1. Be dense, durable, equidimensional (not flat or thin), angular, and clean.

2. Size will be dependent upon bank slope and water velocity (the rock will generally be 12 to 18 inches in diameter).

3. Where possible, native rock of similar appearance and acidic properties to adjacent rock or soil will be utilized as riprap.

E. Watercourse riprap will be constructed as follows:

1. It will not be undermined from the side.

2. Remove all stumps, organic matter and work material.

3. Grade the bank to a maximum slope of 1.5:1.

4. Cut the subgrade sufficiently deep for the finished grade of the riprap to be at the same elevation as surrounding area.

5. Compact the subgrade to a density approximately equal to the surrounding soils.

6. Construct toe of trench to "key" in bottom of armor protection (the trench will be a minimum of 18 inches wide and 18 inches deep).

7. Place the filter blanket (gravel, gravel-sand or geotextile) and riprap (rock) immediately following grading and subgrade compaction.

8. Place any filter fabric used directly on the prepared subgrade unless excessive turbulence exists (edges of adjoining pieces will be overlapped a minimum one foot, upstream fabric over downstream fabric, and anchor pins will be placed a maximum of 36 inches along the overlap).

9. Bury the outside edges of the cloth to a minimum of one foot below the ground around the riprap perimeter.

10. Place riprap on slope to be protected and larger rocks at the base and face of the slope (install riprap to a depth of 1.5 to 2.0 times the diameter of the rock or at least 12 inches thick on the slope and thicker at the base).

F. Since riprap will be placed by equipment, sufficient precautions must be taken to avoid damaging the filter fabric or causing excessive gravel movement that exposes subgrade material to hydraulic forces. Should damage to the filter fabric occur during riprap placement, the riprap will be removed, and the sheet will be repaired by adding another layer of filter material with a minimum overlap of one

foot over the original material.

G. The riprap structure will be inspected during general right-of-way monitoring for undermining and rock loss. Prior to completion of construction repairs to the riprap will be carried out as necessary.

H. The use of riprap should be minimized to the greatest extent possible.

SM4. Restore the natural contour of the stream channel after open cut trenching. Divert water around right-of-way to prevent sediment transport during restoration activities.

SM5. Replace all boulders and other substrate particle sizes that are removed or destroyed during pipeline construction to what naturally occurred in the right-of-way.

SM6. Establish vegetation on stream banks immediately after completing BMPs SM1 – SM5. Technical assistance on stream bank stabilization and channel restoration is available from several state and federal agencies and non-governmental agencies. There are also consultants that specialize in stream restoration and stream bank stabilization. When in doubt about how to restore a stream channel or bank, consult an experienced professional with a background in hydrology and stream geomorphology. Utilize these resources that are available for technical assistance.

Minimizing Non-sediment related Contaminant Exposure

To prevent petroleum products from contaminating soils and water bodies, the following BMPs will be implemented:

NS1. Construction equipment and vehicles will be properly maintained to prevent leakage of petroleum products.

NS2. Herbicides, fertilizers, vehicle maintenance fluids, petroleum products will be stored, and/or changed in staging areas established at least 300 vegetated feet from streams, wetlands, and karst features. These products must be discarded at disposal sites in accordance with state and federal laws, rules, and regulations.

NS3. Drip pans and tarps or other containment systems will be used when changing oil or other vehicle/equipment fluids.

NS4. Areas where discharge material, overburden, fuel, and equipment are stored will be designed and established at least 300 vegetated feet from the edge of streams, wetlands, and karst features. Further distance is recommended, but with proper barriers, surface design, and/or maintaining a vegetated buffer, most impacts can be avoided or significantly reduced.

NS5. Any contaminated soils or materials will be disposed of off-site in proper receptacles at

an approved disposal facility.

NS6. Vehicle and equipment fueling will be attended at all times by site personnel. Spill cleanup materials will be stored on site and employees will be trained in spill control procedures.

NS7. Vehicle washing will not occur on the project site, but at an area with appropriate wash facilities to manage contaminated wash water. Wash water will never be discharged directly into water bodies or karst features.

NS8. Petroleum products and other chemicals will be properly stored in appropriately labeled containers under sheltered areas. Storage shelters will be designed with an impermeable floor area and adequately secured to prevent vandalism.

NS9. Materials for cleaning up spills will be kept on site. Spills will be reported to the appropriate regulatory agencies and cleaned up immediately in accordance with state and federal regulations. Spill response protocols and kits will be maintained on site to address these concerns.

RESTORATION

Restoration involves restoring the right-of-way to pre-construction conditions by final grading, installation of permanent erosion control measures such as slope breaks at appropriate distances to prevent rill (channel) formation between slope breaks, and re-establishing vegetation.

R1. Commence cleanup operations immediately following backfill operations on slopes approaching streams, springs, seeps, wetlands, or other karst features.

R2. Stream channels that are open-cut trenched must be restored to the natural contour slope and substrates that are appropriate to that stream (based on upstream and downstream substrate characteristics) restored to the stream channel within the pipeline right-of-way. Banks may be stabilized with riprap or other rock underlain with filter fabric from the area provided that the rock is of sufficient size to remain in place during large flood events.

R3. Complete final grading to restore pre-construction contours and leave soil in proper condition for planting, replace topsoil, and install permanent erosion control structures within 7 days after backfilling the trench.

R4. Restoration crew will follow construction crews as they work systematically from one end to the other end of the pipeline laying pipe. If crews cannot work systematically from one end to the other end, then erosion control BMPs must be maintained on all

slopes approaching a stream, spring, seep, wetland, or other karst features and adjacent to these sensitive areas. If seasonal or other weather related conditions prevent compliance with these time frames, maintain erosion control BMPs until conditions allow completion of cleanup.

R5. Prepare seed bed in disturbed areas to a depth of three to four inches using appropriate equipment to provide a firm seedbed.

R6. When hydro-seeding, scarify the seedbed to facilitate lodging and germination of seed. Perform seeding within local recommended seeding dates.

R7. Seed all disturbed areas within 7 days of final trench backfilling, weather and soil conditions permitting.

R8. If seeding cannot be done within those dates, use appropriate erosion control BMPs discussed above.

R9. Soil additives such as fertilizer and soil pH modifiers are strongly encouraged. Consult your local NRCS District Conservationist for site specific recommendations.

R10. Avoid applying fertilizer and soil pH modifiers between the last slope break and stream banks. On gentler slopes with greater spacing between slope breaks, avoid application of these soil additives within 250 feet of a stream, spring, seep, wetland, or other karst features.

R11. Mulching/seeding and laying fabrics on steeper slopes and areas difficult to re-establish vegetation due to loss of topsoil or soil type may be necessary to re-establish vegetation.

R12. All areas being re-vegetated will be inspected for establishment of new vegetation and replanted if right-of-way is not 95 percent revegetated as soon as weather permits, but within 6 months upon completion of trenching at any given point along the right-of-way.

R13. Remove all temporary sediment barriers when replaced with permanent erosion control measures or when re-vegetation and channel stability is successful.

R14. Post-construction and reclamation monitoring will be conducted within 48 hours following the end of a 0.5 inch rainfall event within a 24 hour period or a 0.25 inch rainfall event in 1 hour until the area is successfully re-vegetated. Follow-up monitoring is required after the first and second growing seasons to determine success of re-vegetation and determine if any new erosion issues have developed within the right-of-

way.

R15. Continue re-vegetation or other erosion control measures until successful. Restoration will be considered successful if the right-of-way surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless requested otherwise by landowner, but will not impede the natural channel of a stream or cover a spring, seep, wetland, or karst feature), re-vegetation is successful, and proper drainage has been restored.

R16. Routine vegetation maintenance clearing will not be done more frequently than every five years. However, to facilitate periodic corrosion and leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be maintained annually in an herbaceous state.

R17. To each landowner or manager, offer to install measures to control unauthorized vehicle access to the pipeline.

ROLE OF ENVIRONMENTAL COMPLIANCE INSPECTORS

Pipeline companies are responsible for applying appropriate planning and BMPs to pipelines. They are also responsible for identifying and addressing erosion problems in timeframes set forth in this document. Environmental Compliance Inspectors must document how they addressed all erosion issues from planning through clearing and then restoration and post-restoration.

The role of the Environmental Compliance Inspector is to:

1. Inspect and verify that activity based BMPs are in place prior to commencement of associated activities per guidelines established within this document, unless otherwise authorized by appropriate regulatory agencies and the FWS.

2. Inspect installed BMPs in accordance with this document.

3. Ensure compliance with BMPs.

4. Communicate to appropriate personnel needed repairs and ensure that repairs are properly installed in a timely manner (within 48 hours, weather permitting).

5. Verify that work is progressing in accordance with schedule. If progress deviates, take corrective actions to ensure erosion and sedimentation is controlled through proper

installation and maintenance of BMPs.

6. Amend and/or halt work schedule when changes are warranted to prevent erosion and sedimentation.

7. Document the information on installation and maintenance of BMPs throughout construction and reclamation phases.

8. Work with state and federal agencies and non-governmental organizations to identify ineffective BMPs and develop alternative solutions in a timely manner (less than two weeks).

CONCLUSION

Environmental management of pipeline crossings requires assessing and balancing various criteria: ecological value of habitats and species, cost, scheduling, and engineering. The federally endangered speckled pocketbook and candidate yellowcheek darter are endemic to the upper Little Red River watershed upstream of Greers Ferry Reservoir, Arkansas. Due to the federal protection afforded them under the ESA, construction of pipelines in this watershed have to place a high value on the ecological component first and foremost. The BMPs outlined in this document were developed to ensure pipeline companies and their employees and contractors select pipeline routes at less vulnerable locations and minimize and/or alleviate disturbances that adversely affect these species.

The greatest risk to speckled pocketbook and yellowcheek darter populations from pipeline construction is sedimentation and altered hydrology or geomorphology characteristics of streams in the watershed. High sediment loads in streams can kill mussels and fish outright, diminish reproductive capacity, change stream morphology which destroys habitats, and deplete food supplies. Detrimental impacts to aquatic resources may occur during short exposure periods and effects to the ecosystem may not be evident for years after the initial impact. We encourage companies to adopt these BMPs in other watersheds to protect the diverse aquatic fauna inhabiting waters of Arkansas.

This is intended to be a dynamic document that will be revised periodically as new information becomes available and new, improved strategies are developed. If the BMPs do not yield the expected results and appear ineffective, then BMPs will be changed as required to achieve the expected results. Planning, implementation, and evaluation of these BMPs will remain an integral part of our efforts to conserve and recover these two species. Evaluation is an essential step in the success of our efforts. Joined with planning and implementation, evaluation provides the link back to making planning more specific and implementation more effective than before.

REFERENCES

California Storm water BMP Handbook. January, 2003. State of California.

Erosion and Sediment Control Techniques (BP-19A). Spokane County, WA, Dept. of Building and Planning.

Erosion and Sediment Control Manual. April, 2005. Oregon Department of Environmental Quality.

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Small Acreage Fact Sheet #13 – Protecting Your Land from Erosion. U.S.D.A. Tualatin Soil and Water Conservation District.

Smolen et al. 1991. Erosion and Sediment Control Field Manual. North Carolina Department of Environment, Health, and Natural Resources.
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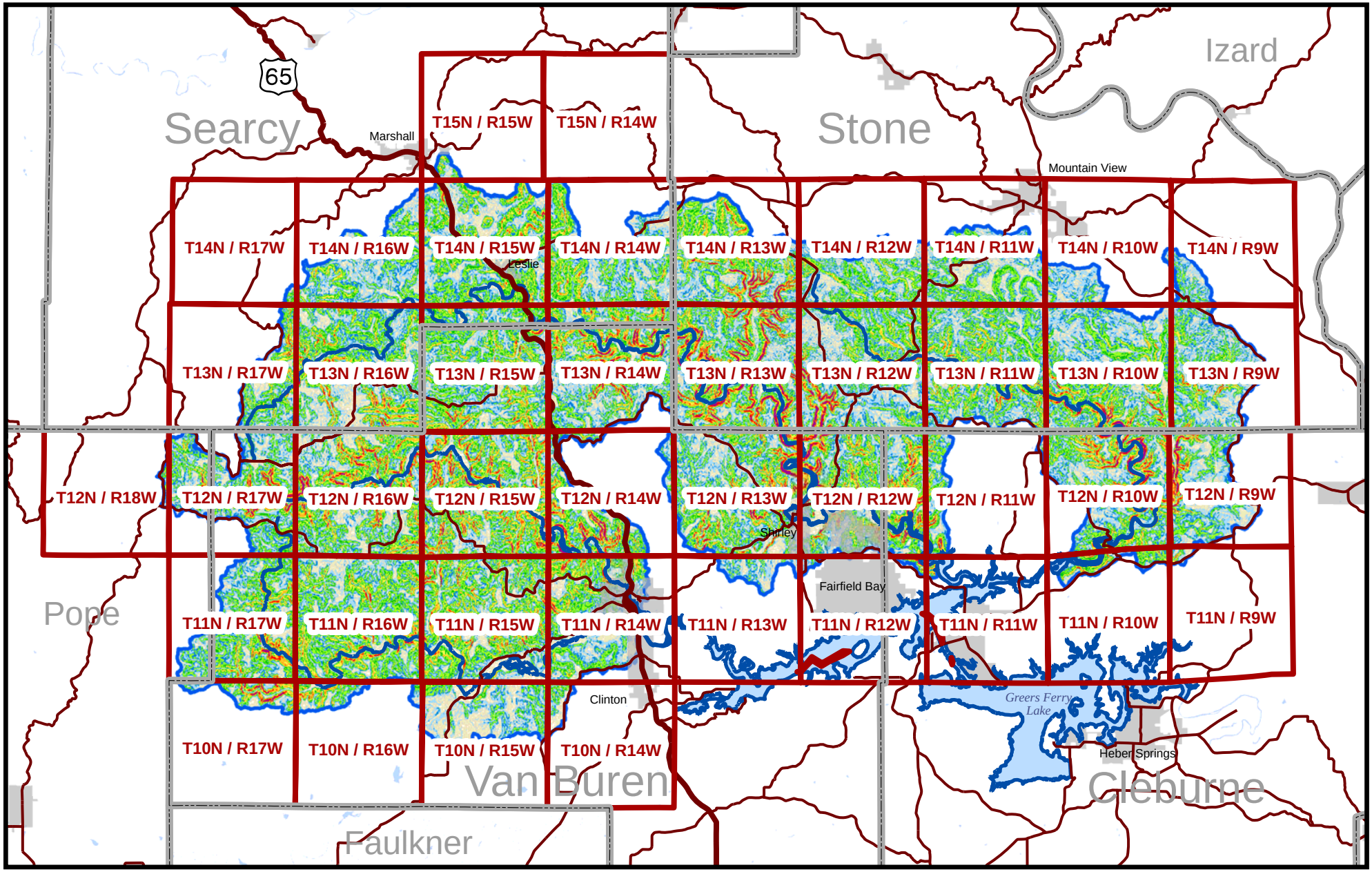
APPENDIX 1

Slope Maps for the Upper Little Red River Watershed

Upper Little Red River Slope Hazard Index

Map Locator



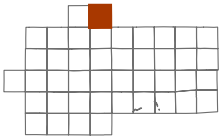
0-5 | 5-10 | 10-14 | 14-20 | 20-25 | 25-30 | 30-40 | 40-50 | 50-60 **Percent Slope**

N

0 1 2 3 4 5 10 Miles

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



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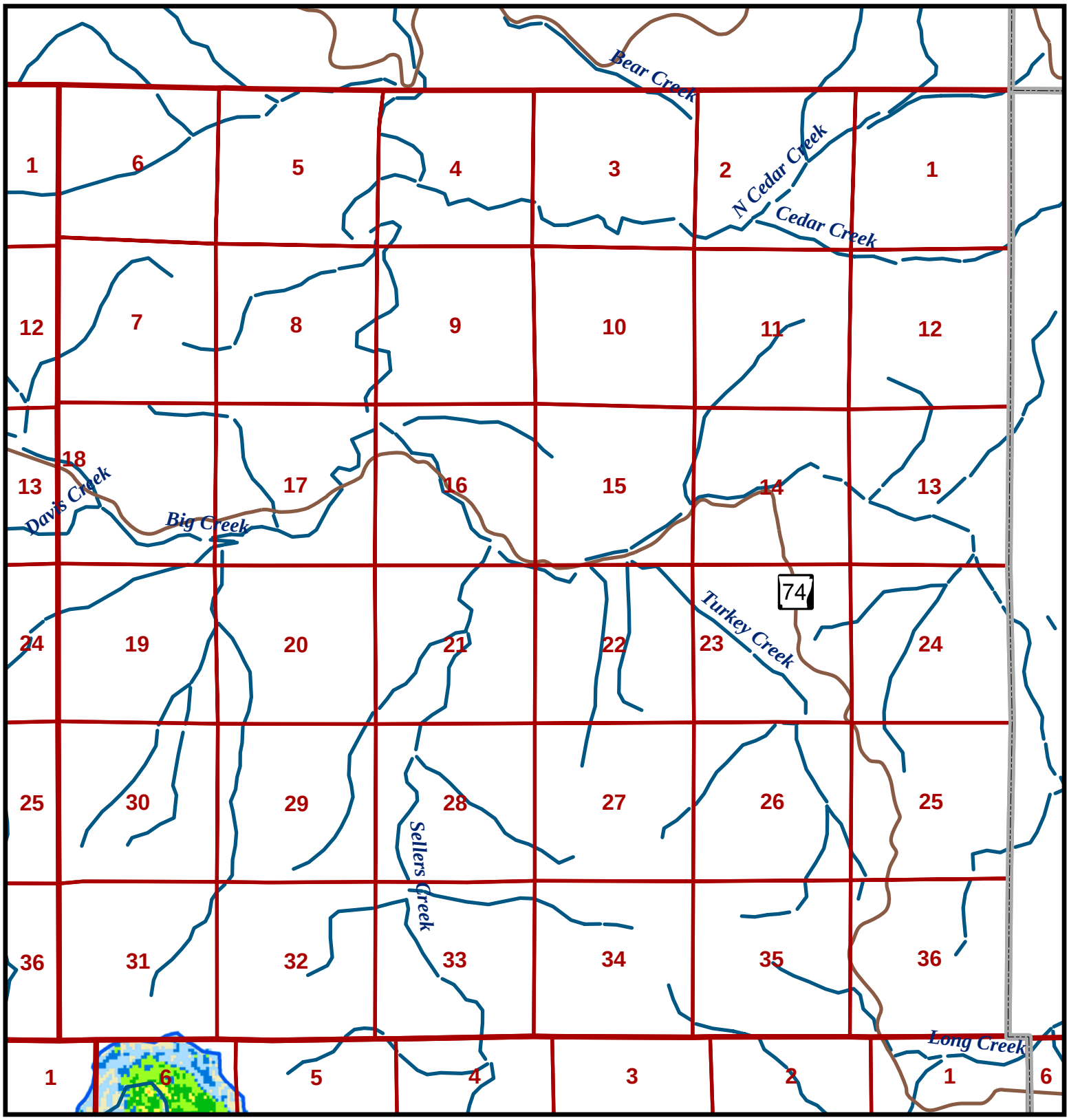

Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T15N / R14W

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
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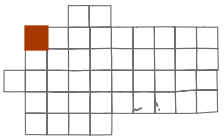
Upper Little Red River Slope Hazard Map (by Township)



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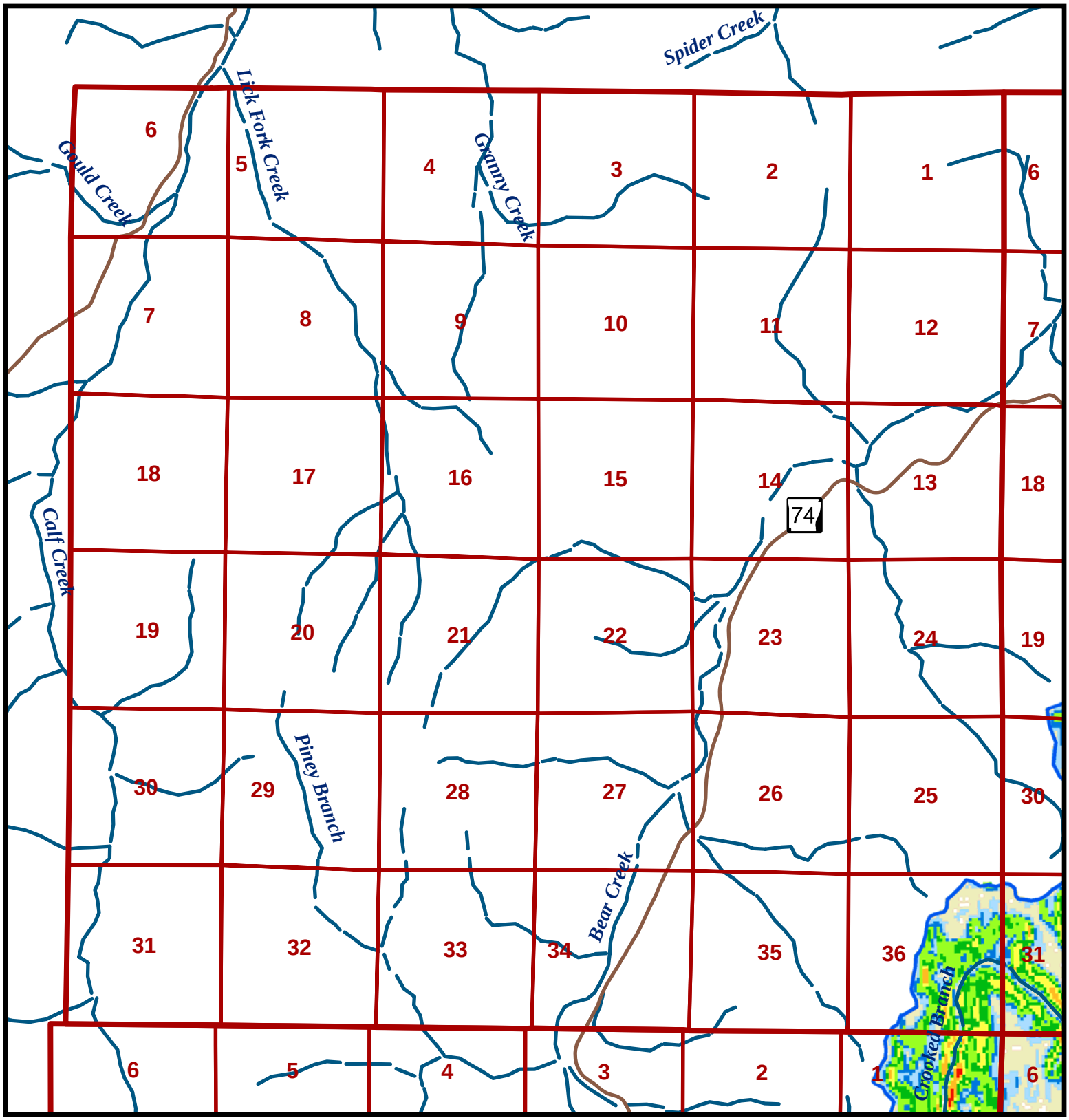

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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T14N / R17W

Arkansas Field Office
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Conway, Arkansas 72032
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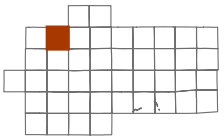
Upper Little Red River Slope Hazard Map (by Township)



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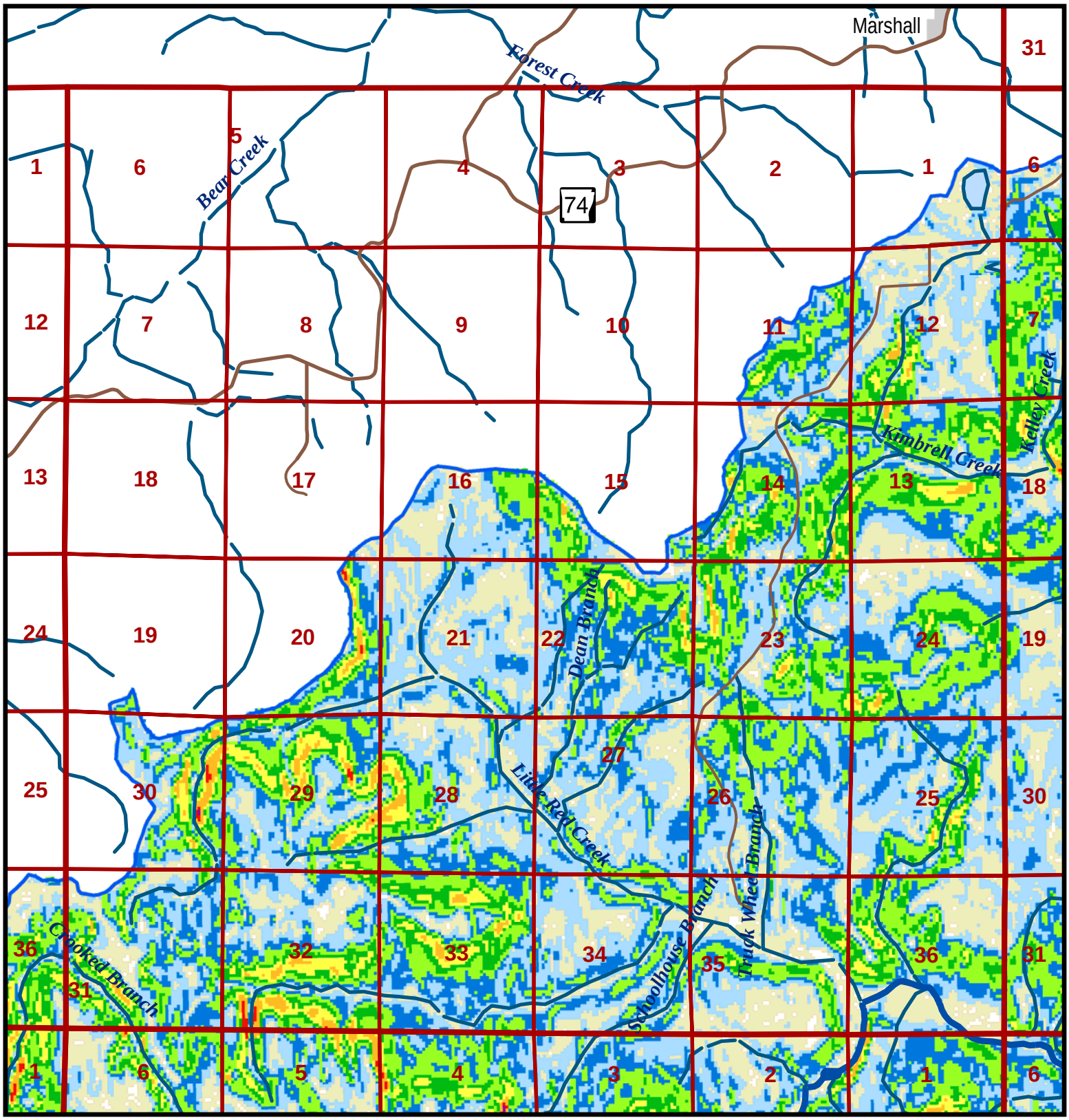

Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

T14N / R16W

0 0.5 1 2

Miles

Arkansas Field Office
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Conway, Arkansas 72032
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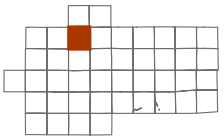
Upper Little Red River Slope Hazard Map (by Township)



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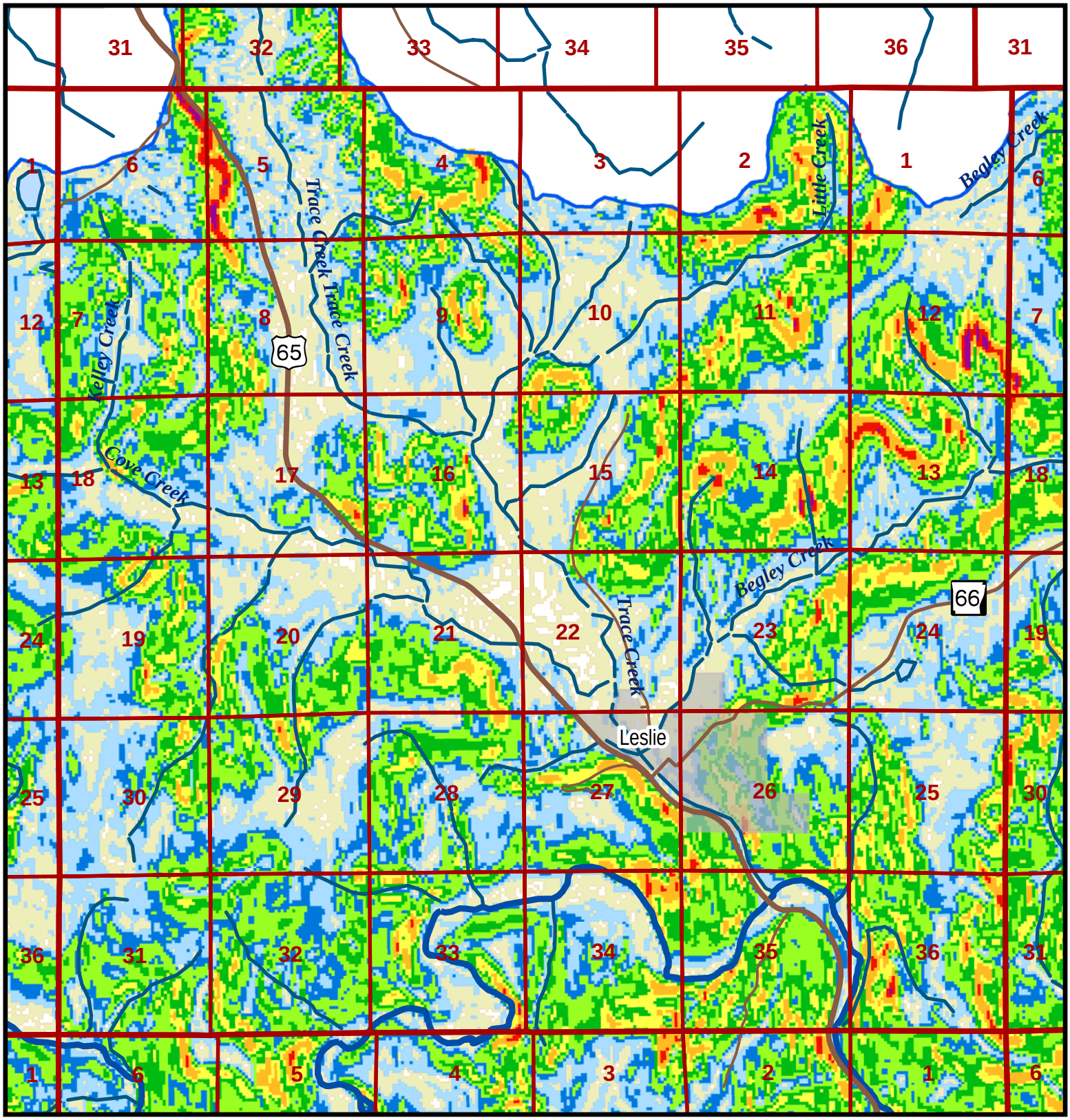

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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T14N / R15W

Arkansas Field Office
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Conway, Arkansas 72032
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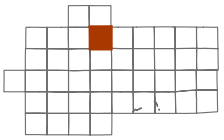
Upper Little Red River Slope Hazard Map (by Township)



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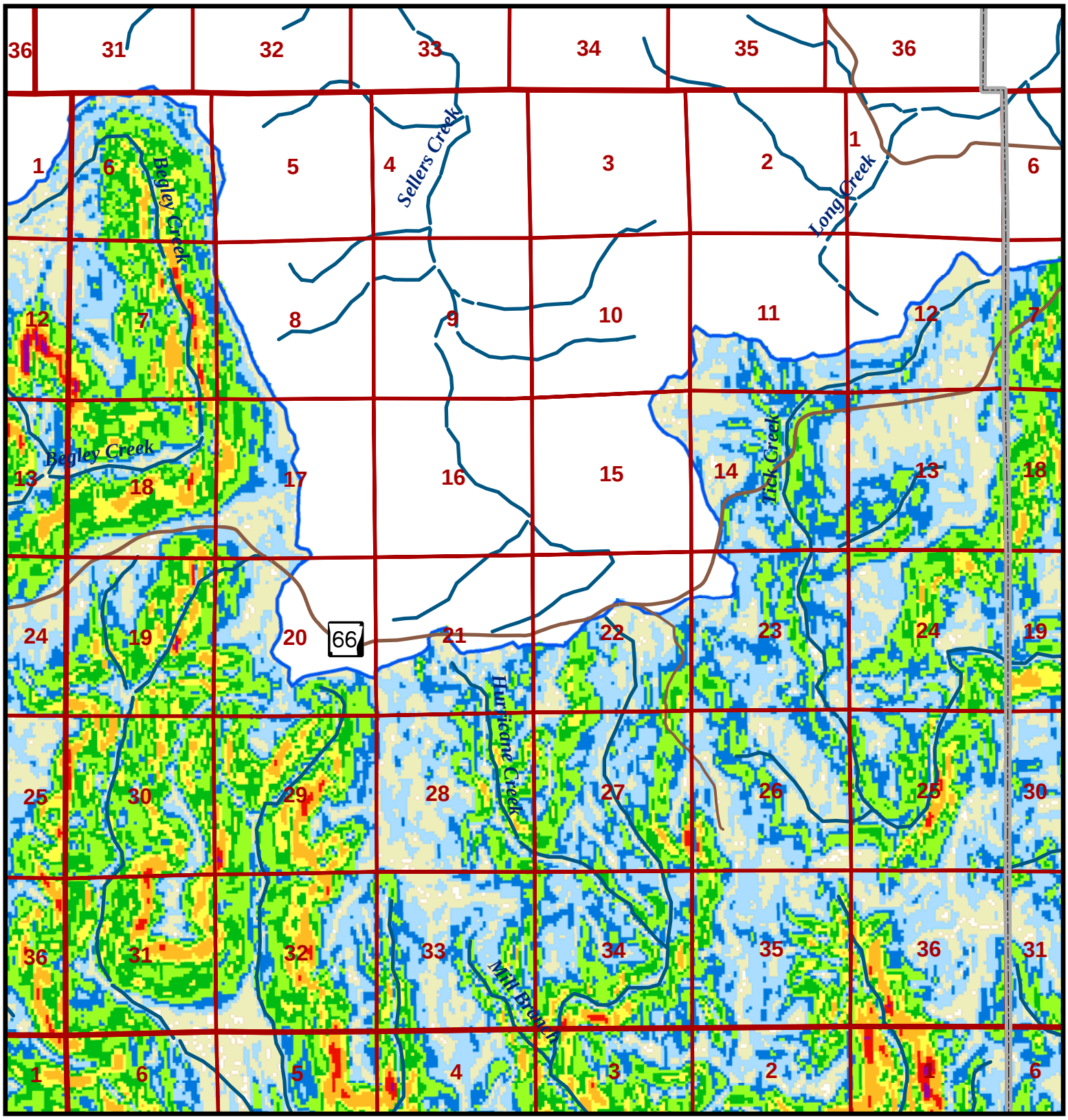

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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T14N / R14W

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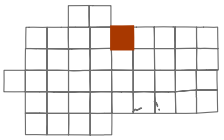
Upper Little Red River Slope Hazard Map (by Township)



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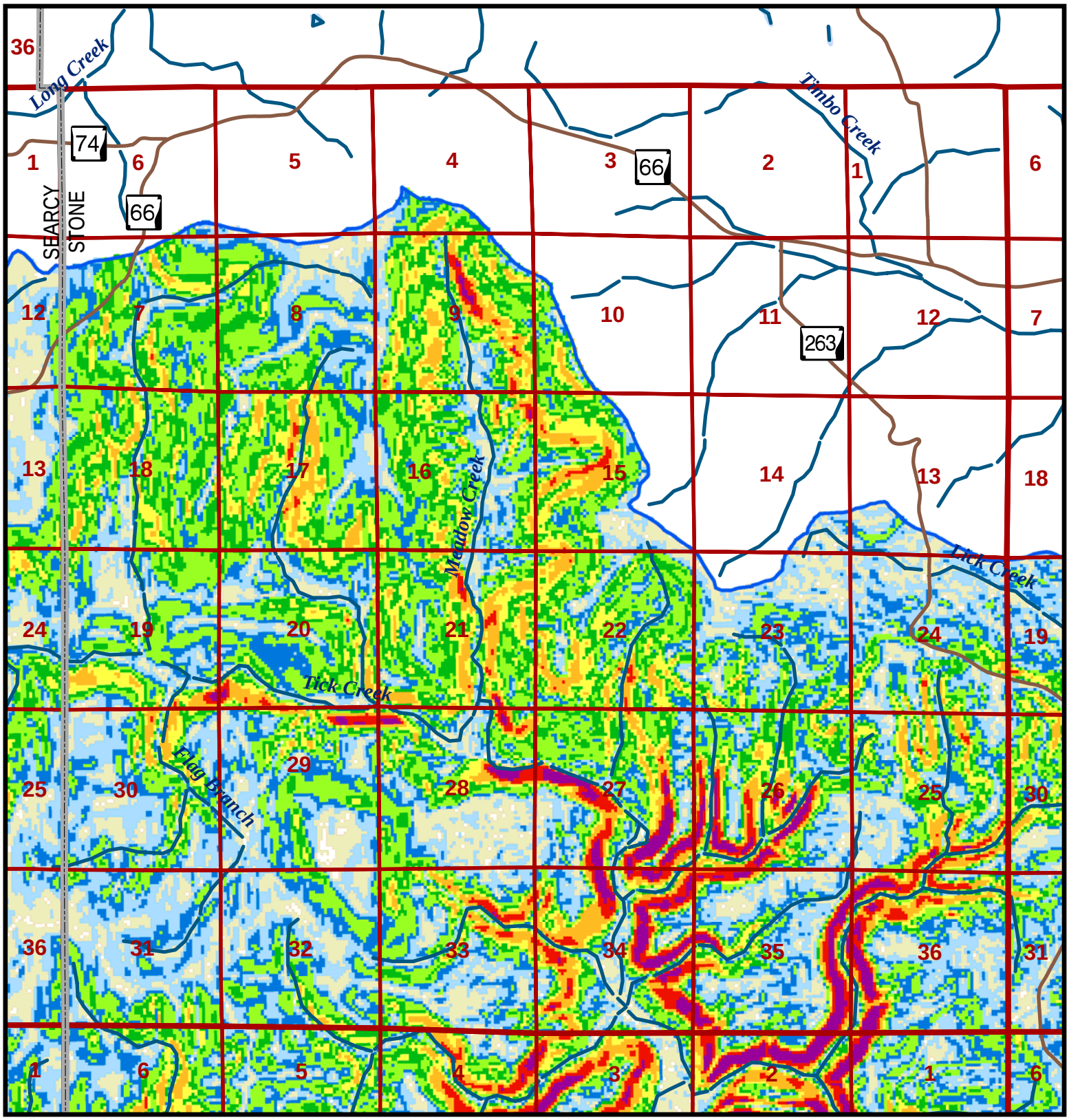

Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T14N / R13W

Arkansas Field Office
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Conway, Arkansas 72032
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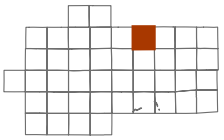
Upper Little Red River Slope Hazard Map (by Township)



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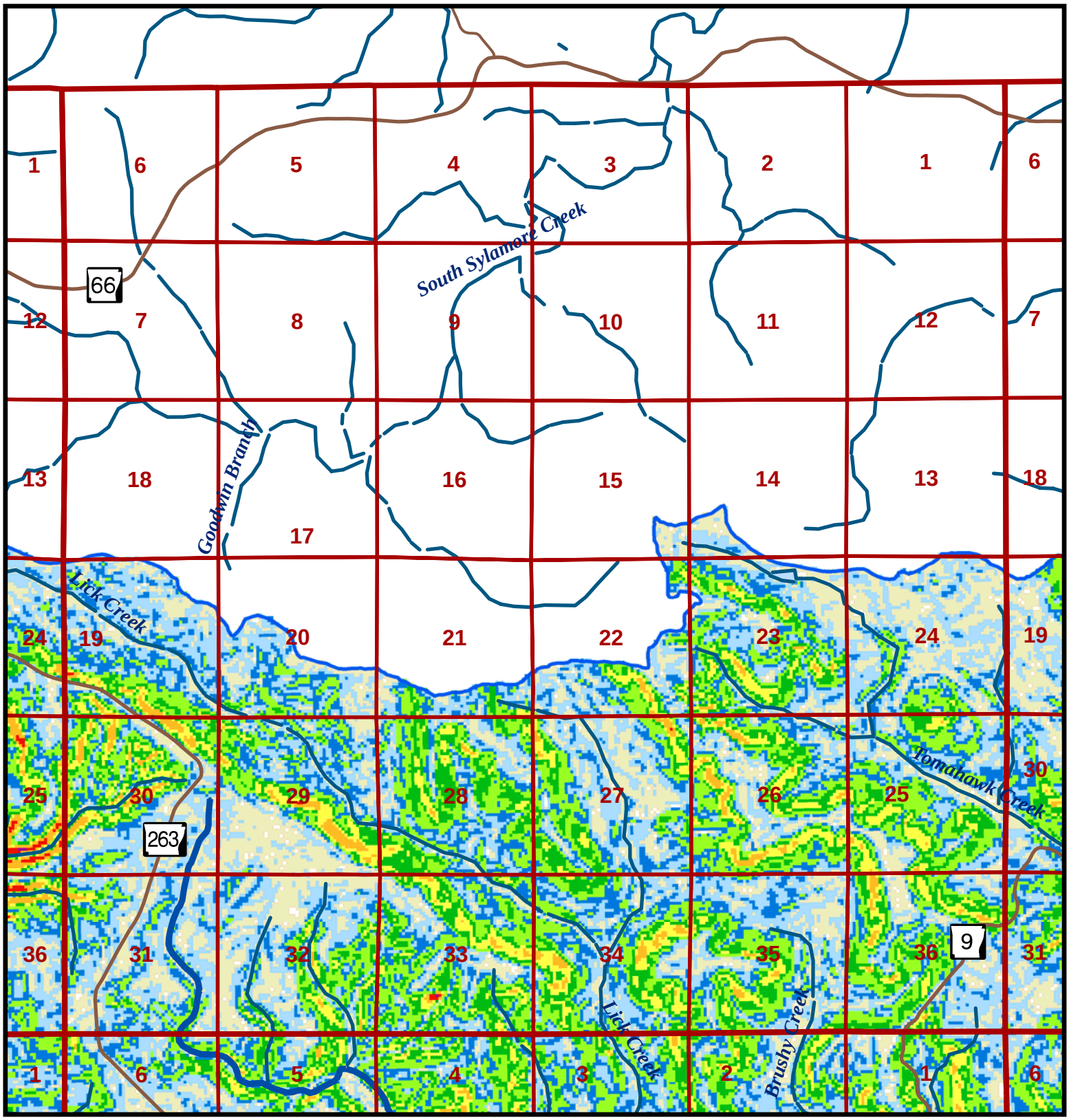

Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

T14N / R12W

0 0.5 1 2

Miles

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
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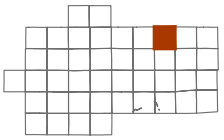
Upper Little Red River Slope Hazard Map (by Township)



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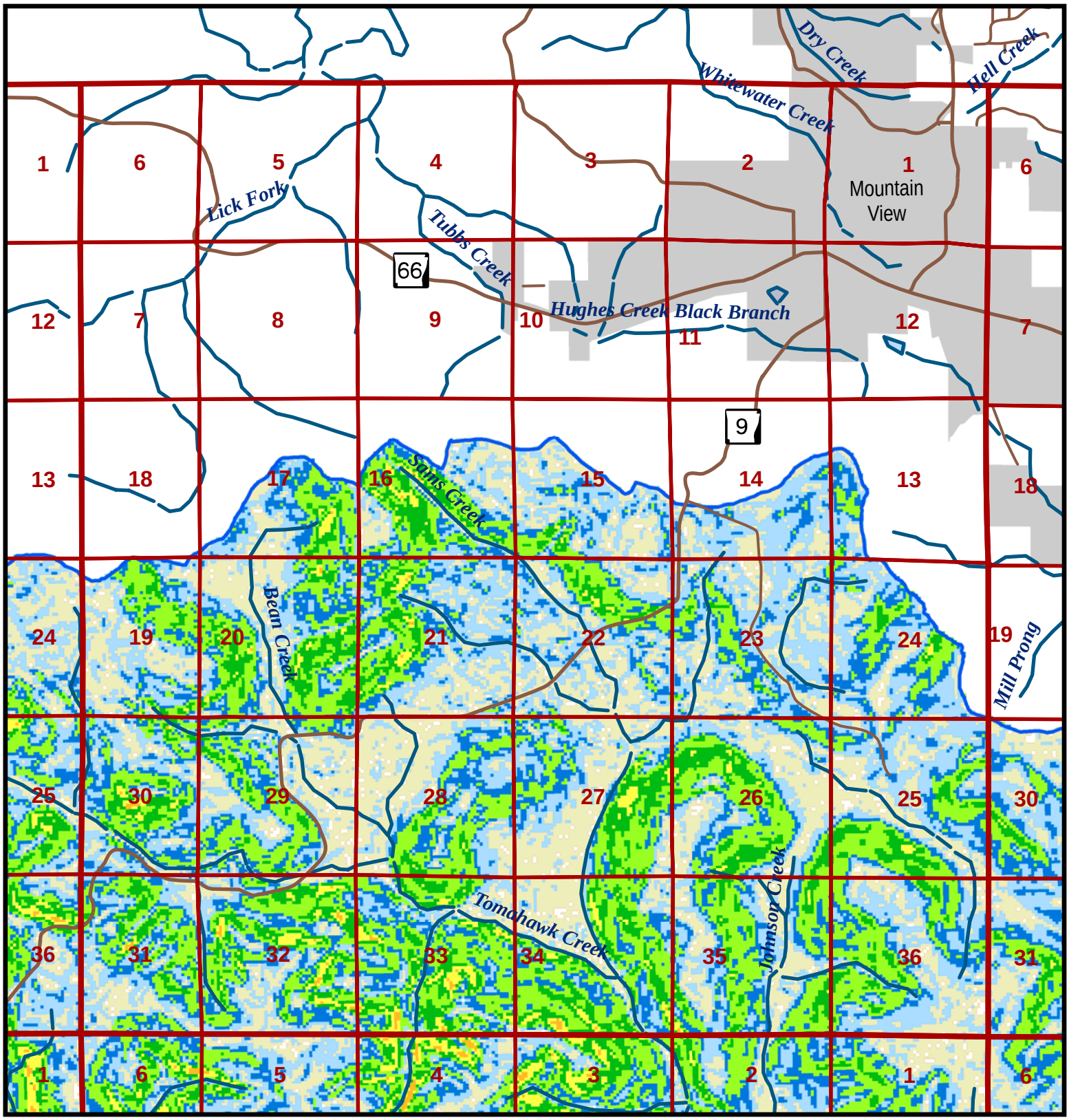

Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

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Percent Slope

N

0 0.5 1 2

Miles

T14N / R11W

Arkansas Field Office
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Conway, Arkansas 72032
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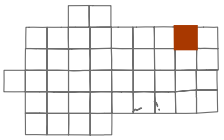
Upper Little Red River Slope Hazard Map (by Township)



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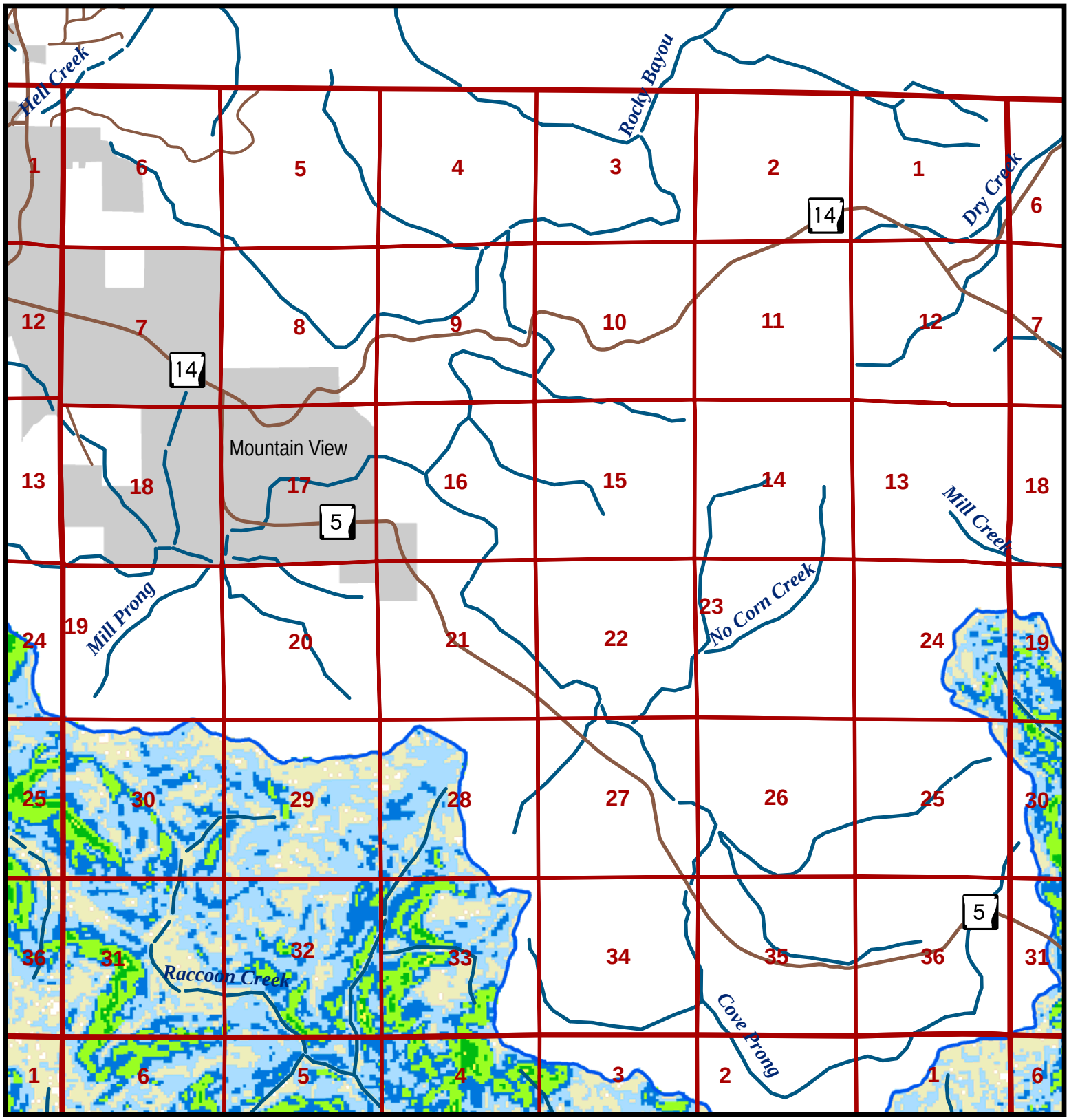

Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T14N / R10W

Arkansas Field Office
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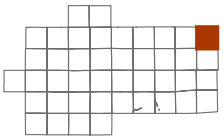
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



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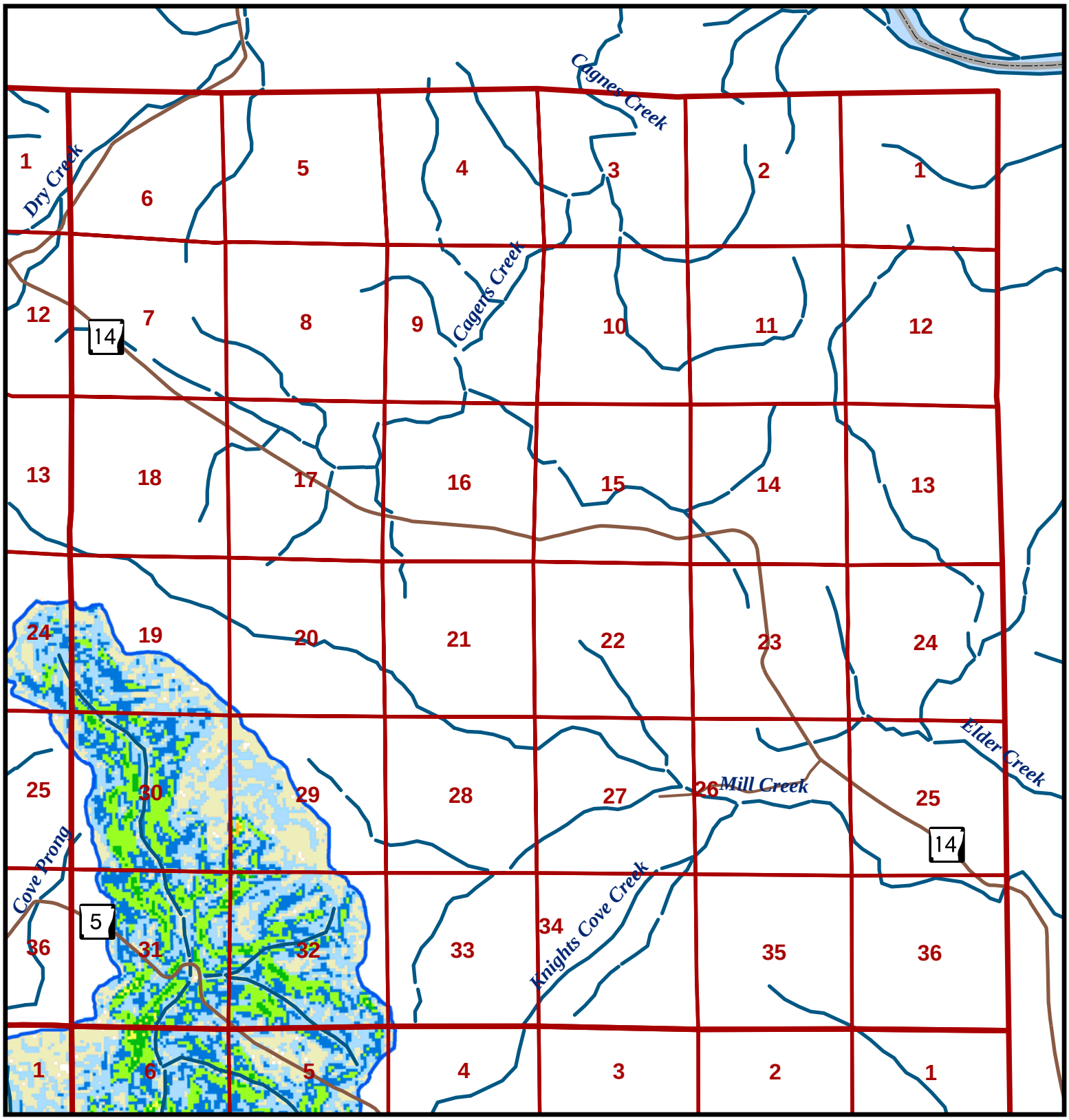


Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

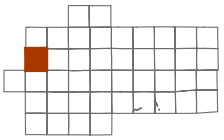
T14N / R9W

0 0.5 1 2

Miles

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



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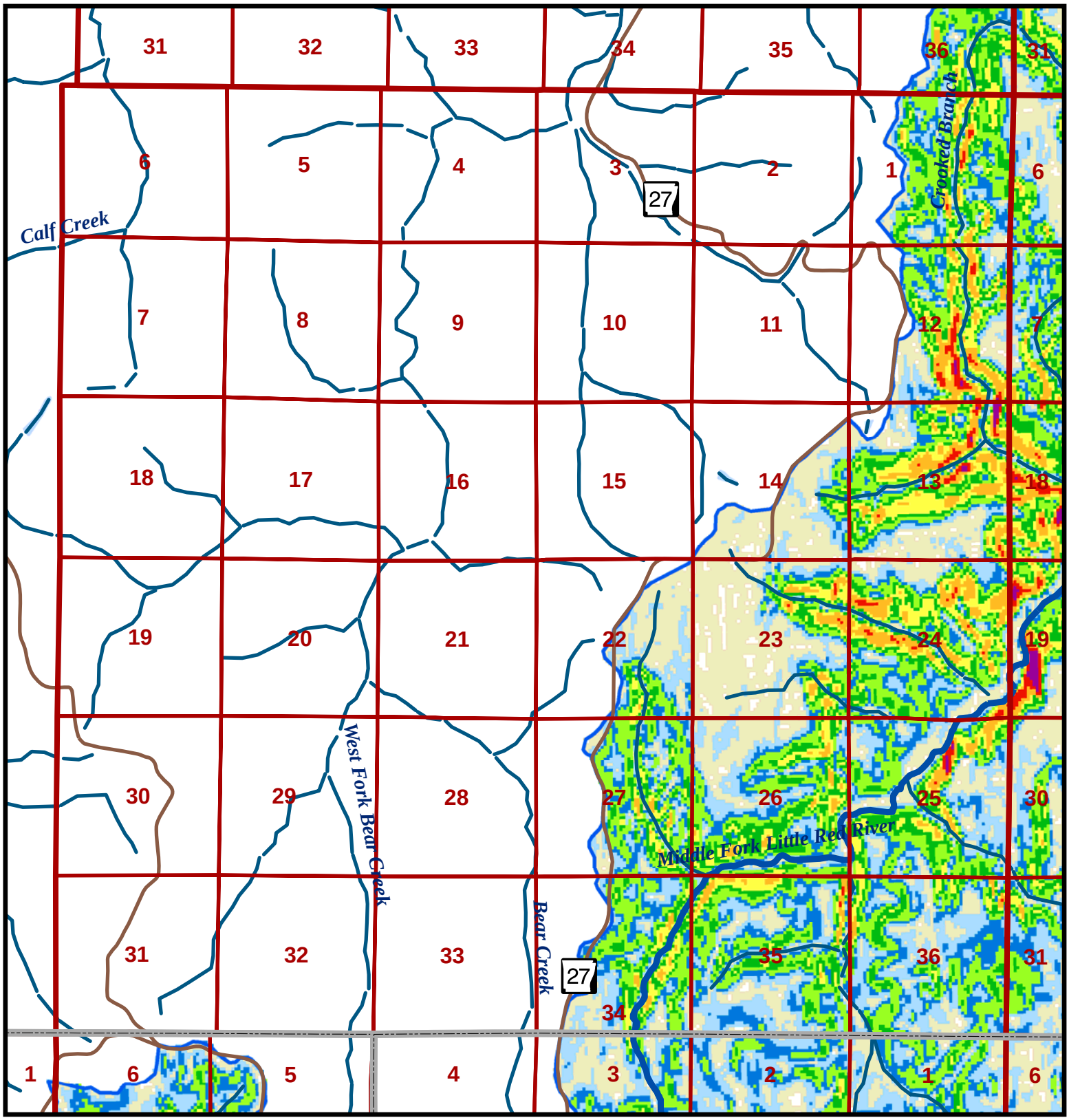


Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

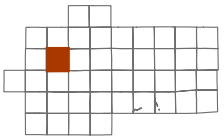
0 0.5 1 2

Miles

T13N / R17W

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



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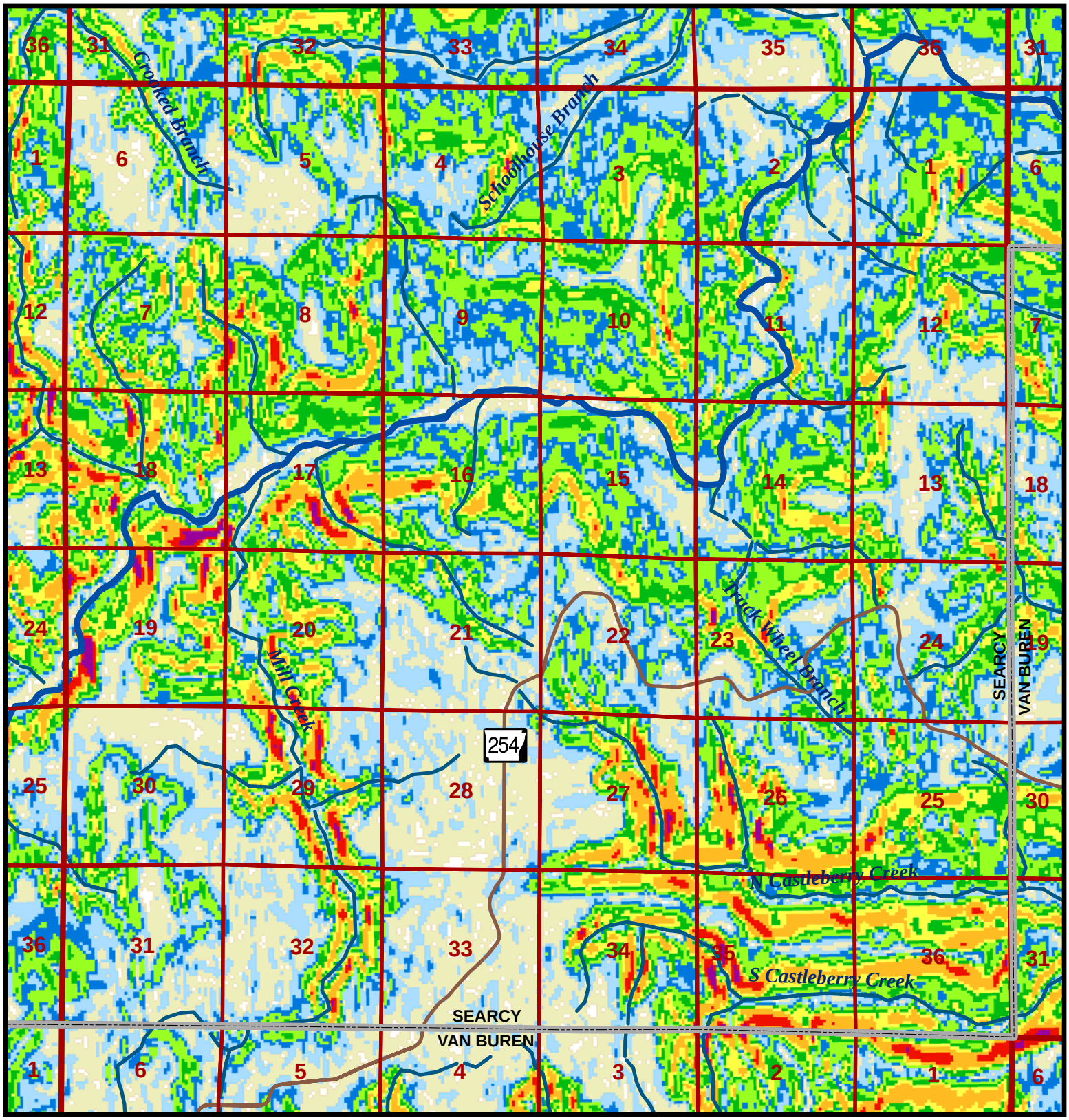


Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

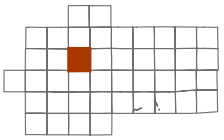
0 0.5 1 2

Miles

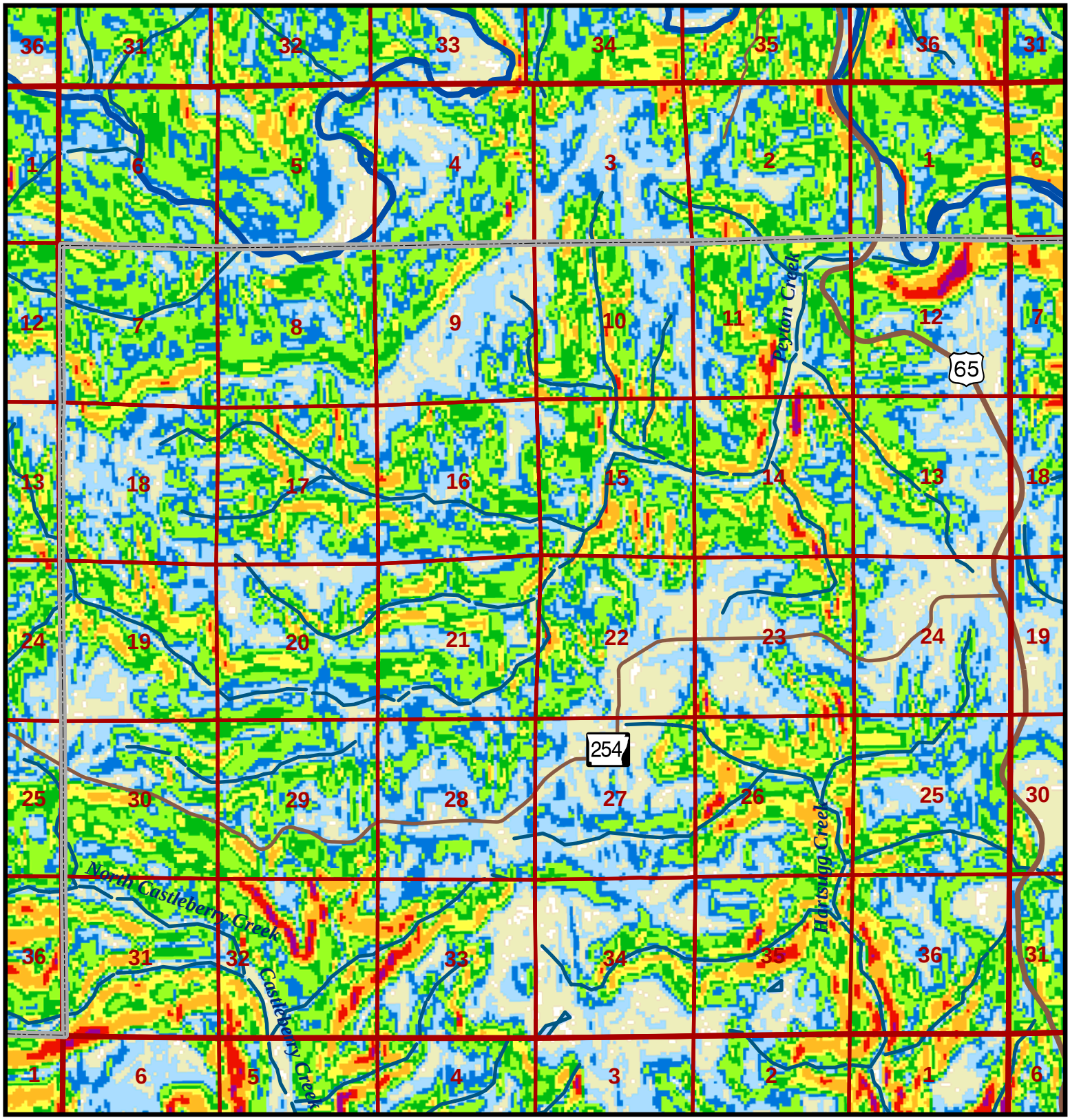
T13N / R16W

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T13N / R15W

Arkansas Field Office
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Conway, Arkansas 72032
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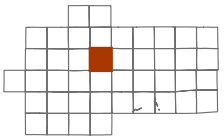
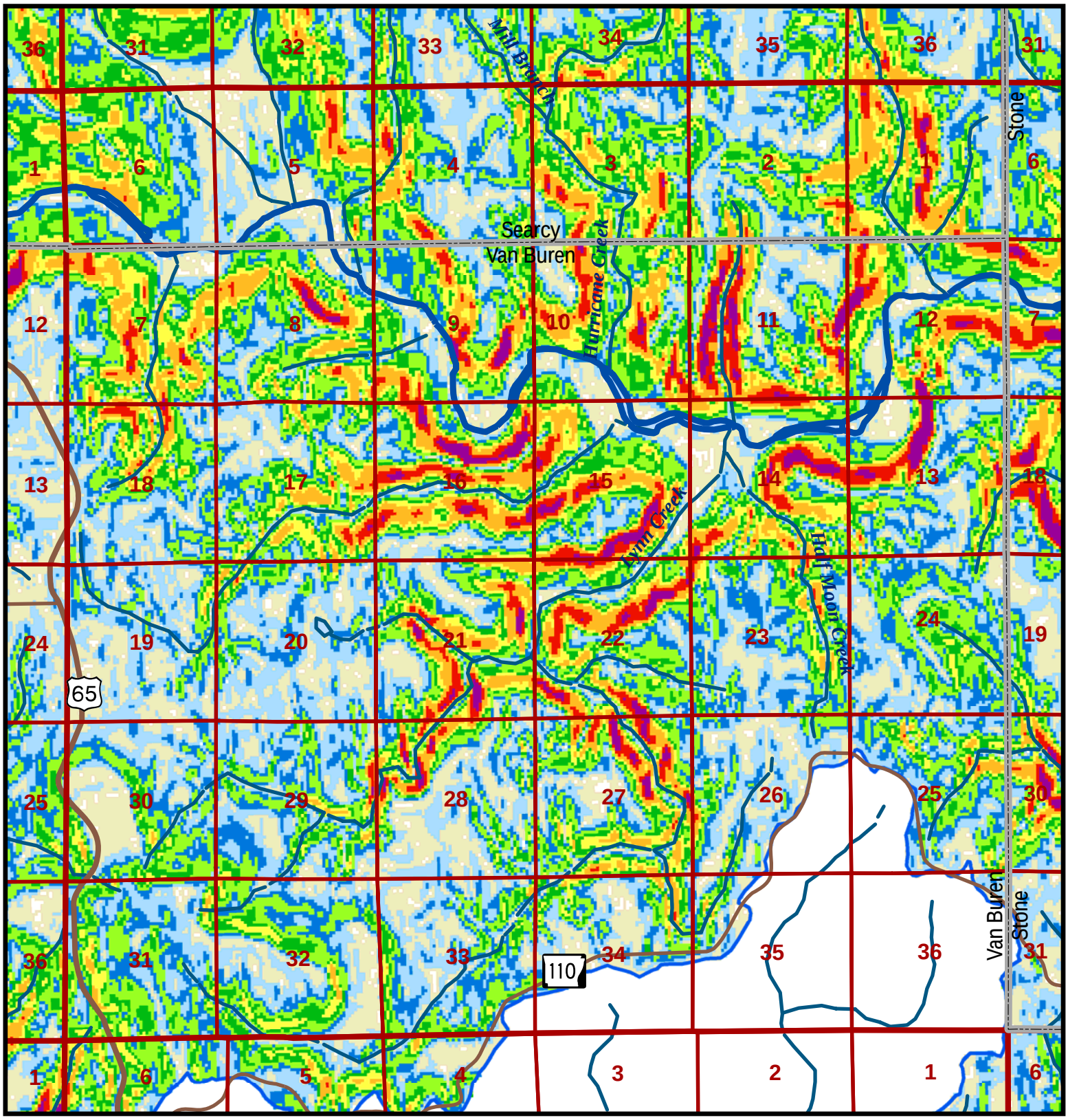
Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T13N / R14W

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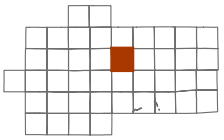
Upper Little Red River Slope Hazard Map (by Township)



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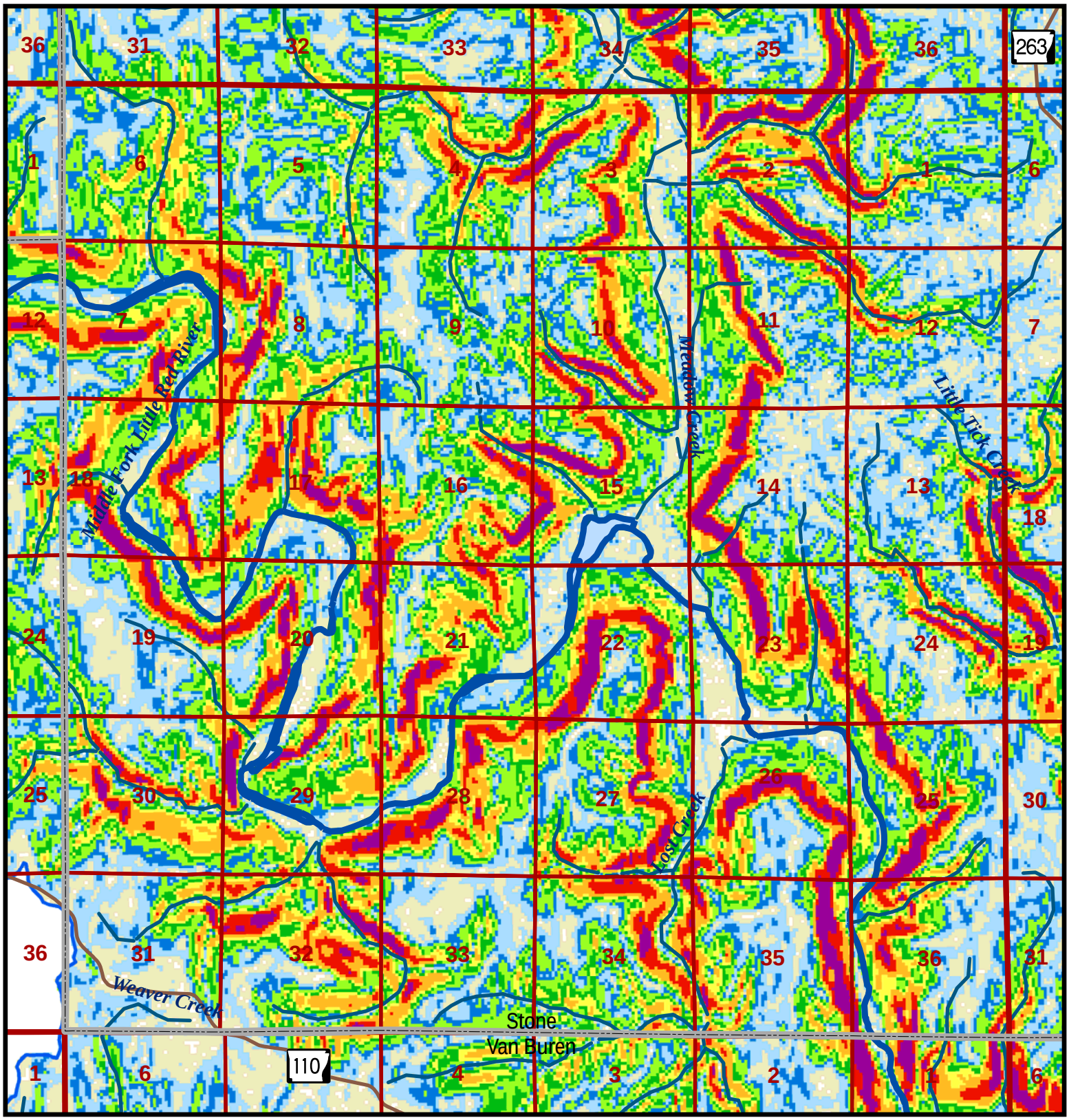

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Percent Slope

N

T13N / R13W

0 0.5 1 2

Miles

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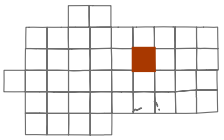

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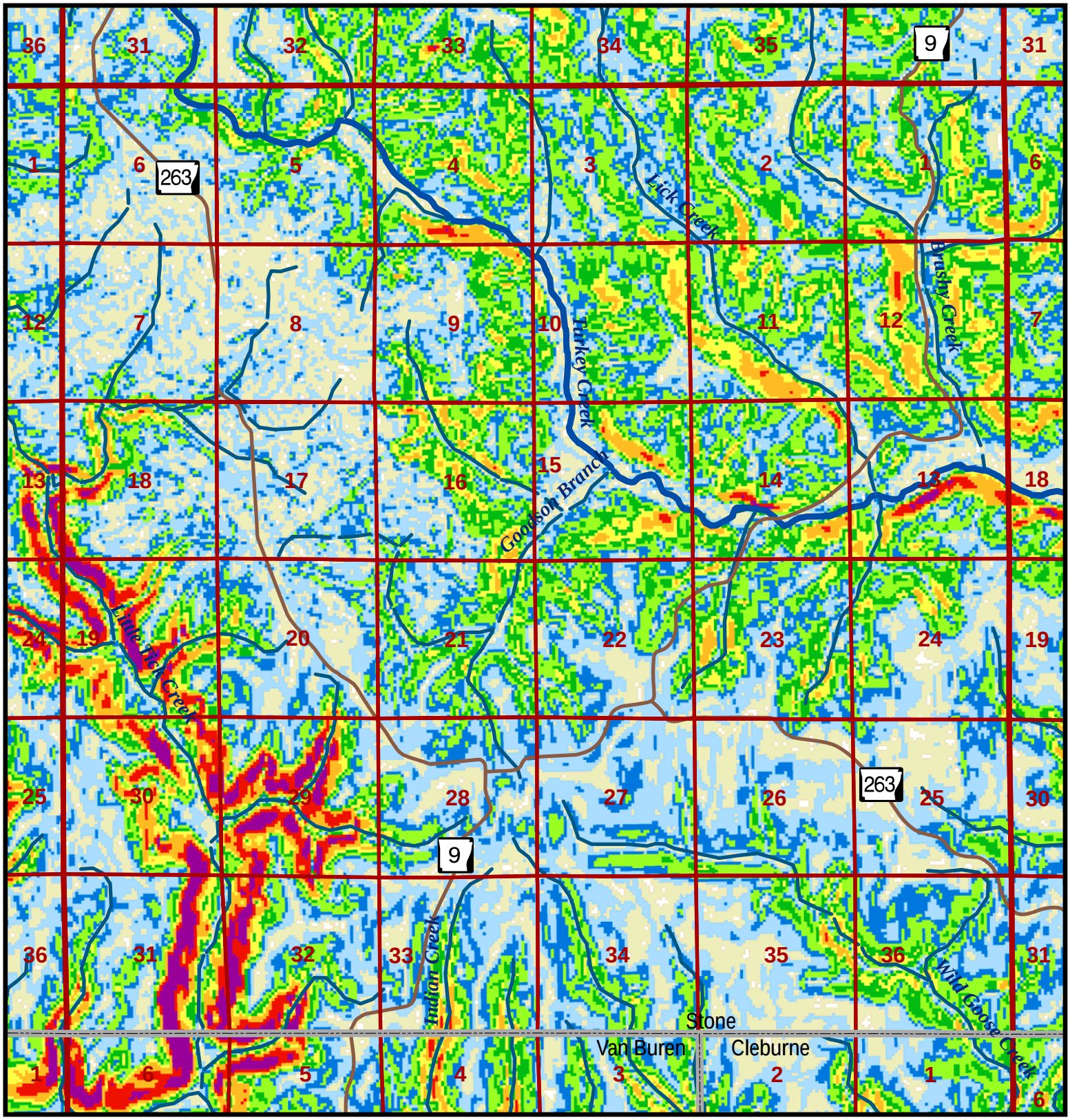

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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T13N / R12W

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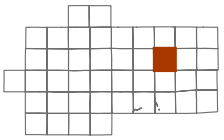

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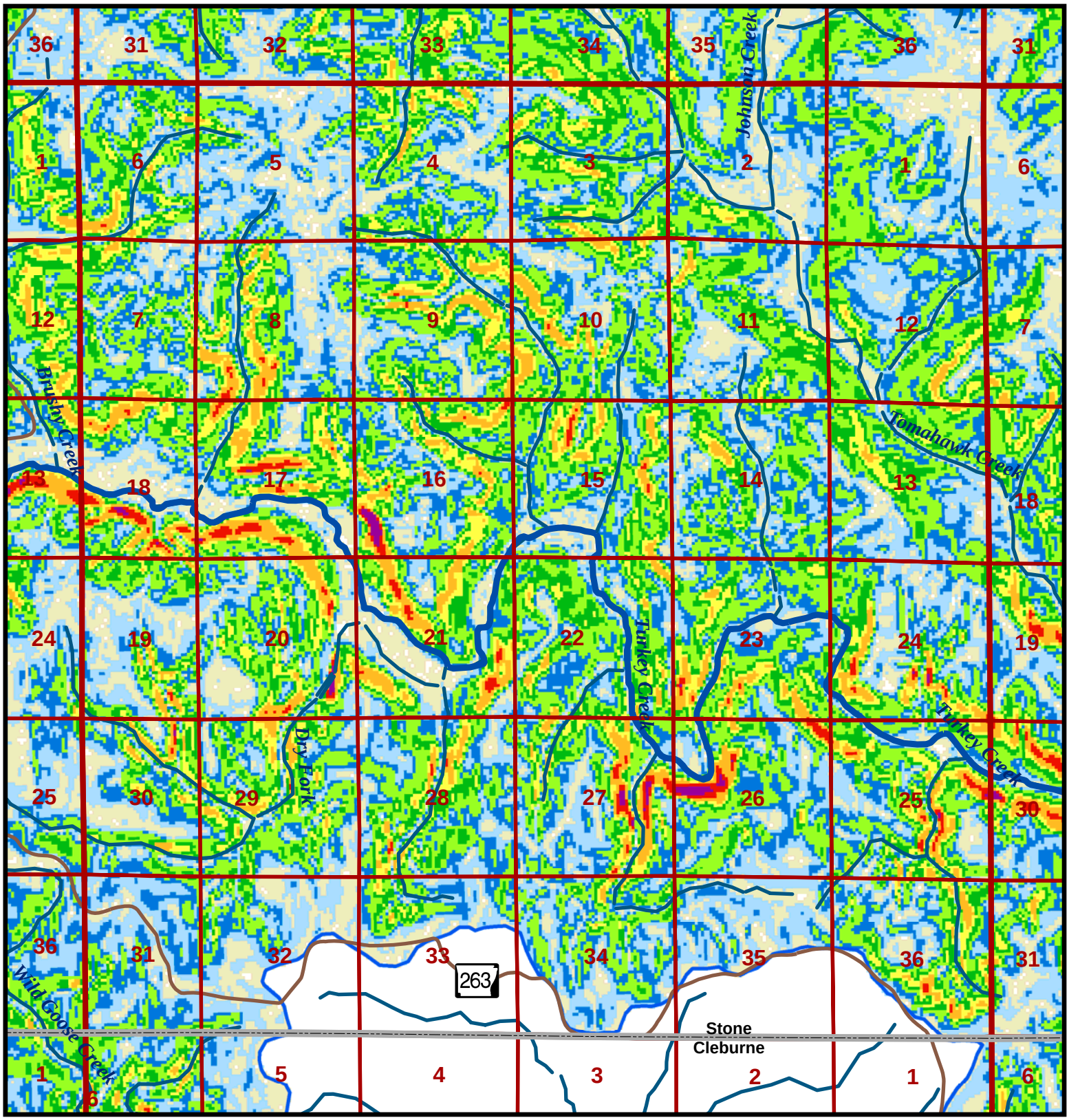

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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T13N / R11W

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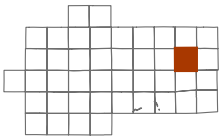
Upper Little Red River Slope Hazard Map (by Township)



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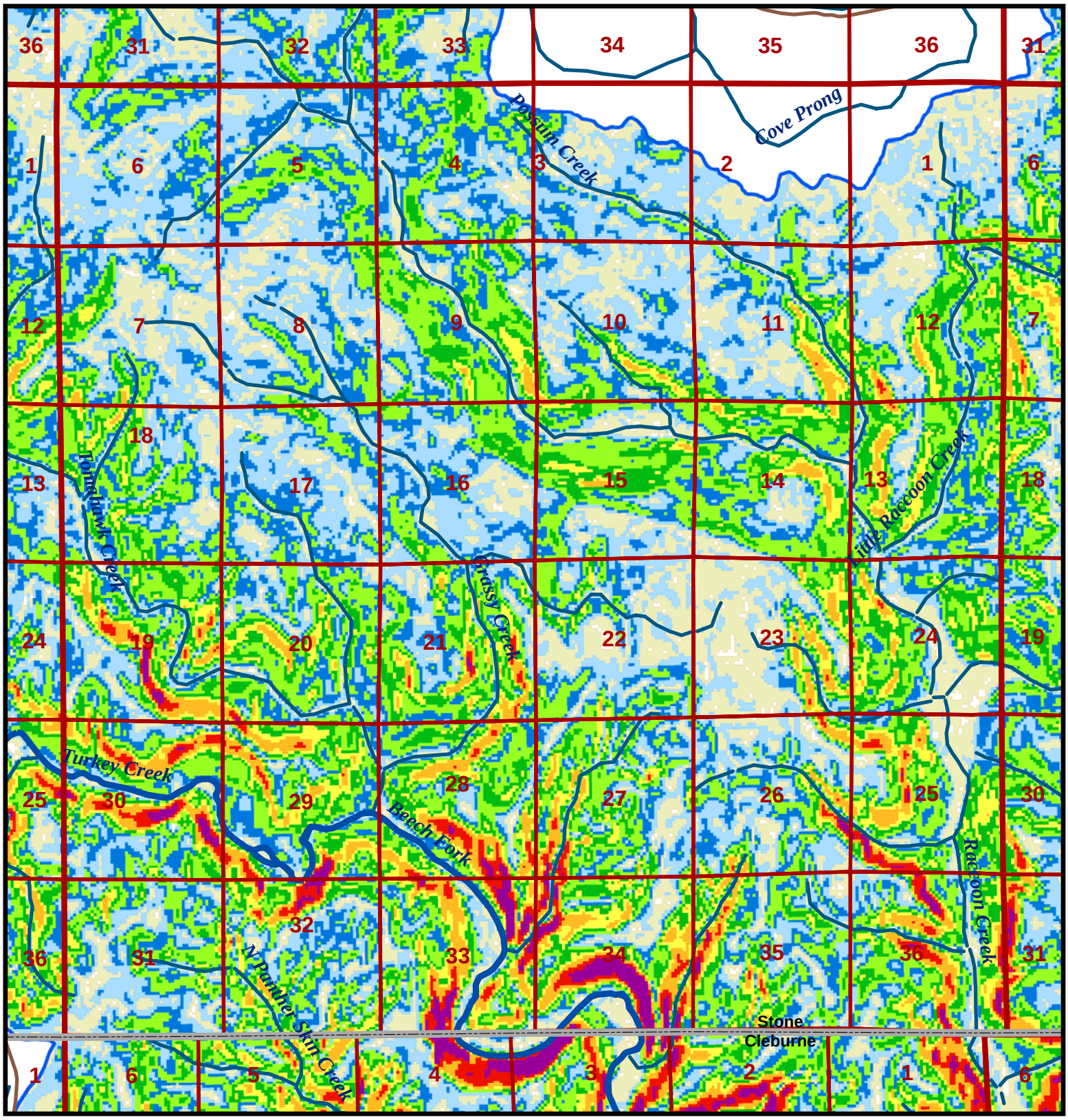

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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

T13N / R10W

0 0.5 1 2

Miles

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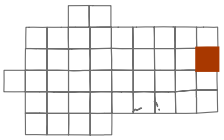
Upper Little Red River Slope Hazard Map (by Township)



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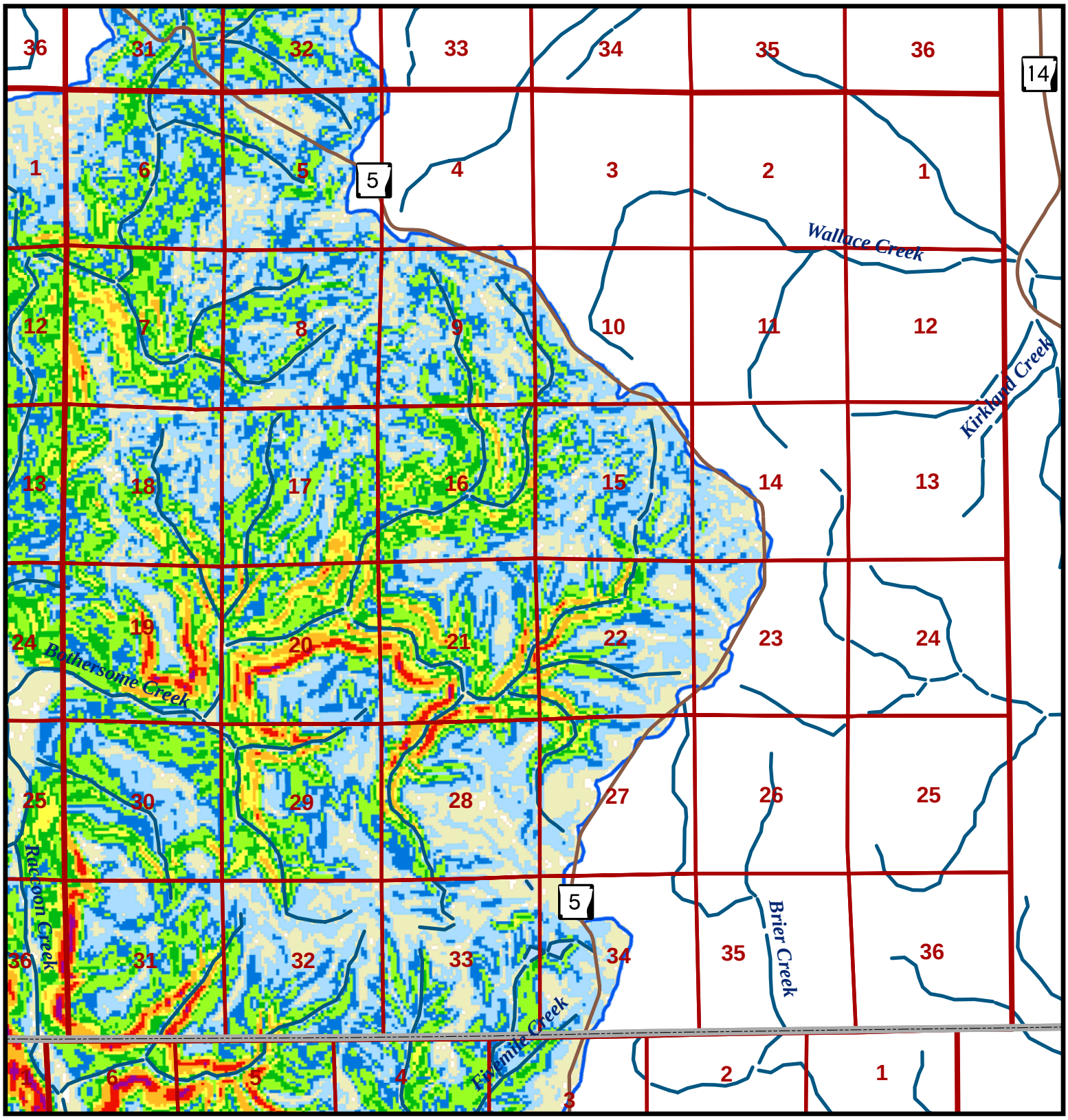

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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

T13N / R9W

0 0.5 1 2

Miles

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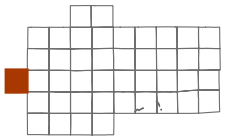
Upper Little Red River Slope Hazard Map (by Township)



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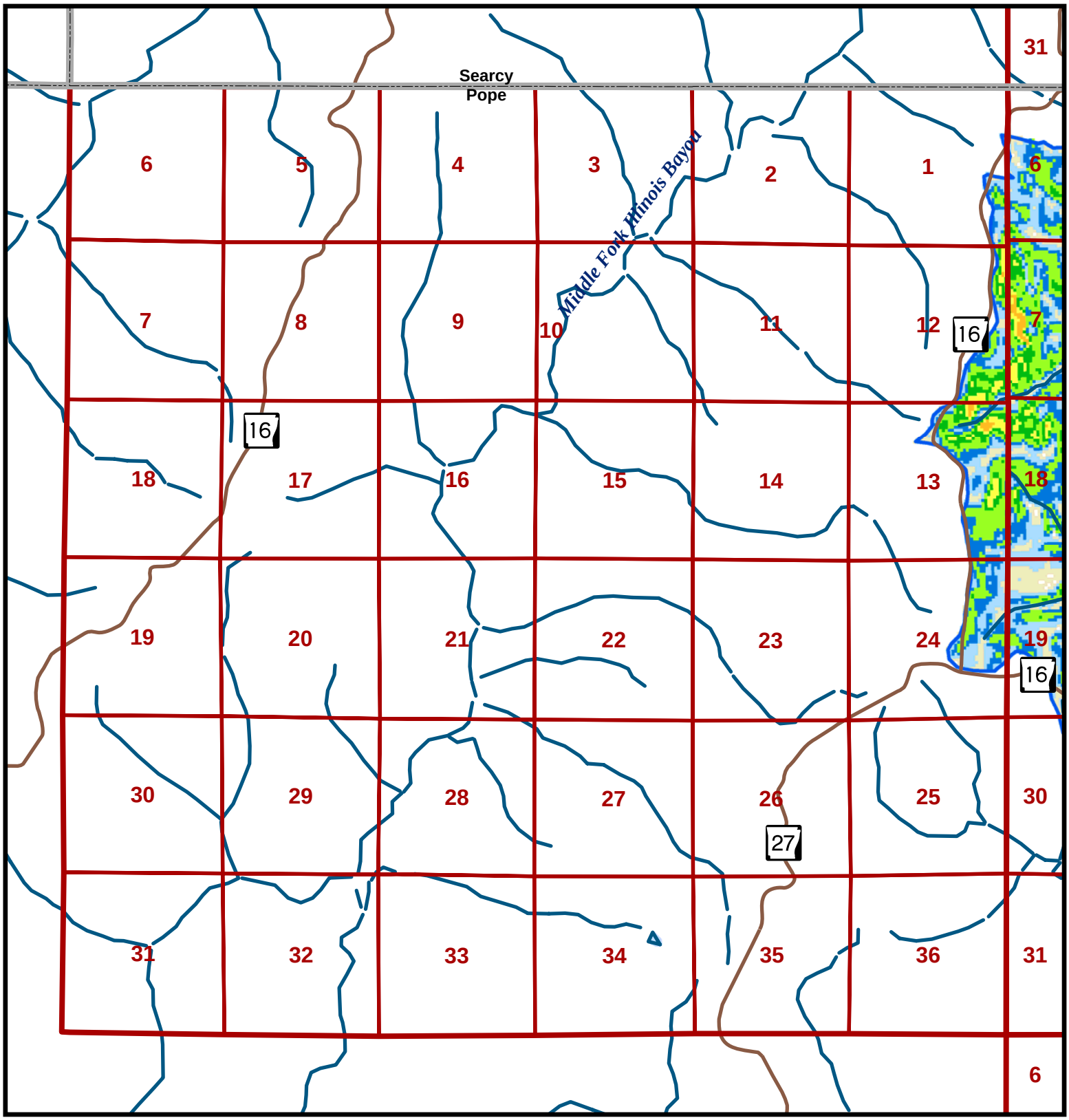

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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T12N / R18W

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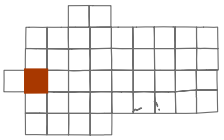
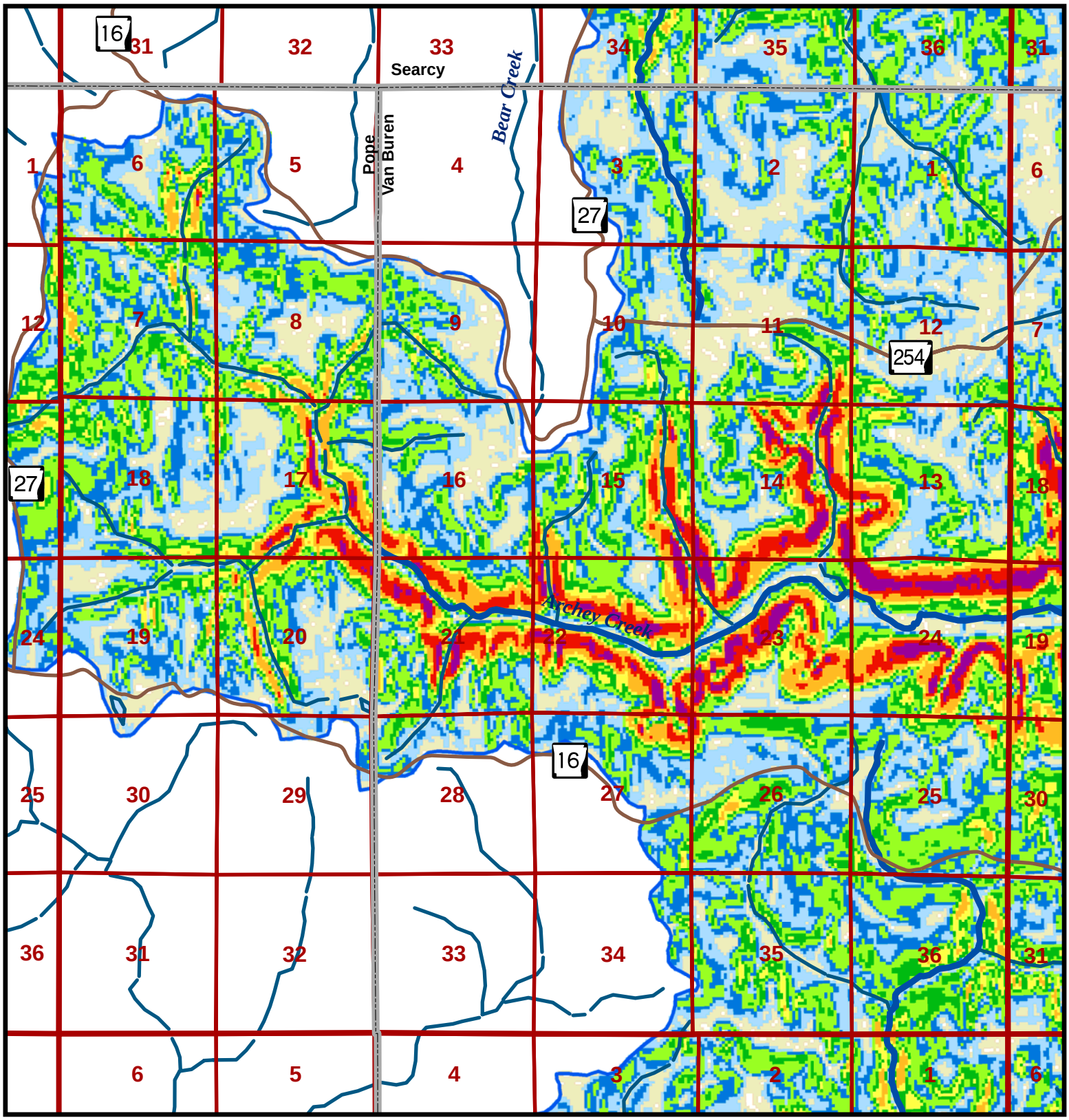
Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T12N / R17W

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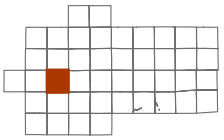
Upper Little Red River Slope Hazard Map (by Township)



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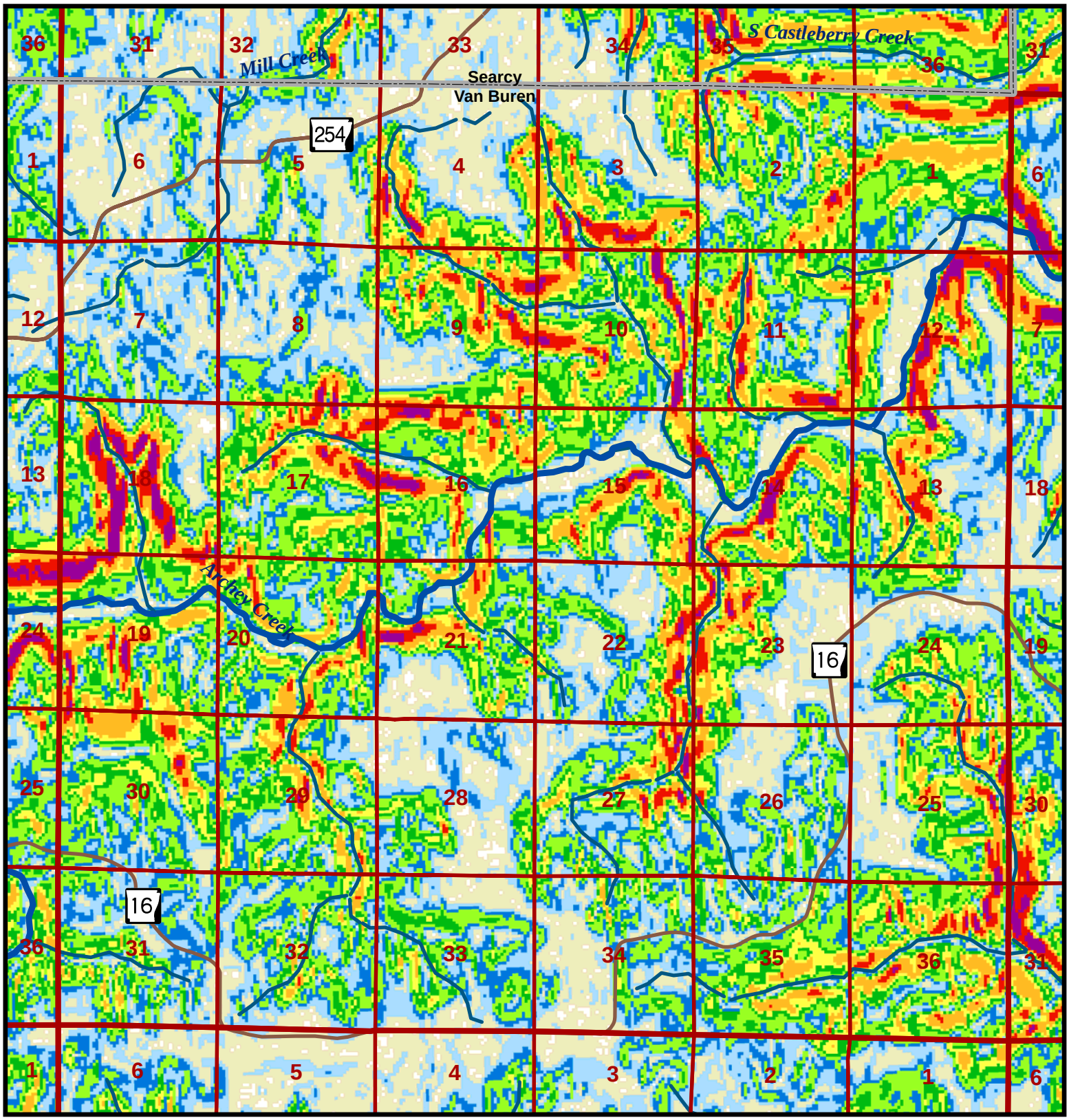

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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

0 0.5 1 2

Miles

T12N / R16W

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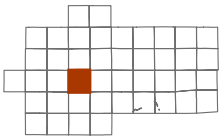
Upper Little Red River Slope Hazard Map (by Township)



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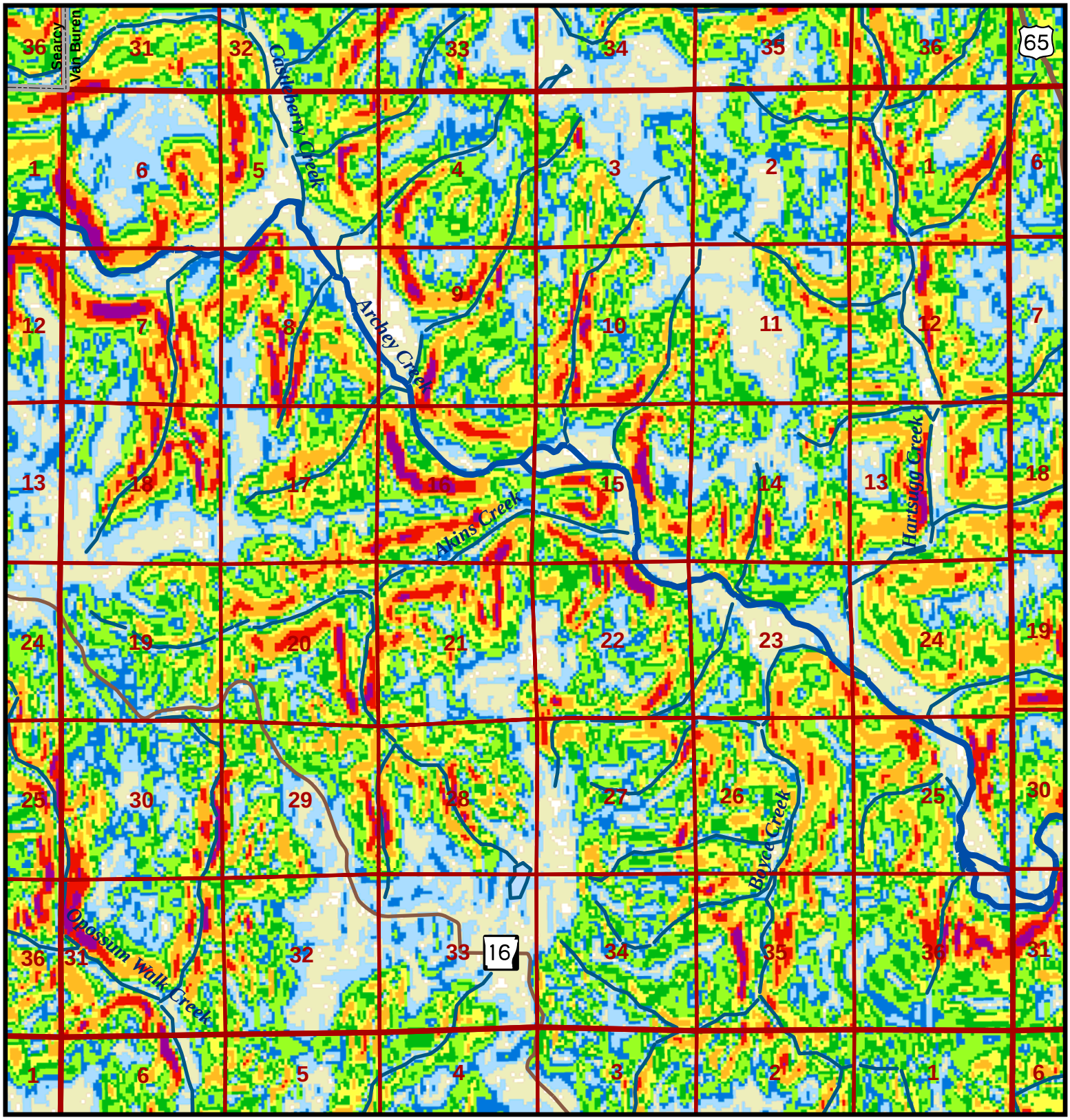

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Percent Slope

N

0 0.5 1 2

Miles

T12N / R15W

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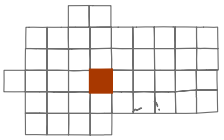

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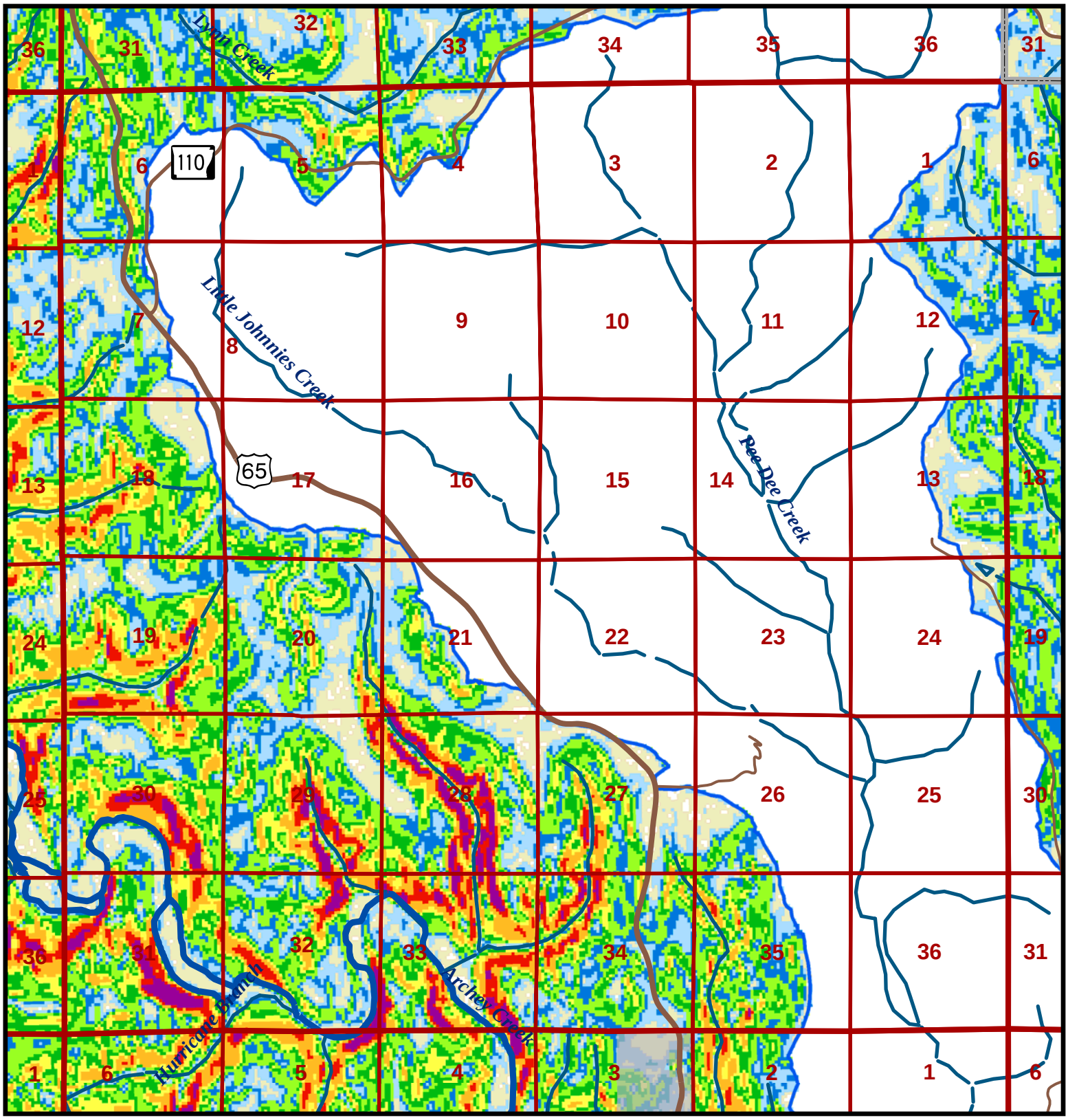

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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

T12N / R14W

0 0.5 1 2

Miles

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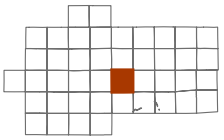
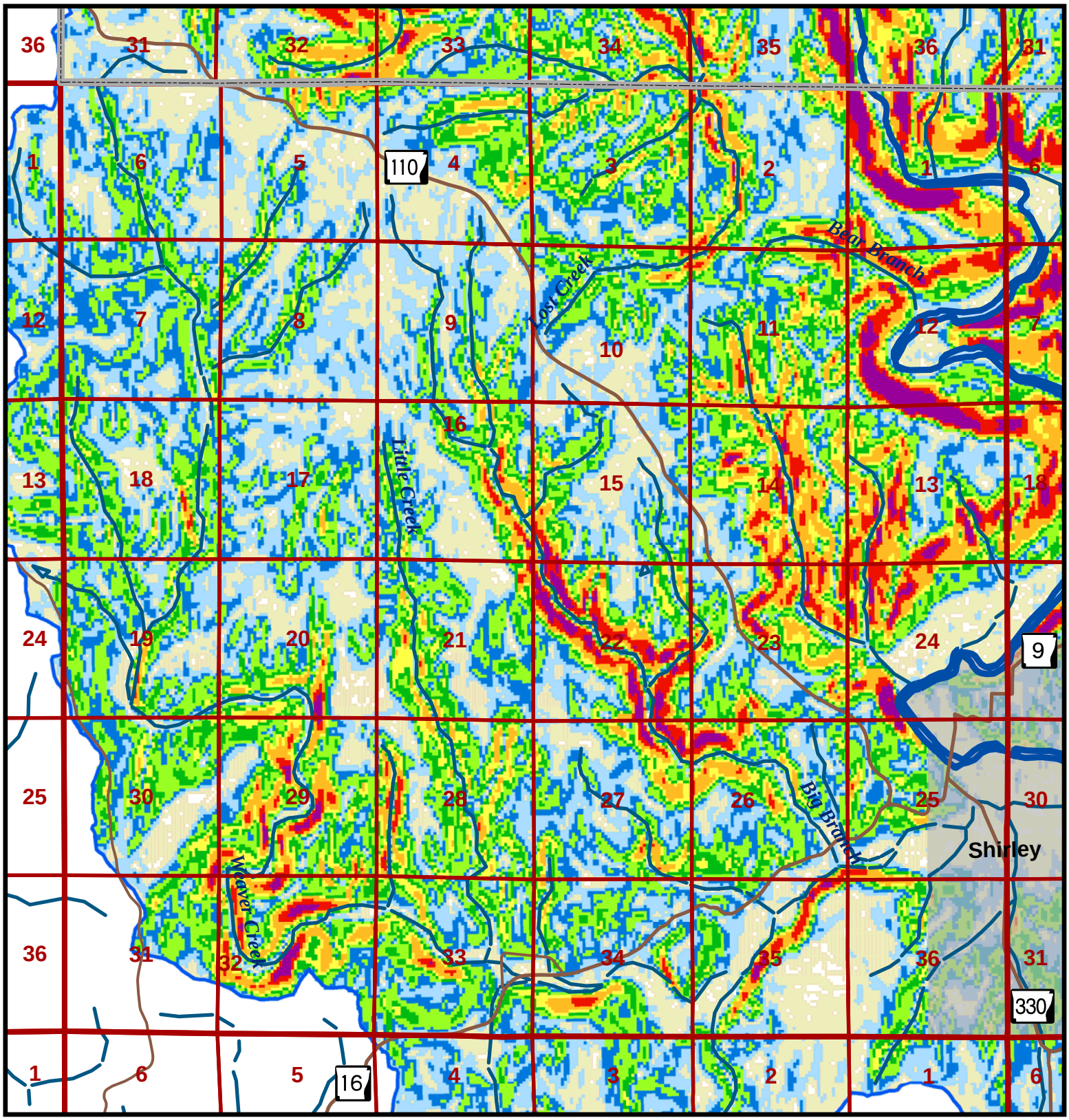
Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

T12N / R13W

0 0.5 1 2

Miles

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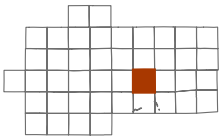
Upper Little Red River Slope Hazard Map (by Township)



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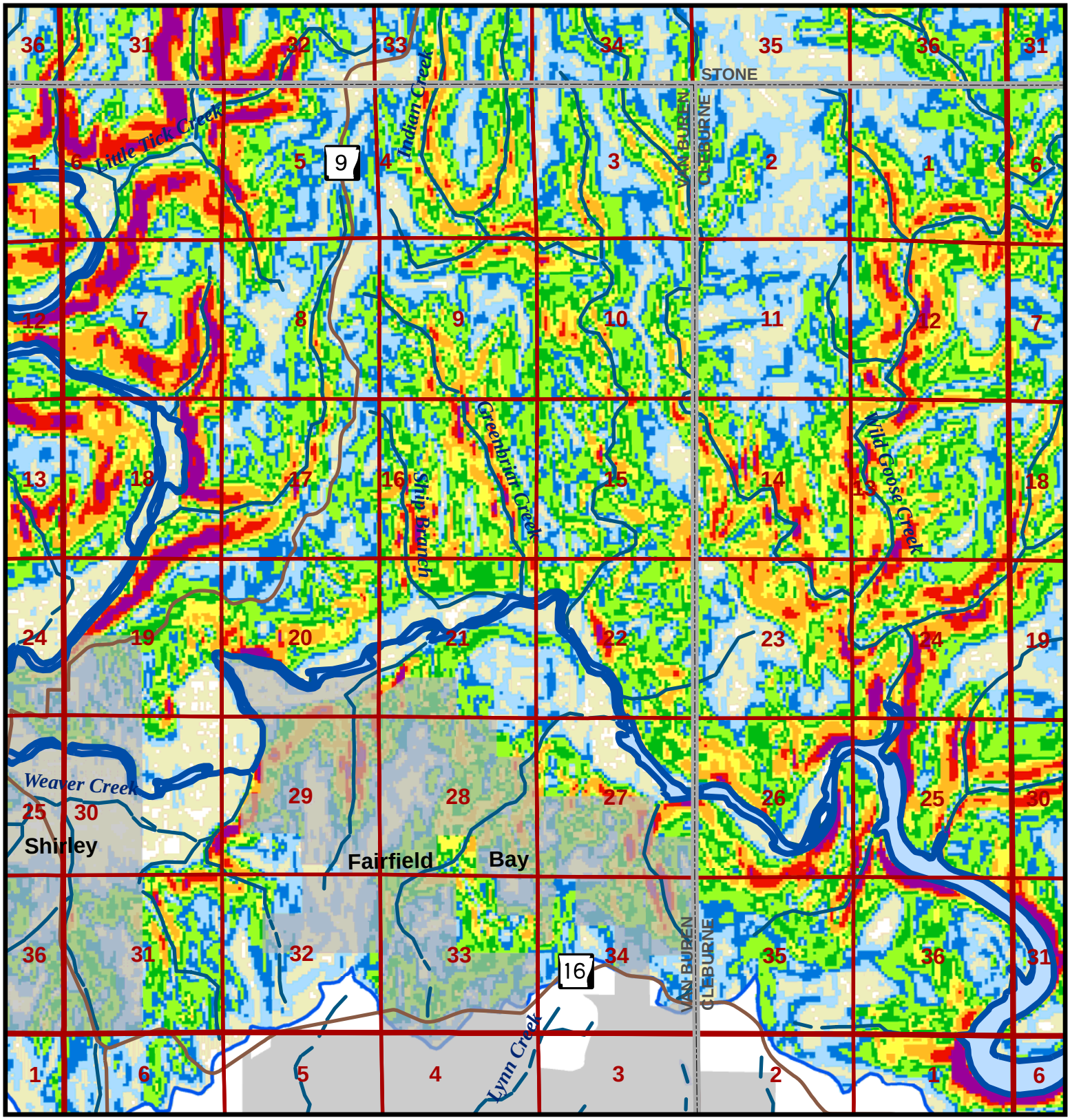

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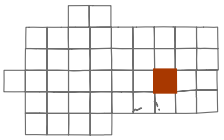

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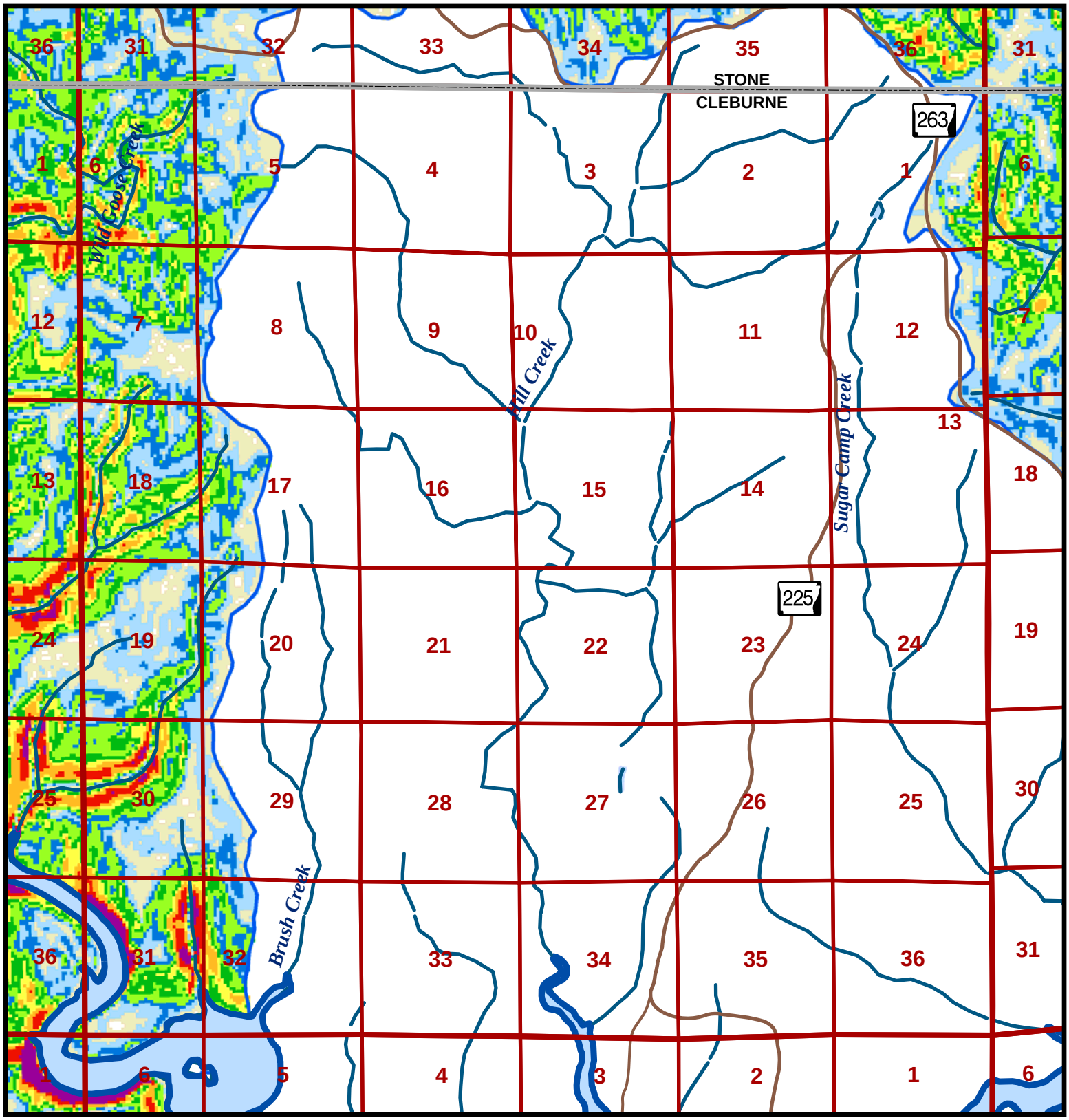

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Percent Slope

N

T12N / R11W

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Miles

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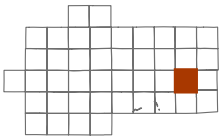
Upper Little Red River Slope Hazard Map (by Township)



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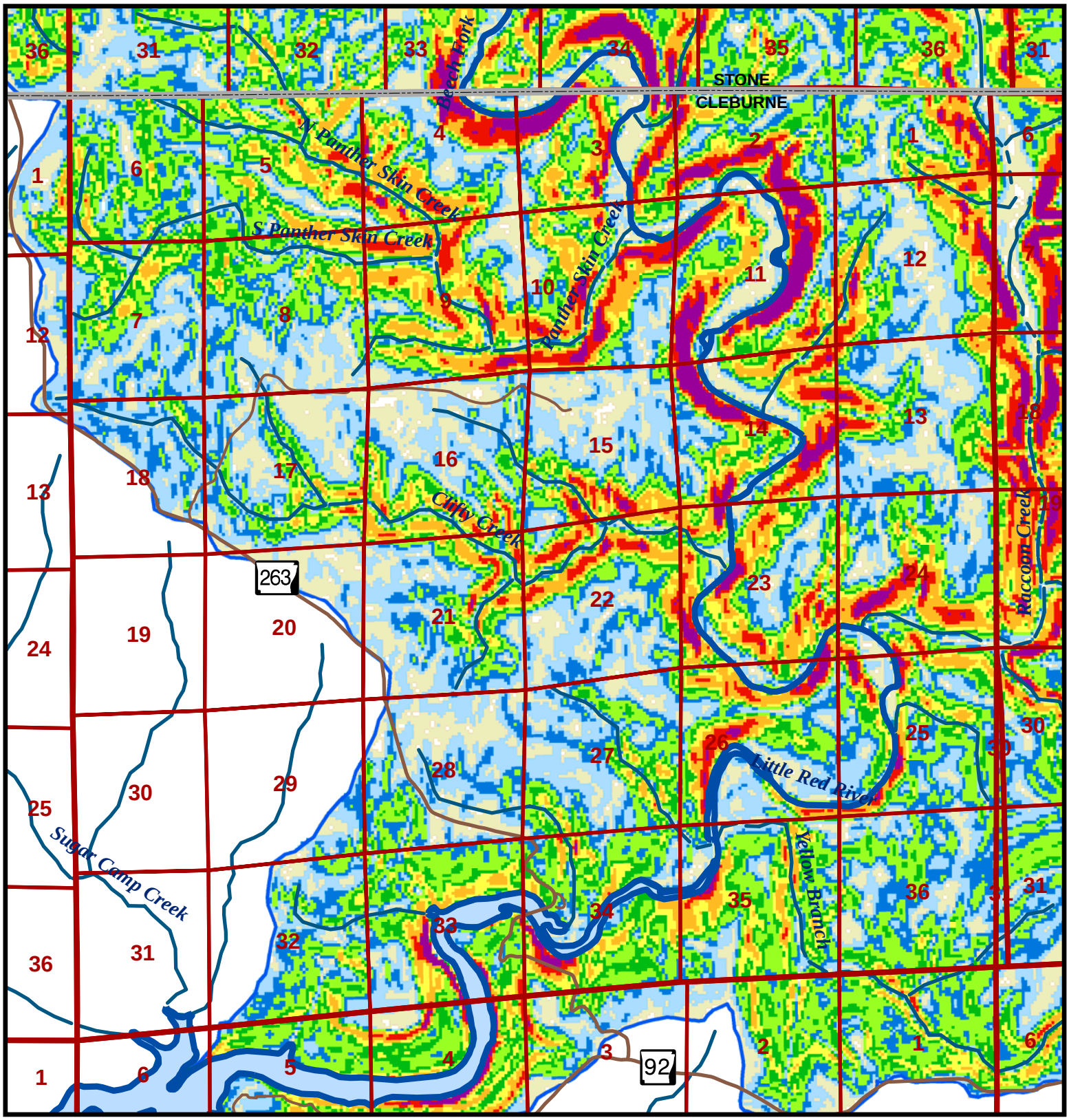

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Percent Slope

N

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Miles

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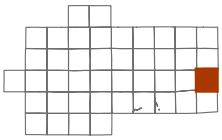
Upper Little Red River Slope Hazard Map (by Township)



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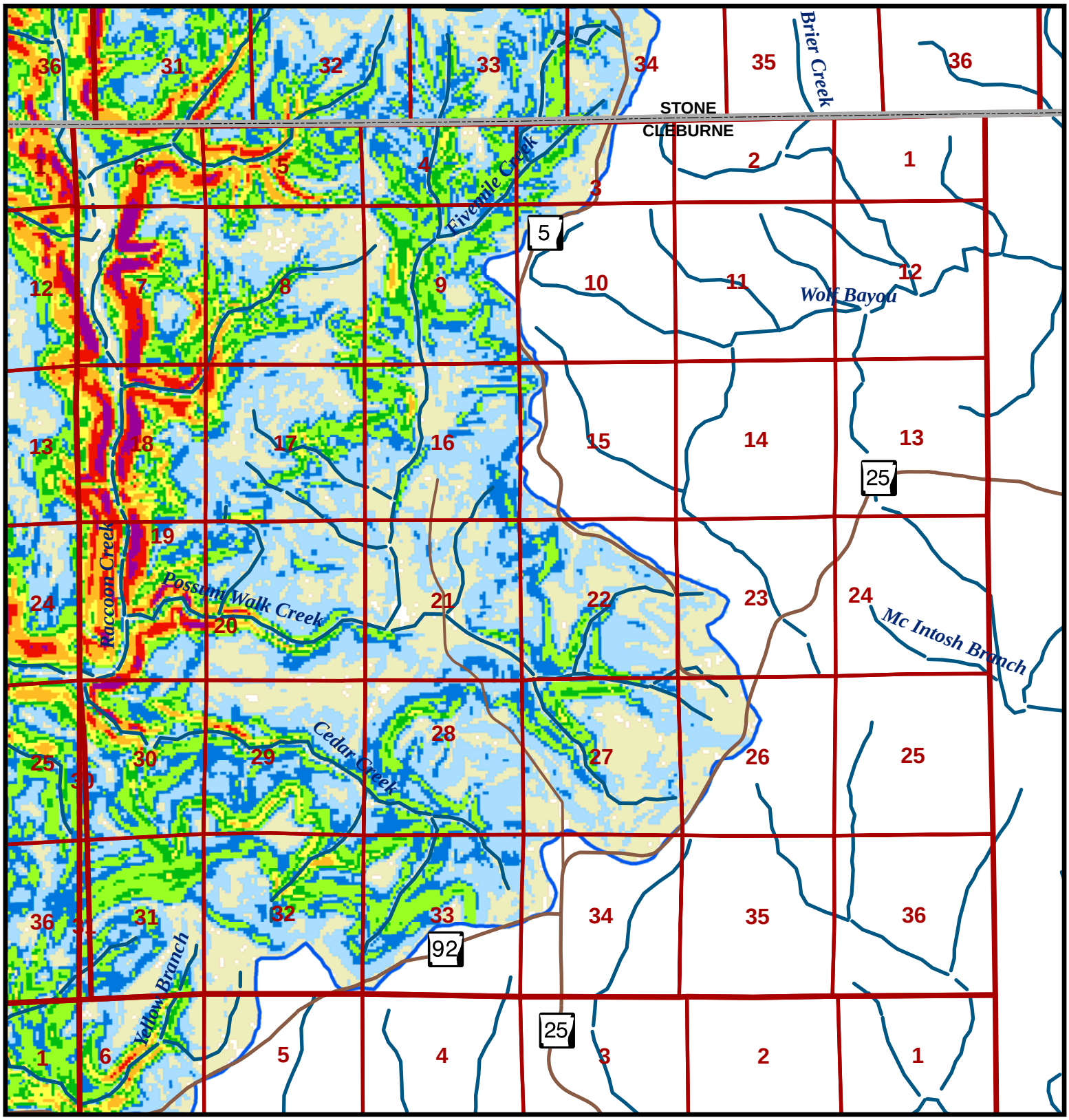

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Percent Slope

N

T12N / R9W

0 0.5 1 2

Miles

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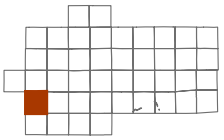
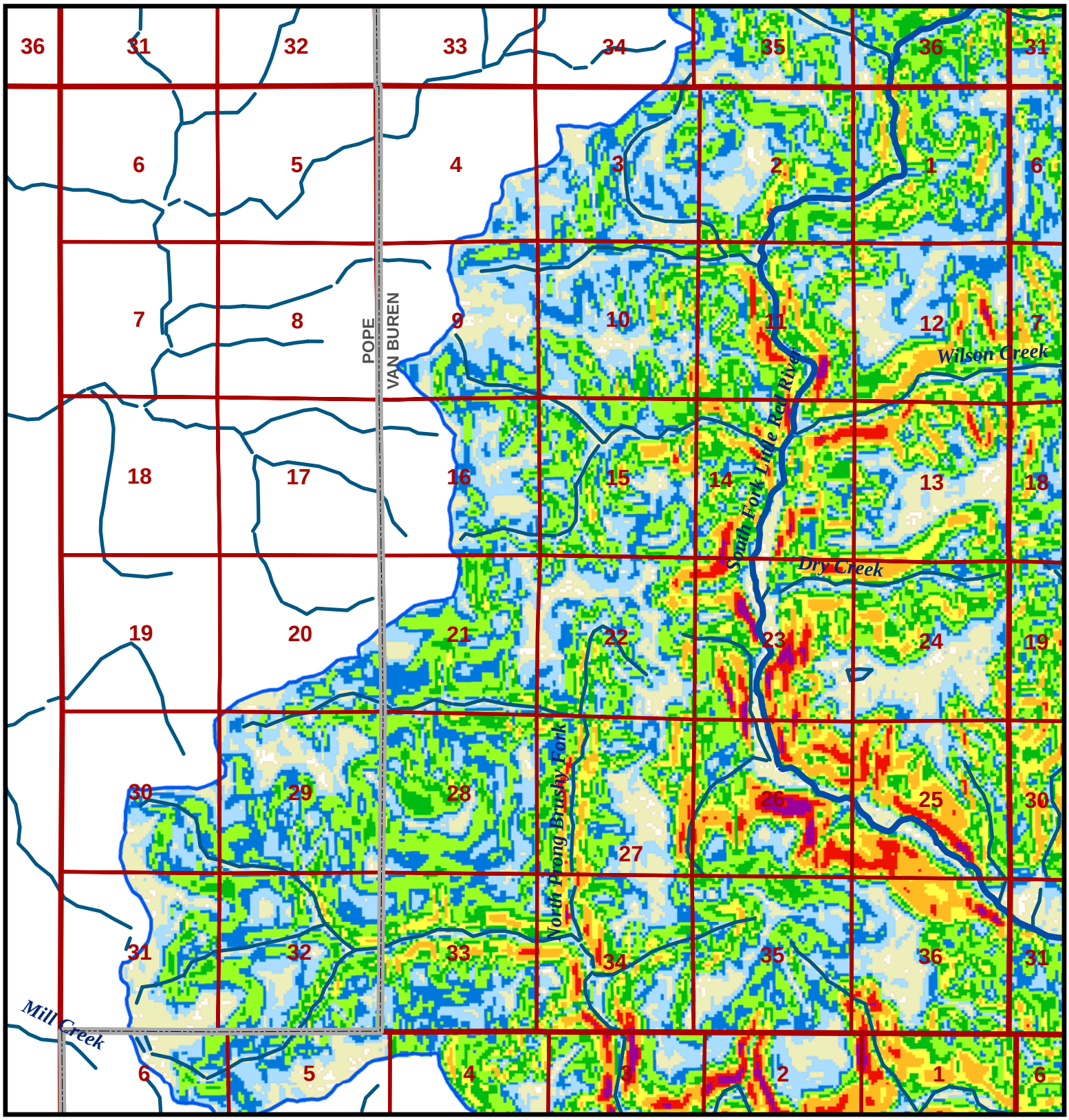
Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



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Percent Slope

N

T11N / R17W

0 0.5 1 2

Miles

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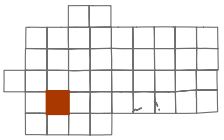
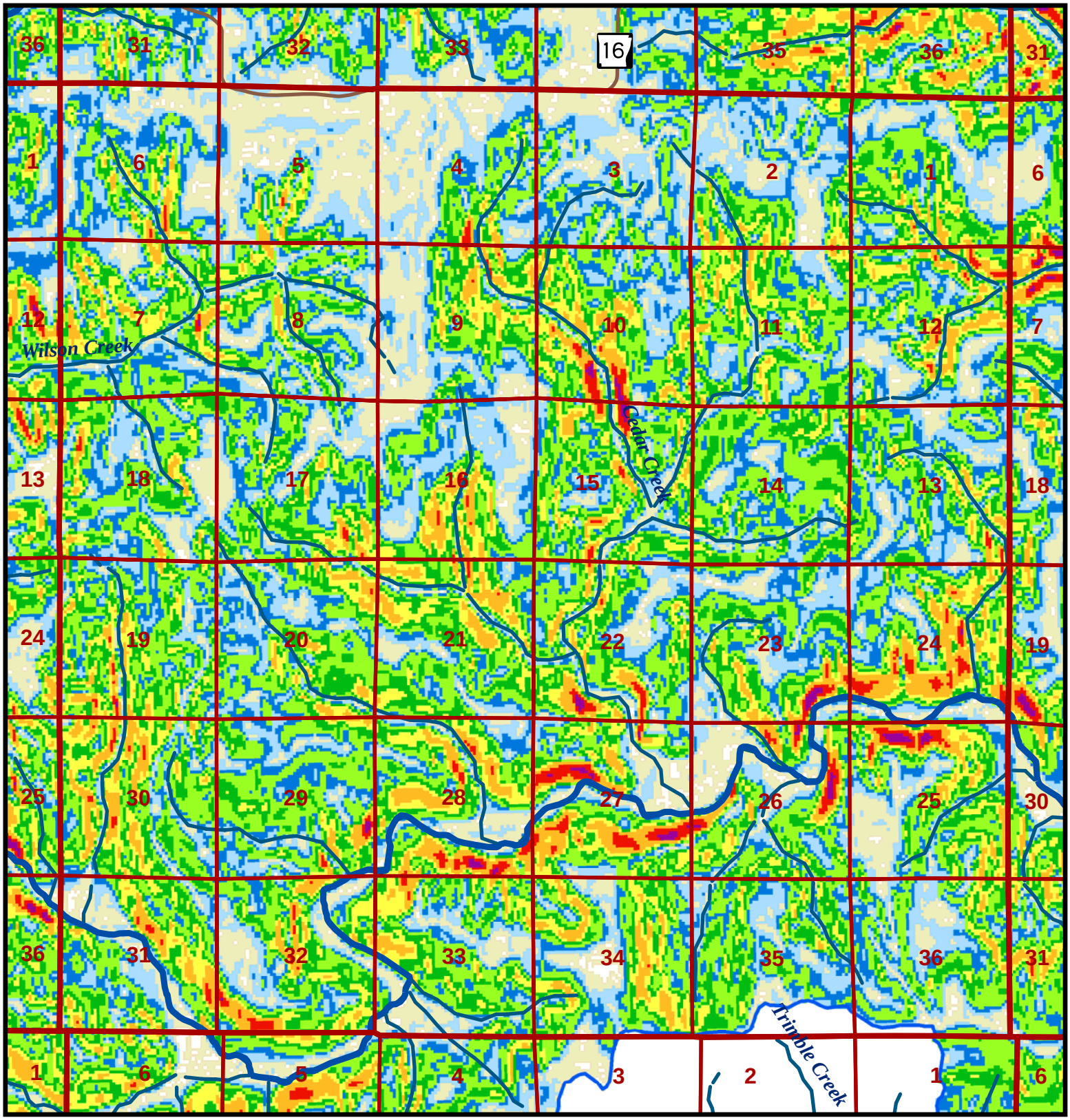
Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



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Percent Slope

N

0 0.5 1 2

Miles

T11N / R16W

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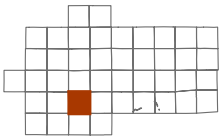
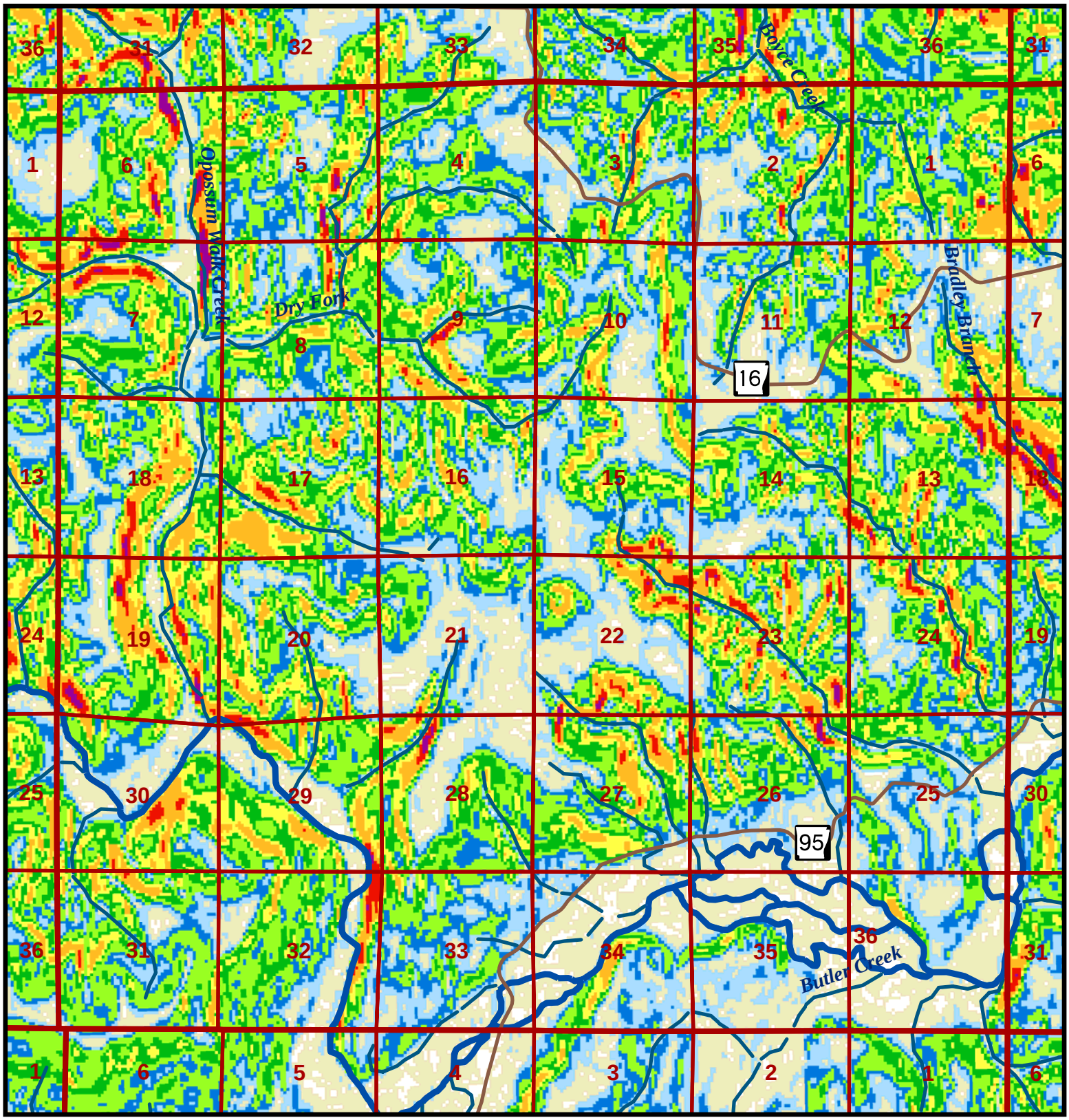
Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



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0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

T11N / R15W

0 0.5 1 2

Miles

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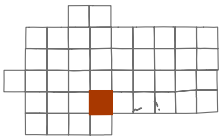
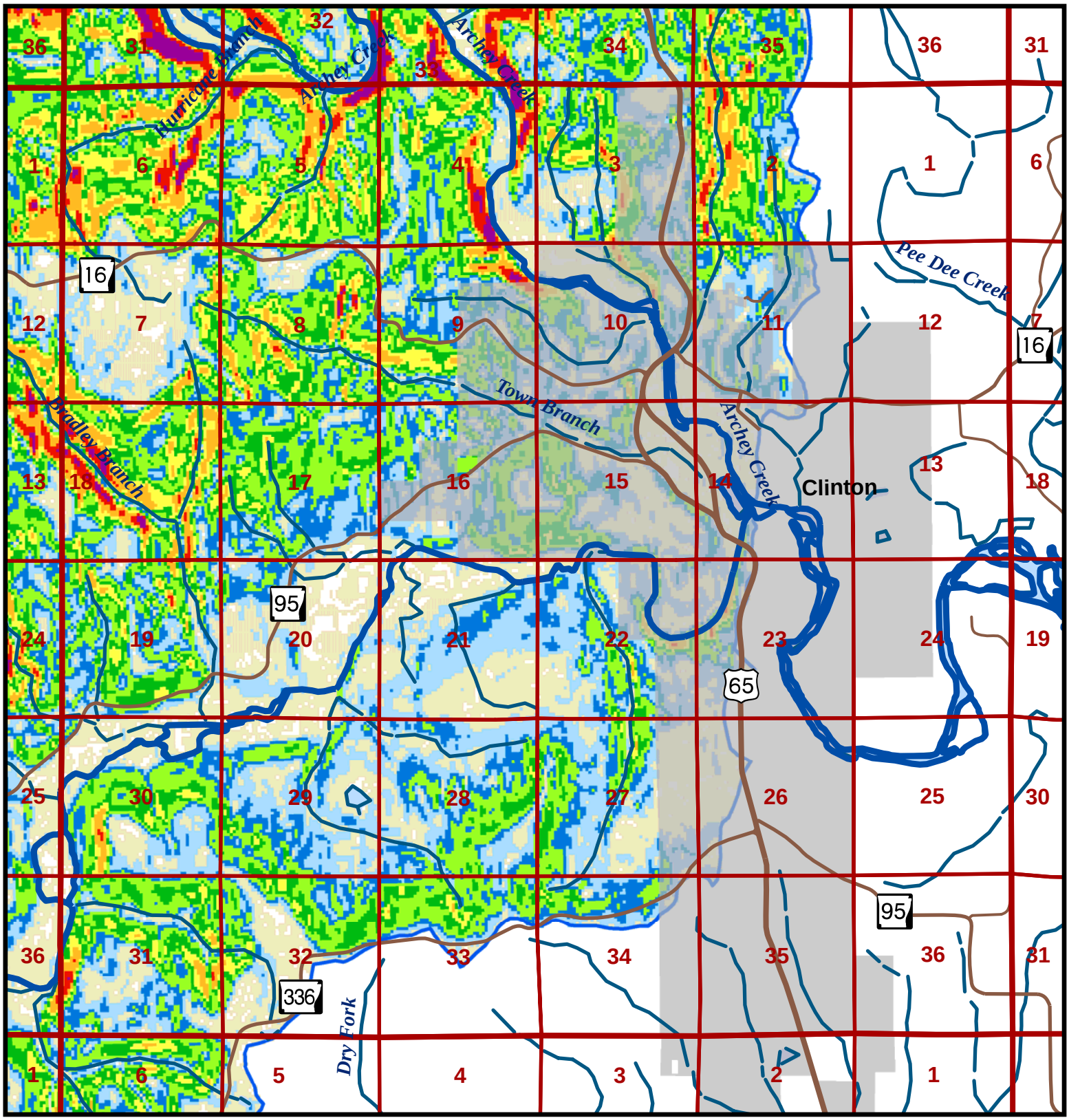
Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

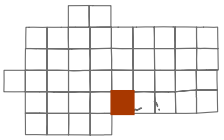
0 0.5 1 2

Miles

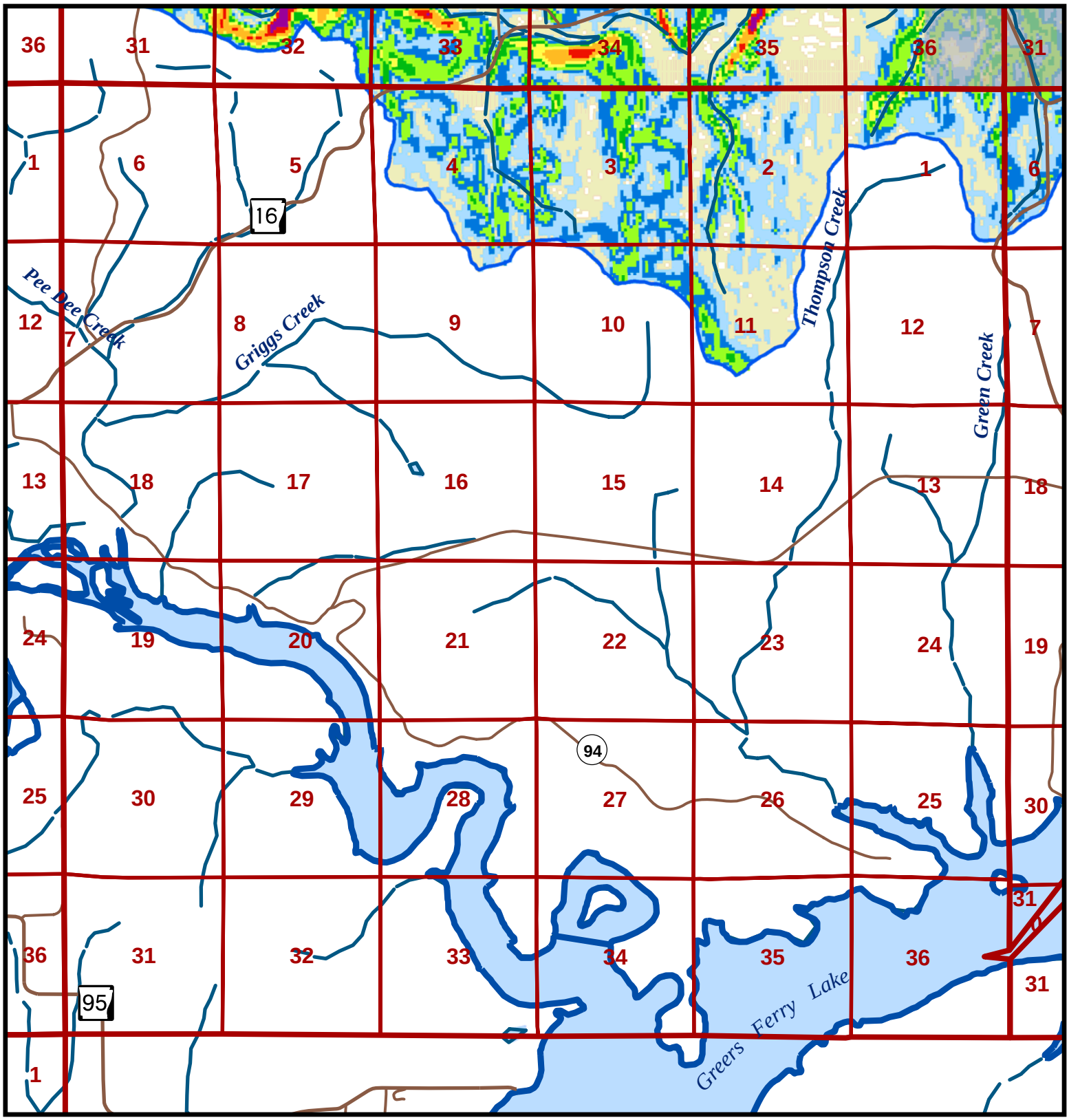
T11N / R14W

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

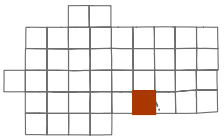
0 0.5 1 2

Miles

T11N / R13W

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



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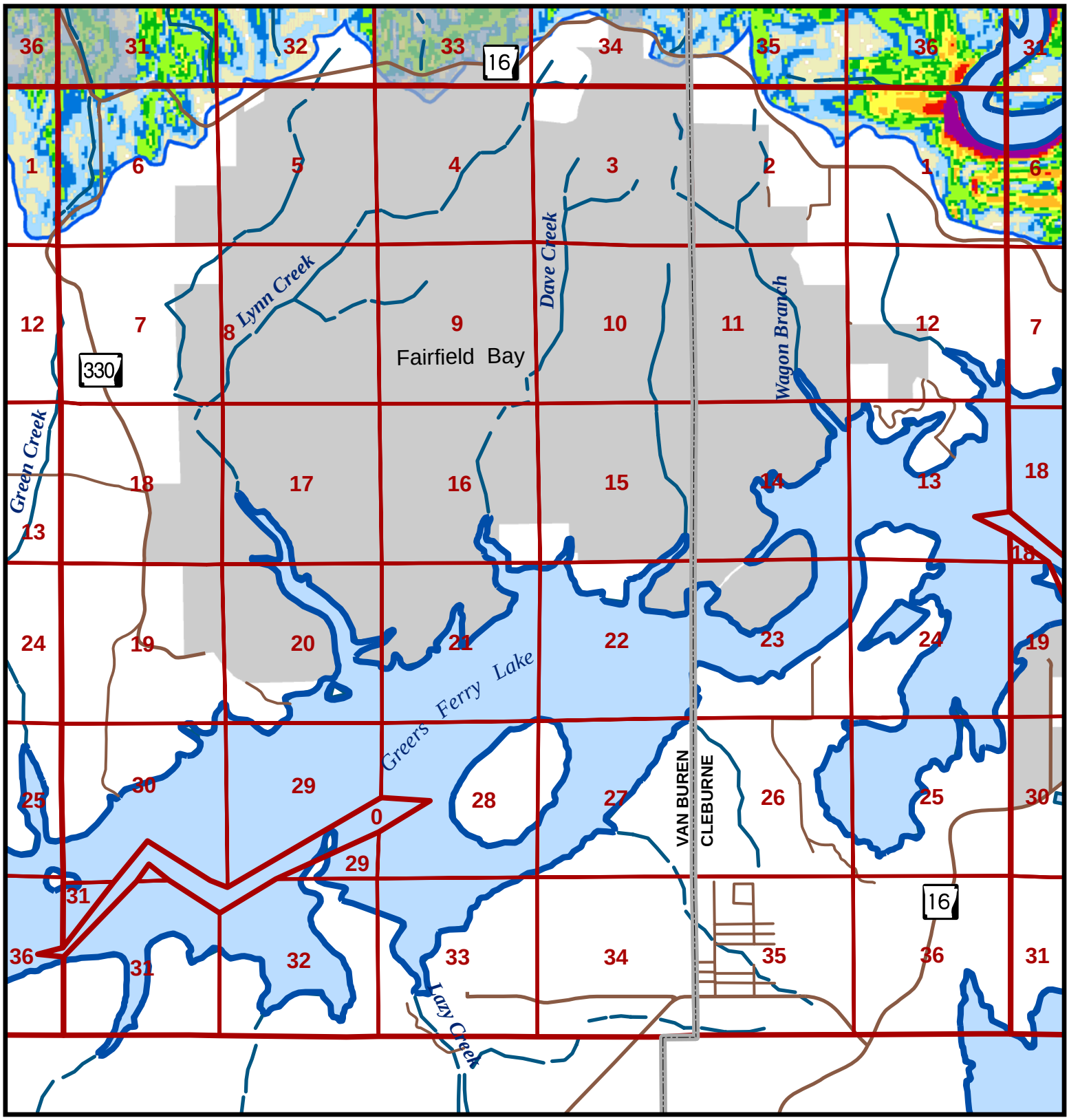


Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

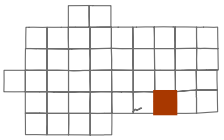
T11N / R12W

0 0.5 1 2

Miles

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



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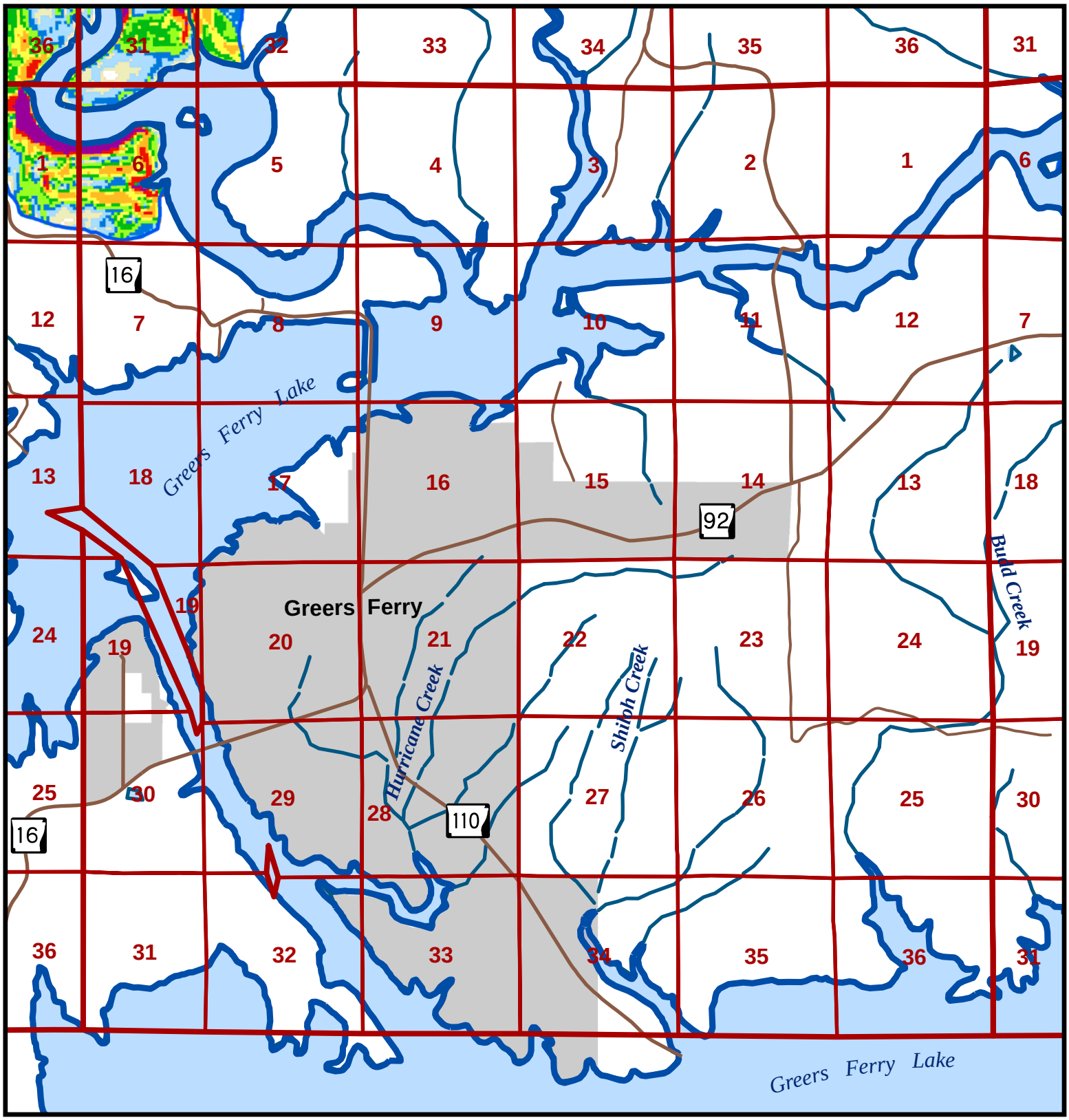


Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

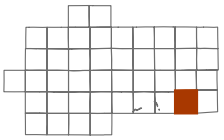
0 0.5 1 2

Miles

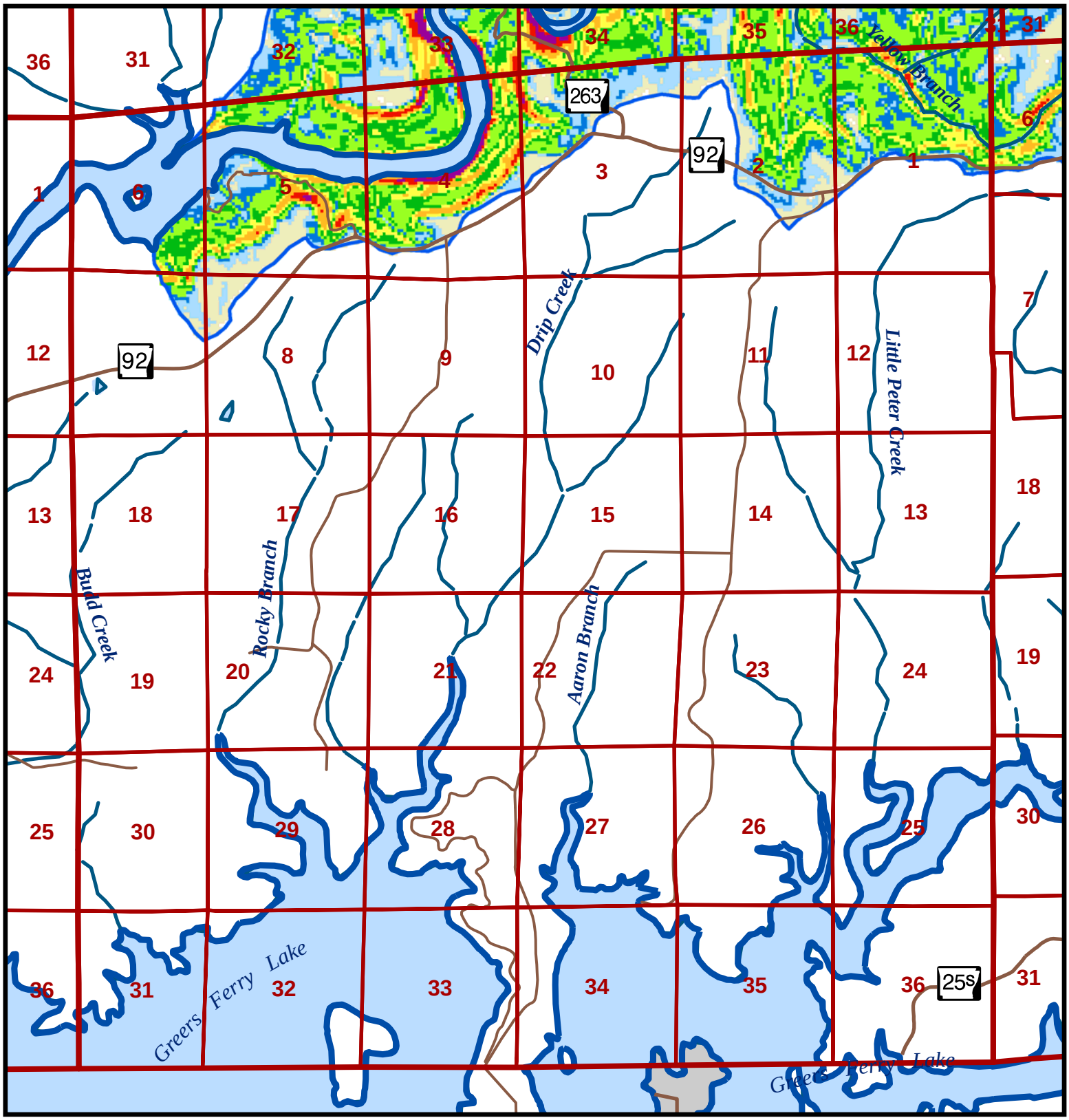
T11N / R11W

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

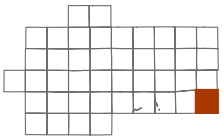
0 0.5 1 2

Miles

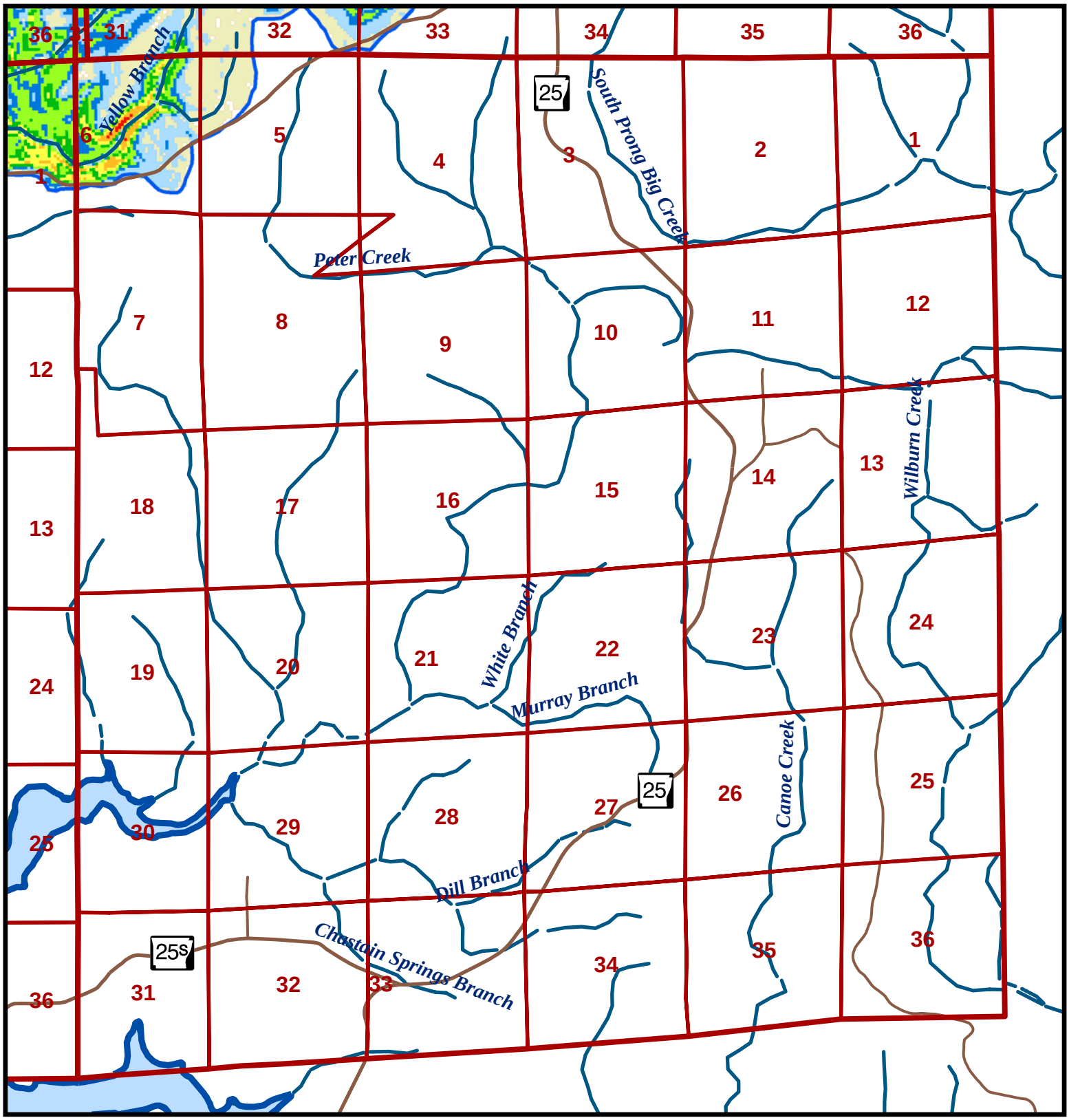
T11N / R10W

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

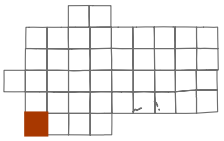
0 0.5 1 2

Miles

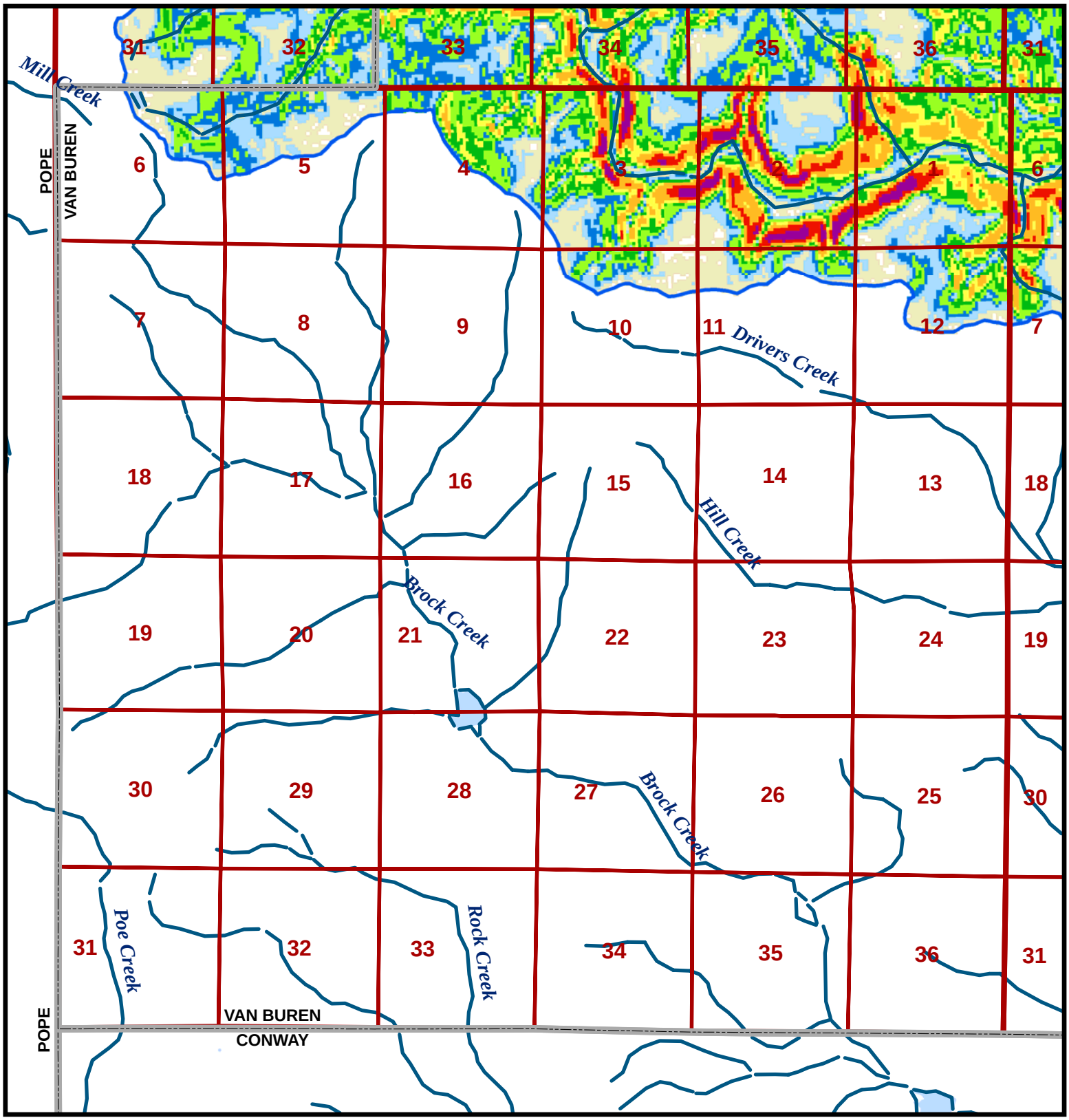
T11N / R9W

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

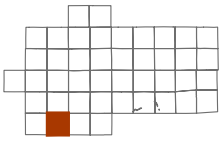
0 0.5 1 2

Miles

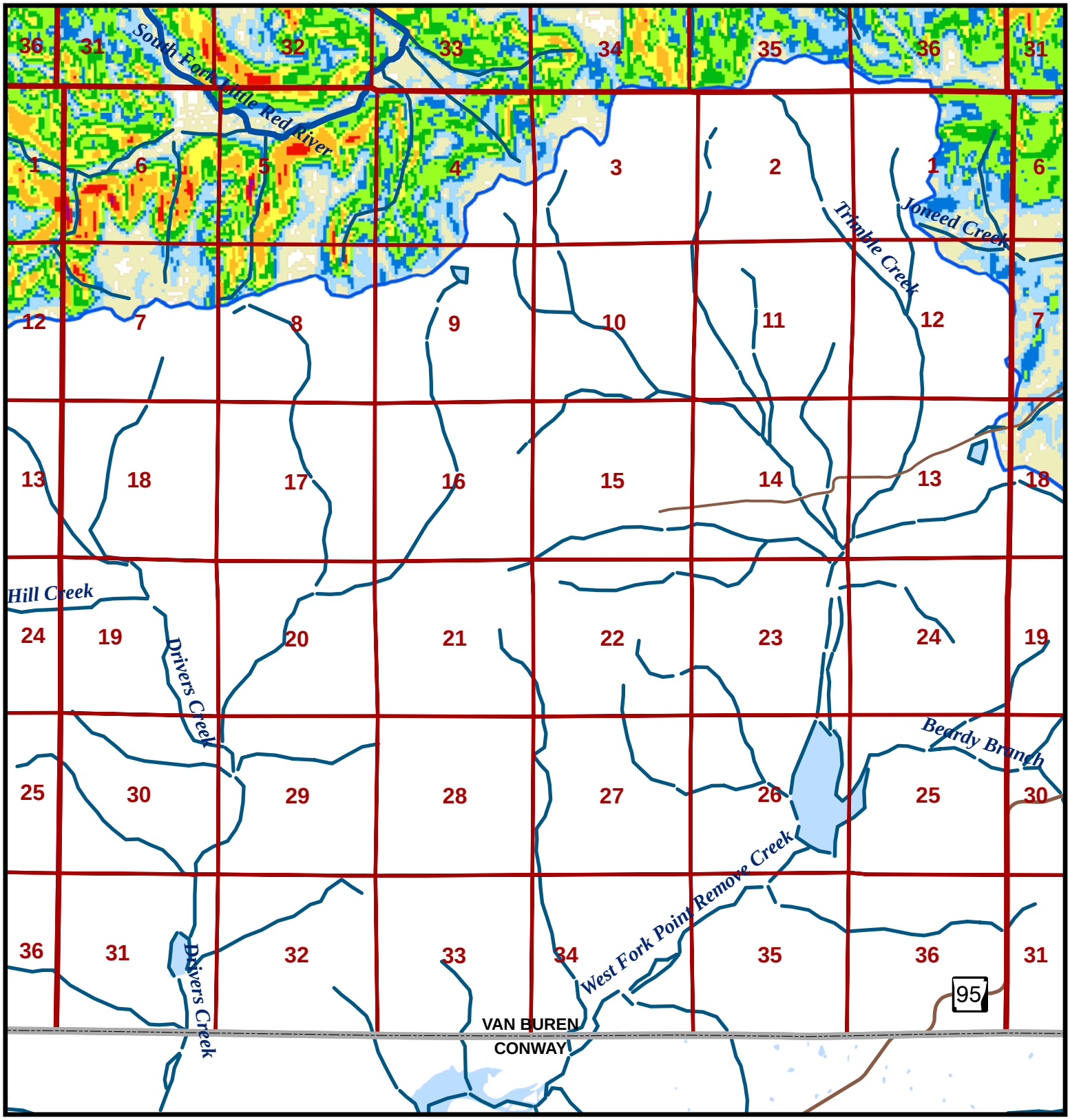
T10N / R17W

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

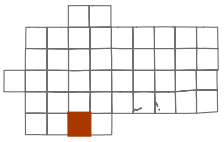
0 0.5 1 2

Miles

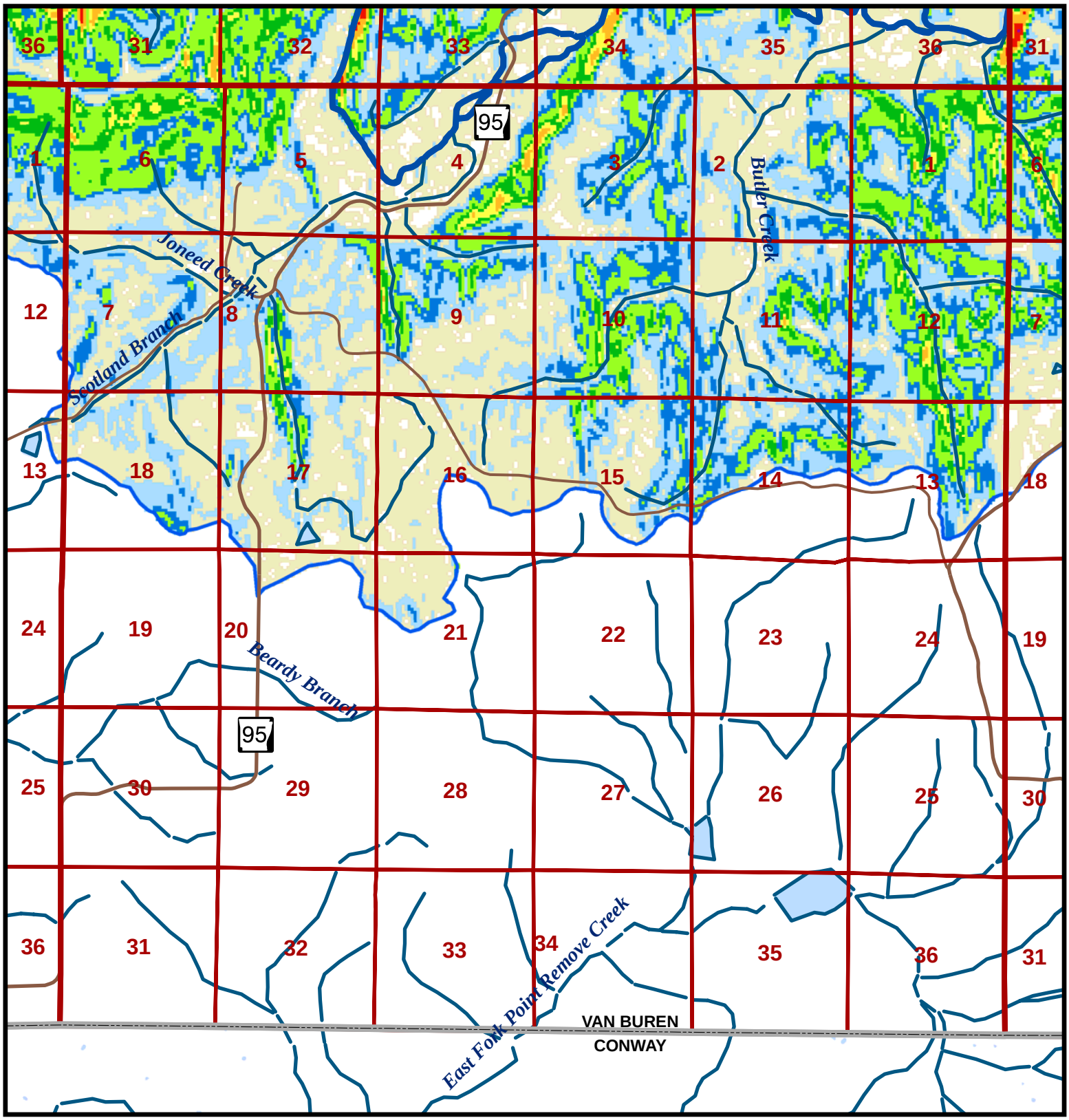
T10N / R16W

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

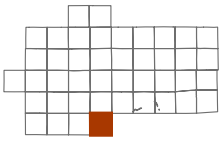
T10N / R15W

0 0.5 1 2

Miles

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



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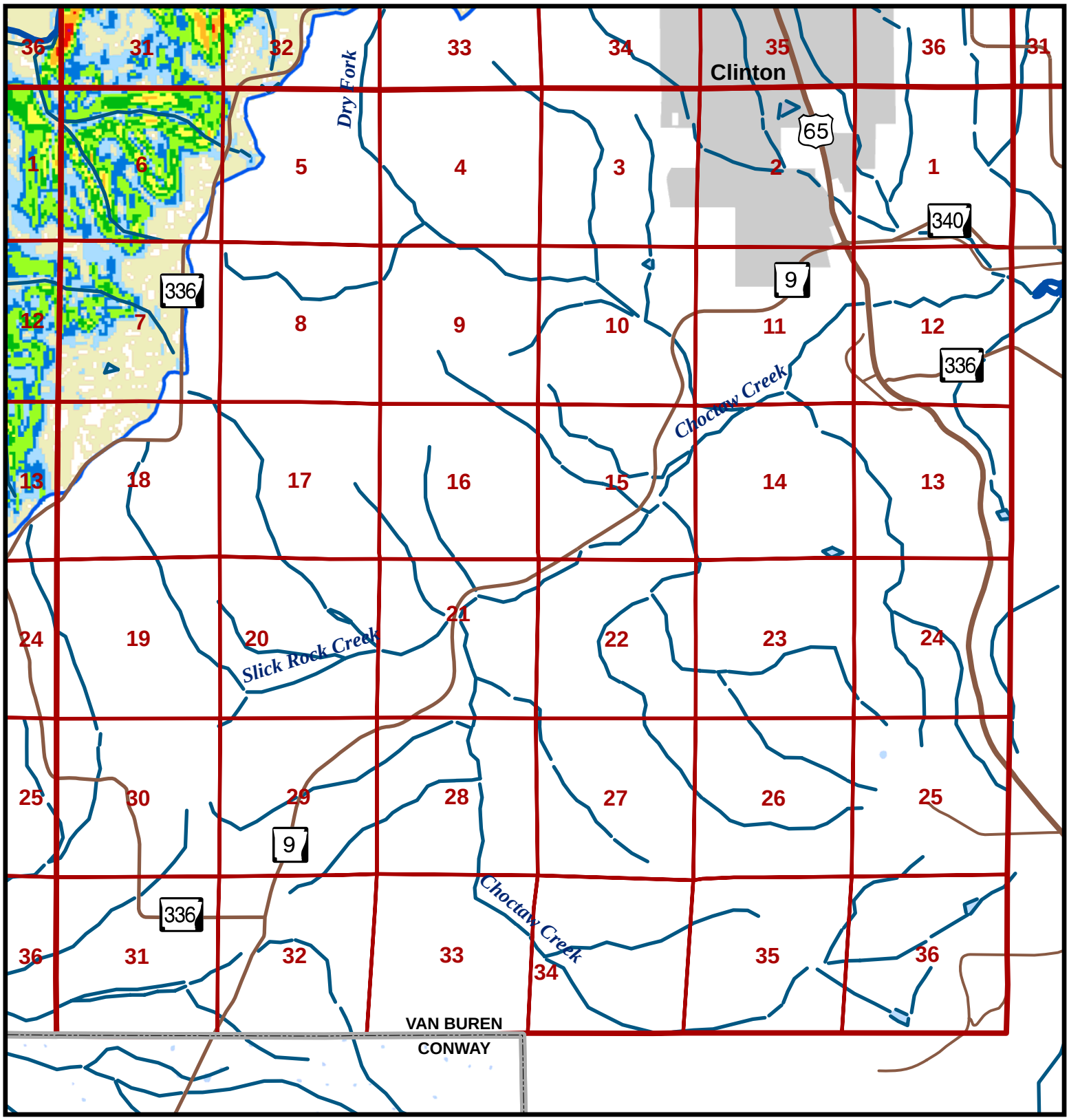


Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

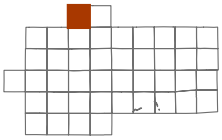
0 0.5 1 2

Miles

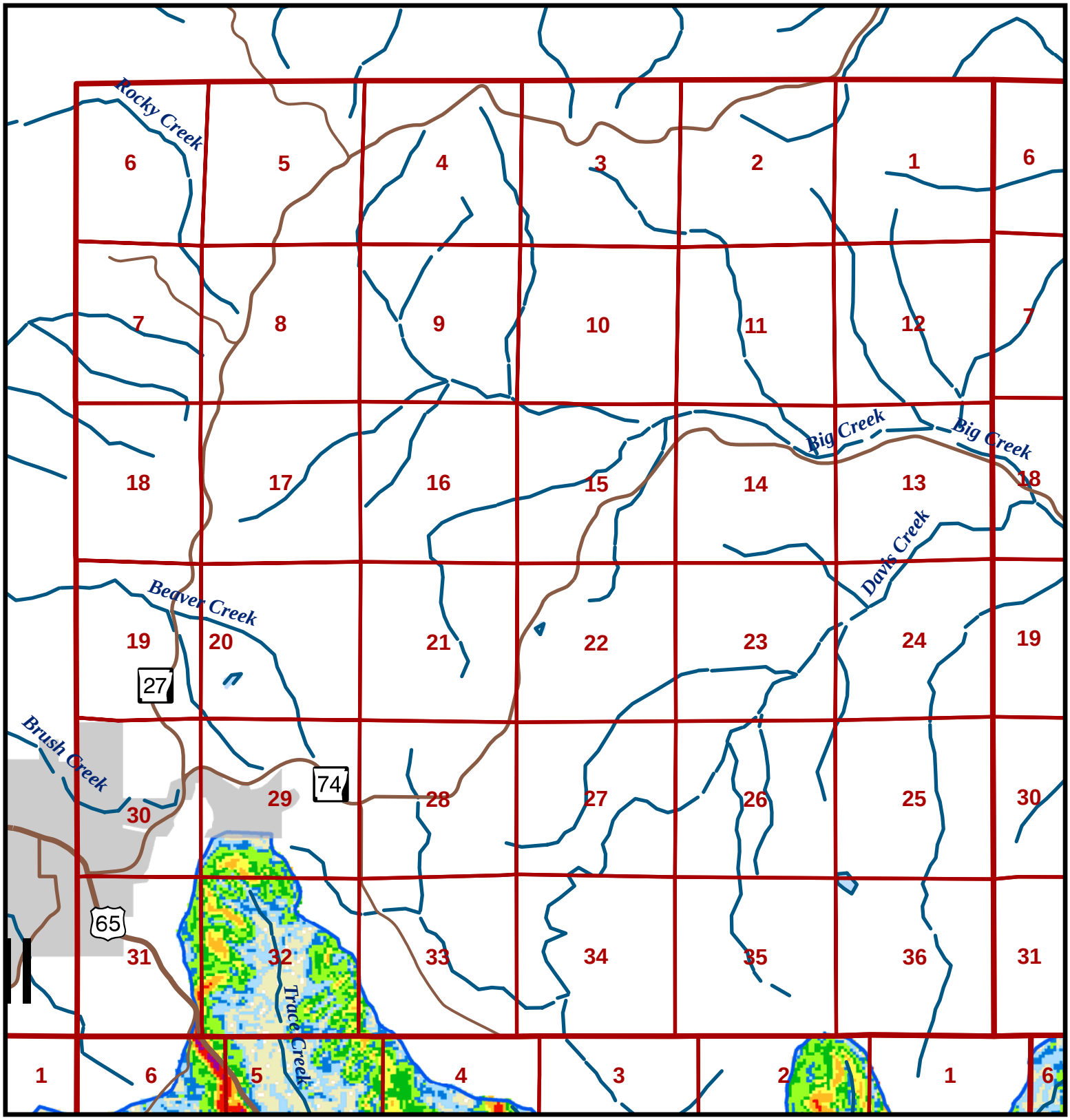
T10N / R14W

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

Upper Little Red River Slope Hazard Map (by Township)



Map Book Locator



Stream layer does **not** include all intermittent and ephemeral streams within the watershed.

0 - 5 | 5 - 10 | 10 - 14 | 14 - 20 | 20 - 25 | 25 - 30 | 30 - 40 | 40 - 50 | 50 - 60

Percent Slope

N

T15N / R15W

0 0.5 1 2

Miles

Arkansas Field Office
110 South Amity Road, Suite 300
Conway, Arkansas 72032
(501) 513-4470

APPENDIX 2

Karst Best Management Practices

The karst region in Arkansas is as an area with a relatively shallow soil profile where climatic events or storm water runoff quickly infiltrates and is transported through underground passages contributing to the groundwater basin. Karst is a distinctive topography in which the landscape is largely shaped by the dissolving action of water on carbonate bedrock (usually limestone, dolomite, or marble). This geological process which occurred over thousands of years resulted in unusual surface and subsurface features ranging from sinkholes, losing streams, and springs, to complex underground drainage systems and caves. Surface waters transported through underground conduits, contribute to the ground water basin.

Surface water enters ground water systems rapidly through thin layers of permeable soil and fractured bedrock, potentially traveling over a mile per day underground. Surface water contamination does contribute to ground water and surface water contamination and affects habitat supporting sensitive cave animals as well as species inhabiting surface streams. These characteristics of karst landscapes make the environment fragile and highly susceptible to human disturbance.

Ground water is used for public and personal water supplies, farm and ranch purposes, and recharges surface waters. Many highly specialized and sensitive fish and wildlife species such as bats, salamanders, cavefish, and crustaceans (e.g., cave crayfish, isopods, and amphipods) spend all or part of their life in these unique and sensitive habitats. The karst region in Arkansas supports six federally endangered species including the Ozark cavefish (*Amblyopsis rosae*), the Benton cave crayfish (*Cambarus aculabrum*), the Hell creek crayfish (*Cambarus zophonastes*), the gray bat (*Myotis grisescens*), the Indiana bat (*Myotis sodalist*), the Ozark big-eared bat (*Corynorhinus townsendii ingens*), and 19 globally imperiled karst dependent species.

As the true extent of the underground environment is difficult to clearly delineate, undiscovered karst features; such as cave openings, sinkholes, and underground passages may occur on or near a project site, even in previously developed areas. Therefore, the Service recommends the following precautionary measures be taken to avoid impacts to groundwater and sensitive or endangered species which may inhabit karst features not previously surveyed.

Karst BMPs

BMPs will be implemented for all pipeline construction and maintenance projects within karst landscapes. It is important that construction plans reduce erosion and sedimentation into streams and karst features by:

K1. Survey existing and any new right-of-ways for karst features such as caves, sinkholes, losing streams, and springs.

K2. Establish a natural area of 300 feet or greater around any cave, sinkhole, losing stream, or spring found during the survey (or during any aspect of project implementation). The FWS will be contacted for further evaluation to determine if caves are used by sensitive or federally listed species.

K3. If a cave is used by sensitive or federally listed species, the FWS may request that the cave be mapped to determine if additional openings or passages may be affected by the

project. The FWS may recommend modifications of the proposed project to allow natural areas to be established. Incorporation of natural areas may be necessary to avoid impacts.

K4. If caves or other openings are encountered during construction, work efforts will cease within 300 feet of the opening. The opening will be adequately marked and protected from work activities, and the FWS will be contacted immediately. No fill materials will be placed into the opening until FWS or approved personnel have the opportunity to inventory the site.

K5. The FWS will assess caves located prior to or during construction for sensitive/endangered species and provide recommendations before activities proceed.

K6. No blasting will be permitted in the vicinity (0.5 mile) of any known karst feature without previous consultation with the FWS.

K7. Care will be taken when working around streams and karst features to prevent unnecessary damage to or removal of vegetation.

K8. If a cave or fracture is breeched or surface water is rerouted into a karst feature, all activities will cease and the FWS will be contacted to assess the situation and provide further consultation before proceeding.

K9. Identify areas with potential for erosion problems prior to construction initiation.

K10. BMPs will include all the "Erosion Control BMPs" discussed earlier in this document necessary to control erosion and prevent sediment transport into sensitive habitats.

K11. Staging areas will be at least 300 feet away from streams, wetlands, and karst features.

K12. Avoid wetlands and low lying areas.

K13. Soil stabilization and erosion control BMPs will be implemented following the "Erosion Control BMPs" outlined earlier in this document. If Karst BMPs differ from BMPs specified earlier in this document, always use the more conservative BMP.

K14. Sediment detention structures may be required in areas with moderate to high erosion potential to compliment other erosion control BMPs.

K15. Where a cave, spring, sinkhole, or losing stream exist or there is a determined public ground water use or rare species, maintain natural vegetation within 1) an 300 foot buffer zone, and 2) apply this same buffer above a cave passage.

K16. Wetlands will be stabilized by replacing the original subsoil and topsoil, replacing vegetation, and returning the topography and hydrologic characteristics of the wetland as closely as possible to their original form. Disturbed wetland buffers will be stabilized by

replanting appropriate vegetation.

K17. **Use horizontal directional drill methods for proposed pipeline crossings of losing streams.** Prior to directional drilling, a geotechnical investigation using the least intrusive means possible (e.g. ground penetrating radar, minimal exploratory bore hole drilling, seismic refraction and reflections, cave radio, resistivity, magnetometry, etc.) will be conducted to determine subsurface/geologic conditions encountered along the drill path to ensure that a directional drill pipeline at the location would be feasible and not result in unnecessary damage to a sensitive area, such as a karst void.

K18. All drilling fluids will be captured and accounted for during drilling activities.

Bat Conservation Practices

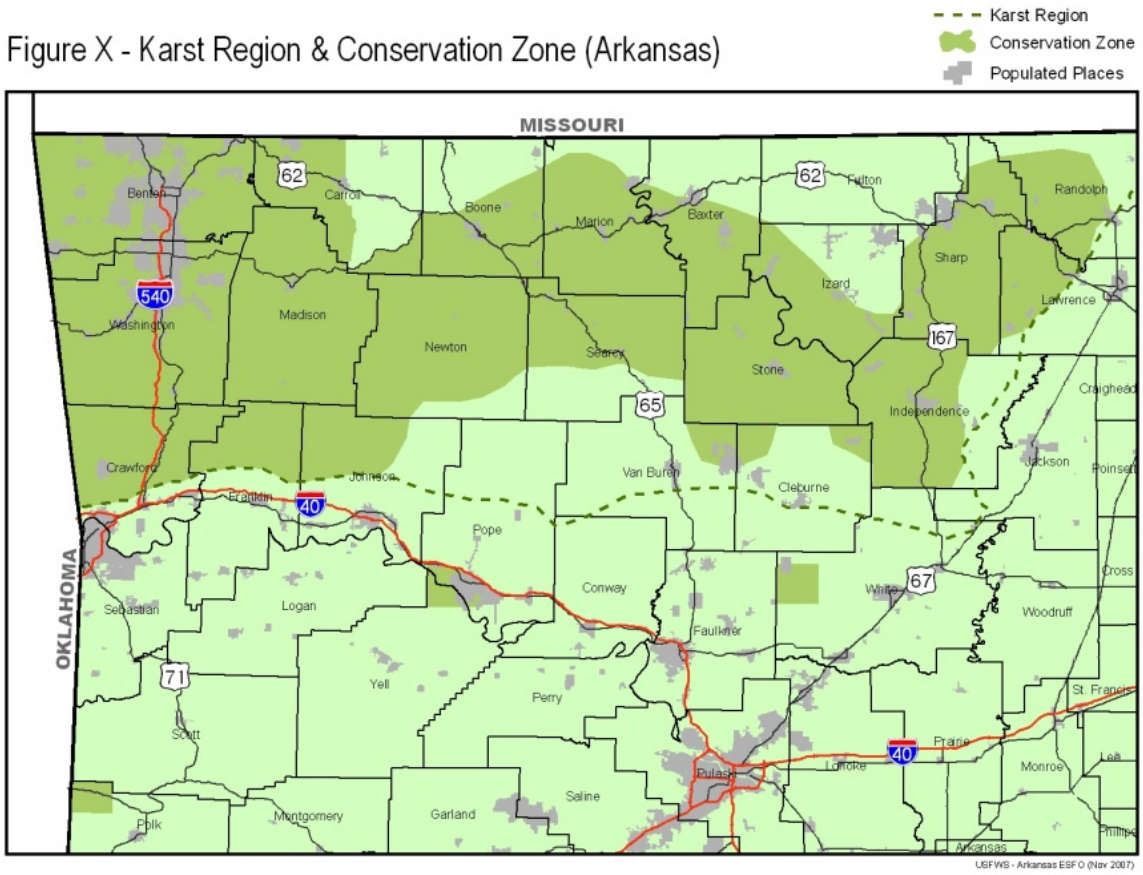
K19. Where rare (state listed) or endangered (federally listed) bat maternity colonies occur, avoid disturbance of these sites from March 15 through October 15. Disruptive forest management practices will not be done within ¼ mile of a maternity colony during this period. Pipeline construction and maintenance activities can occur during the opposing season.

K20. Where rare or endangered bat hibernation occurs, avoid disturbance of these sites from October 16 through March 14. Disruptive pipeline construction and maintenance activities will not be done within ¼ mile of hibernacula during this period.

K21. Chemicals will not be broadcast within the bat conservation zone, but individual tree selection is appropriate following chemical labels.

If industry representatives, consultants, contractors, or private landowners have questions about karst or identification of karst features, please contact the FWS Karst Biologist at 501-513-4477.

Figure X - Karst Region & Conservation Zone (Arkansas)



APPENDIX 3

Environmental Compliance Inspector Forms

Environmental Compliance Inspector

Erosion and Sedimentation Control Plan Preliminary Review Checklist

LOCATION INFORMATION

_____ Reviewed slope maps prior to site inspection

_____ Description of Project location

_____ Maps of project area

GENERAL SITE FEATURES (PLAN ELEMENTS)

_____ Delineate limits of ROW on topographic map

_____ GPS existing structures (roads, etc)

_____ GPS Geologic features: (streams, seeps, springs, etc.)

_____ Send request for USFWS concurrence letter w/ROW shapefile or similar topographic map(s) depicting corridor

_____ Receipt of USFWS concurrence letter

_____ Receipt of other State and Federal Permits

NOTE: All GPS points should be collected in decimal degrees.

EROSION CONTROL MEASURES

_____ Location & type of temporary measures

_____ Location & type of permanent measures

_____ Construction drawings and details for temporary and permanent measures

_____ Schedule for installation of erosion controls

_____ Expected maintenance requirements and frequency of measures

_____ Justification for specific erosion control measures (describe site specific requirements)

_____ Contact person(s) responsible for maintenance

NOTE: Always use the most conservative erosion control measure if state and federal requirements differ.

STREAM CROSSING FEATURES

_____ Record stream type & crossing method

_____ Take photograph in proposed corridor, facing upstream and downstream

_____ Existing and planned drainage patterns (include off ROW areas that drain through project)

_____ Size and location of culverts

_____ Culvert type & design, including headwall and endwall

_____ Type and location of other drainage features

_____ Location and type of bridge crossings (temporary or permanent)

_____ Location of HDD stream crossings

_____ Existing vegetated buffer width to be left after HDD stream crossing (specify each stream bank)

_____ Soil information: type, special characteristics

NARRATIVE AND CONSTRUCTION SEQUENCE

_____ Narrative describing the nature & purpose of the construction/maintenance activity

_____ Construction/maintenance sequence related to erosion and sediment control (including installation of critical measures prior to initiation of land disturbing activities, immediately following clearing activities, for maintenance during construction, for reclamation, and post reclamation

Environmental Compliance Inspector

Erosion and Sedimentation Control Plan Preliminary Review Checklist

_____ Ensure all employees and contractors responsible for erosion control measure installation, maintenance, and inspection are properly trained

_____ Preconstruction conference with employees, environmental compliance inspector, and contractors

KEY POINTS TO CONSIDER IN PRECONSTRUCTION CONFERENCE

_____ Adjacent areas that need special protection from sedimentation, particularly sensitive areas such as streams, seeps, springs, and karst features

_____ Critical areas with high erosion potential such as steep slopes, highly erodible soils (soil erosive factor), construction access routes, stream crossings, water disposal sites

_____ Location of erosion and sediment control measures and their implementation and maintenance

_____ Sequence of practice installation with respect to the construction schedule

_____ Surface stabilization plans, temporary and permanent erosion controls

_____ Construction schedule and any anticipated shut-downs

_____ Maintenance plans and company's and/or contractors procedure for monitoring performance.

_____ Location of off-site disposal areas

Erosion and Sedimentation Control Inspection Form

RAIN EVENT CHECKLIST

Environmental Compliance Inspector: _____ Date: _____

Amount of Last Rainfall (inches): _____ Time Since Last Rainfall (hours): _____

CONTROL ITEMS	STATUS	
1. SILT FENCES	INSPECTED _____	ISSUES (Y/N) _____
2. SLOPE BREAKS	INSPECTED _____	ISSUES (Y/N) _____
3. TRENCH BREAKS	INSPECTED _____	ISSUES (Y/N) _____
4. CHECK DAMS	INSPECTED _____	ISSUES (Y/N) _____
5. HAY BALES	INSPECTED _____	ISSUES (Y/N) _____
6. STREAM CROSSINGS	INSPECTED _____	ISSUES (Y/N) _____
7. SEEDING AREAS	INSPECTED _____	ISSUES (Y/N) _____
8. MULCH AREAS	INSPECTED _____	ISSUES (Y/N) _____

COMMENTS: _____

_____

_____

_____

_____

Note: Any Control Items not in compliance with FWS or FWS approved BMPs require an **Erosion and Sedimentation Control Maintenance Form** detailing the problem and recommended solution to be attached to this checklist**.** If inspector is unsure how to address problem(s), contact the appropriate resource agencies for technical assistance.

Inspector Signature: _____

Erosion and Sedimentation Control Maintenance Form

SILT FENCE

Environmental Compliance Inspector: _____ Date: _____

GPS Location (Decimal Degrees): _____

Pre-Existing Problem? (Y/N): _____ Date of Last Inspection: _____

Description of Previous Measures Taken to Alleviate Problem (if Pre-Existing):

_____

_____

CONDITION OF SILT FENCE

Is the Bottom of the Fabric Still Buried? _____

Recommendation: _____

_____

Is the Fabric Torn or Sagging? _____

Recommendation: _____

Are the Post Tipped Over? _____

Recommendation: _____

How Deep is the Sediment in front of Silt Fence (≥40% capacity requires cleanout)? _____

Recommendation: _____

_____

Additional Maintenance Needs? _____

Recommendation: _____

_____

<u>Initial Report</u>

Inspector's Signature: _____ Date: _____

<u>Inspection of Repairs</u>

Inspector's Signature: _____ Date: _____

Erosion and Sedimentation Control Maintenance Form

SLOPE and TRENCH BREAKS

Environmental Compliance Inspector: _____ Date: _____

GPS Location _____

GPS Location (Decimal Degrees): _____

Pre-Existing Problem? (Y/N): _____ Date of Last Inspection: _____

Description of Previous Measures Taken to Alleviate Problem (if Pre-Existing):

_____

_____

CONDITION OF SLOPE and TRENCH BREAKS

Rills Evident Between Slope Breaks? _____

Recommendation: _____

_____

Runoff Directed Into Sensitive Area? _____

Recommendation: _____

_____

Depth of Sediment in Relation to Slope Break Height (Refer to EC7J2): _____

Recommendation: _____

Depth of Sediment Basin at Outlet: _____ (Remove Sediment at 50% Capacity)

Recommendation: _____

For Trench Break, is Spoil Material Contained in ROW? _____

Recommendation: _____

_____

Initial Report Inspector's Signature: _____ Date: _____

Inspection of Repairs

Inspector's Signature: _____ Date: _____

Erosion and Sedimentation Control Maintenance Form

CHECK DAMS

Environmental Compliance Inspector: _____ Date: _____

GPS Location _____

GPS Location (Decimal Degrees): _____

Pre-Existing Problem? (Y/N): _____ Date of Last Inspection: _____

Description of Previous Measures Taken to Alleviate Problem (if Pre-Existing):

_____

_____

CONDITION OF CHECK DAMS

Is the Center of the Dam Lower Than Its Edges? _____

Recommendation: _____

_____

Is Additional or Larger Stone Needed? _____

Recommendation: _____

_____

Is there an Accumulation of Large Debris and/or Trash? _____

Recommendation: _____

Depth of Sediment at Center of Dam: _____ (Remove Sediment at 50%)

Recommendation: _____

Additional Maintenance Needs? _____

Recommendation: _____

_____

<u>Initial Report</u> Inspector's Signature: _____ Date: _____

<u>Inspection of Repairs</u>

Inspector's Signature: _____ Date: _____

Erosion and Sedimentation Control Maintenance Form

HAY BALES

Environmental Compliance Inspector: _____ Date: _____

GPS Location (Decimal Degrees): _____

Pre-Existing Problem? (Y/N): _____ Date of Last Inspection: _____

Description of Previous Measures Taken to Alleviate Problem (if Pre-Existing):

_____

_____

CONDITION OF HAY BALES

Are the Hay Bales Tightly Abutted to One Another with Adequate Soil to Bale Contact? _____

Recommendation: _____

_____

Are Hay Bales Adequately Staked? _____

Recommendation: _____

Are Hay Bales Entrenched at least 4 inches? _____

Recommendation: _____

How Deep is the Sediment in front of Hay Bales (Is cleanout required)? _____

Recommendation: _____

_____

Additional Maintenance Needs? _____

Recommendation: _____

_____

<u>Initial Report</u>

Inspector's Signature: _____ Date: _____

<u>Inspection of Repairs</u>

Inspector's Signature: _____ Date: _____

Erosion and Sedimentation Control Maintenance Form

STREAM CROSSING (Page 1 of 2)

Environmental Compliance Inspector: _____ Date: _____

GPS Location _____

GPS Location (Decimal Degrees): _____

Pre-Existing Problem? (Y/N): _____ Date of Last Inspection: _____

Description of Previous Measures Taken to Alleviate Problem (if Pre-Existing):

_____

_____

CONDITION OF STREAM CROSSING

Is Sedimentation Evident in Stream? _____

Recommendation: _____

_____

Is Water Noticeably Muddier Downstream of ROW Than Upstream? _____

Source and Recommendation: _____

_____

Are Erosion Controls Properly Installed _____ and Maintained? _____

Recommendation: _____

_____

Is there Erosion Around Culvert Inlet and/or Outlet or Bridge Approaches? _____

Recommendation: _____

_____

Is there Evidence of Stream Channel Incision? _____

Recommendation: _____

_____

Erosion and Sedimentation Control Maintenance Form

STREAM CROSSING (Page 2 of 2)

Are Stream Banks Eroding? _____

Recommendation: _____

_____

Are There Additional Maintenance Needs? _____

Recommendation: _____

_____

_____

_____

Initial Report

Inspector's Signature: _____ Date: _____

Inspection of Repairs

Inspector's Signature: _____ Date: _____

Erosion and Sedimentation Control Maintenance Form

SEEDING and MULCH AREAS

Environmental Compliance Inspector: _____ Date: _____

GPS Location _____

GPS Location (Decimal Degrees): _____

Pre-Existing Problem? (Y/N): _____ Date of Last Inspection: _____

Description of Previous Measures Taken to Alleviate Problem (if Pre-Existing):

_____

_____

CONDITION OF SEEDING and MULCH AREAS

In Seeding Areas, Are there Bare Spots? _____

Recommendation (Circle All That Apply):

- Lime and Fertilize
- Mulch
- Tack or Tie Down Mulch
- Repair Damage Area
- Broadcast New Seed in Bare Spots
- Seed Evenly Over Large Area

In Mulch Areas, Is there Evidence of Washout, Breakage, or Erosive Areas? _____

Recommendation (Circle All That Apply):

- Repair Surface
- Remulch
- Reseed as Prudent
- Install New Netting or Retack

Additional Maintenance Needs? _____

Recommendation: _____

Initial Report Inspector's Signature: _____ Date: _____

Inspection of Repairs Inspector's Signature: _____ Date: _____

APPENDIX 4

Template Letter and Map

For

U.S. Fish and Wildlife Service

Endangered Species Clearance Letter

Company Logo and address

Date

U.S. Fish and Wildlife Service
Arkansas Ecological Services Field Office
ATTN: Endangered Species Coordinator
110 South Amity Road, Ste. 300
Conway, AR 72032

Dear To Whom It May Concern *(or name of **person** if known)*:

The following proposed project is submitted for notification purposes, review, and comment.

Project Name:	Line ABC: Install approximately _____ feet of new ___inch diameter *type* natural gas pipeline from _____ to _____.
County:	*Insert County Name*
Legal Description:	Starting Point: Ending Point:
Latitude/Longitude:	Starting Point: Ending Point:

Comments: *EXAMPLE TEXT FOLLOWS, BUT MAY VARY BASED ON PROJECT*

Company Name proposes to install approximately _____ feet of new ____ inch diameter *type* natural gas pipeline (*name of line*) from *location* to *location*. The project location is near ____. The new line will be constructed using a ____ foot permanent right-of-way and an approximately ____ foot temporary right-of-way. All work will be accomplished in accordance with the *Arkansas Best Management Practices for Pipeline Construction and Maintenance in the Fayetteville Shale Area – Upper Little Red River Watershed*, associated agreements with your office, and in accordance with appropriate state and federal rules, regulations, and laws. The project will cross the following streams at these approximate locations:

List each stream crossing, identify stream type (i.e., intermittent, etc), crossing method, and latitude/longitude of stream crossing.

This project is being sent to you for review and comment as a condition of *existing agreement with USFWS, as a condition of state or federal permit, etc* to identify any potential environmental concerns.

INCLUDE 8.5X11 COLOR MAPS ILLUSTRATING RIGHT-OF-WAY AND STREAM CROSSINGS WITH TOPOGRAPHIC FEATURES AS A BACKGROUND.

APPENDIX 5

Best Management Practice Illustrations

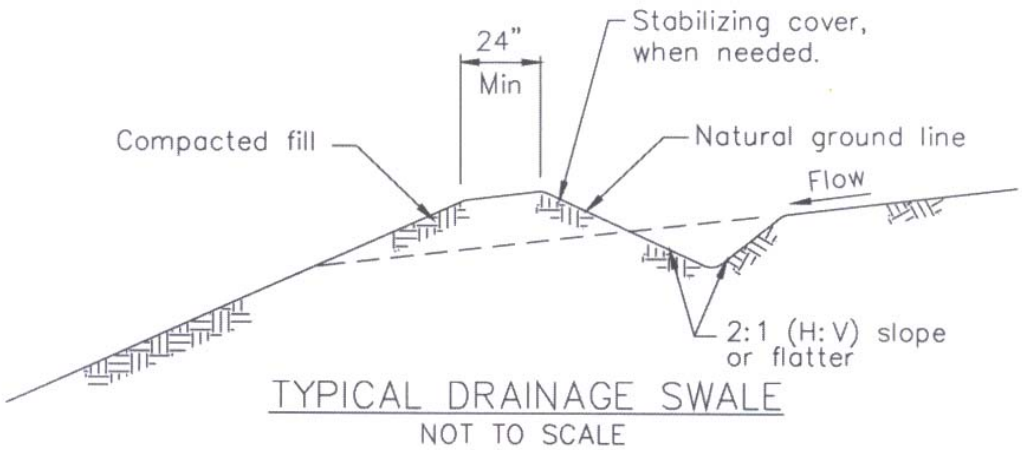
Sources

California Stormwater BMP Handbook (2003)

Fayetteville Express Pipeline, LLC – Typical Construction Drawings (2008)

ILLUSTRATION 1A

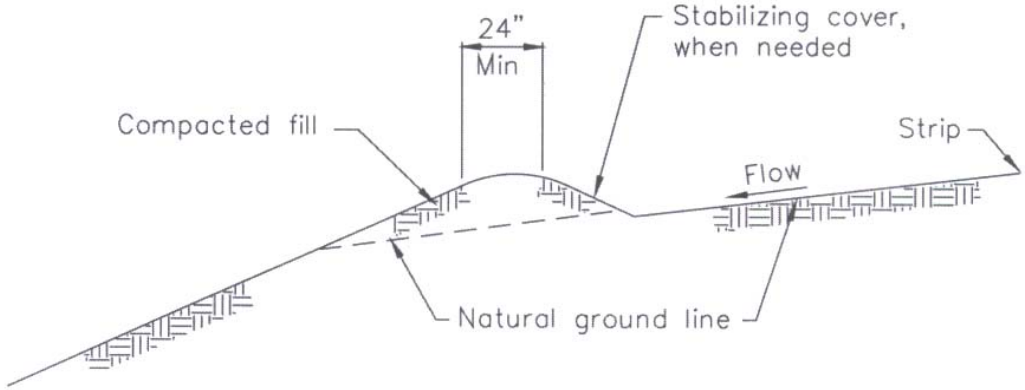
Typical Slope Breaker (a.k.a. Grade Break or Water Bar)



TYPICAL DRAINAGE SWALE
NOT TO SCALE

NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.



TYPICAL EARTH DIKE
NOT TO SCALE

ILLUSTRATION 1B

Typical Slope Breaker (a.k.a. Grade Break or Water Bar)

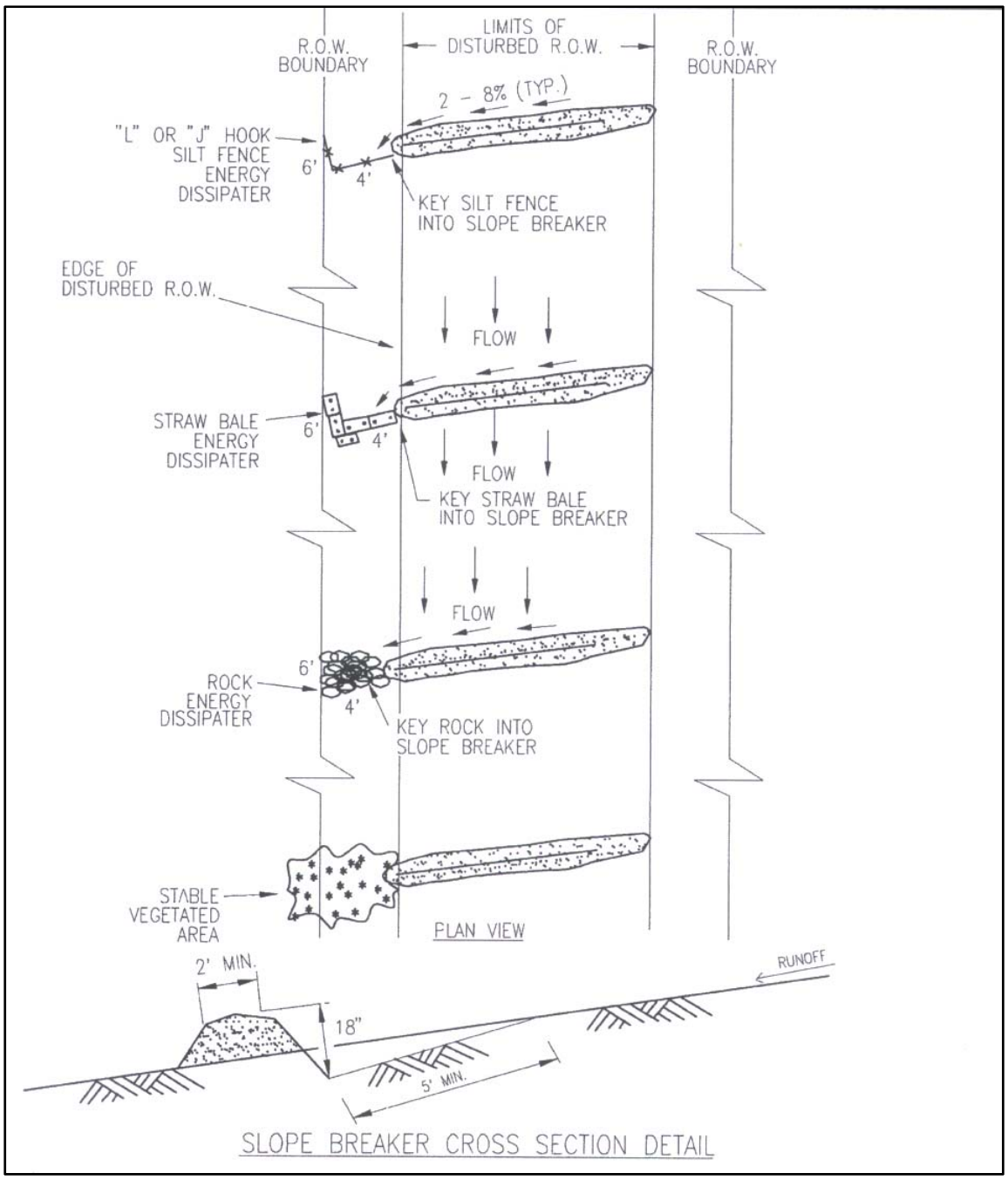


ILLUSTRATION 1C

Typical Slope Breaker (a.k.a. Grade Break or Water Bar)

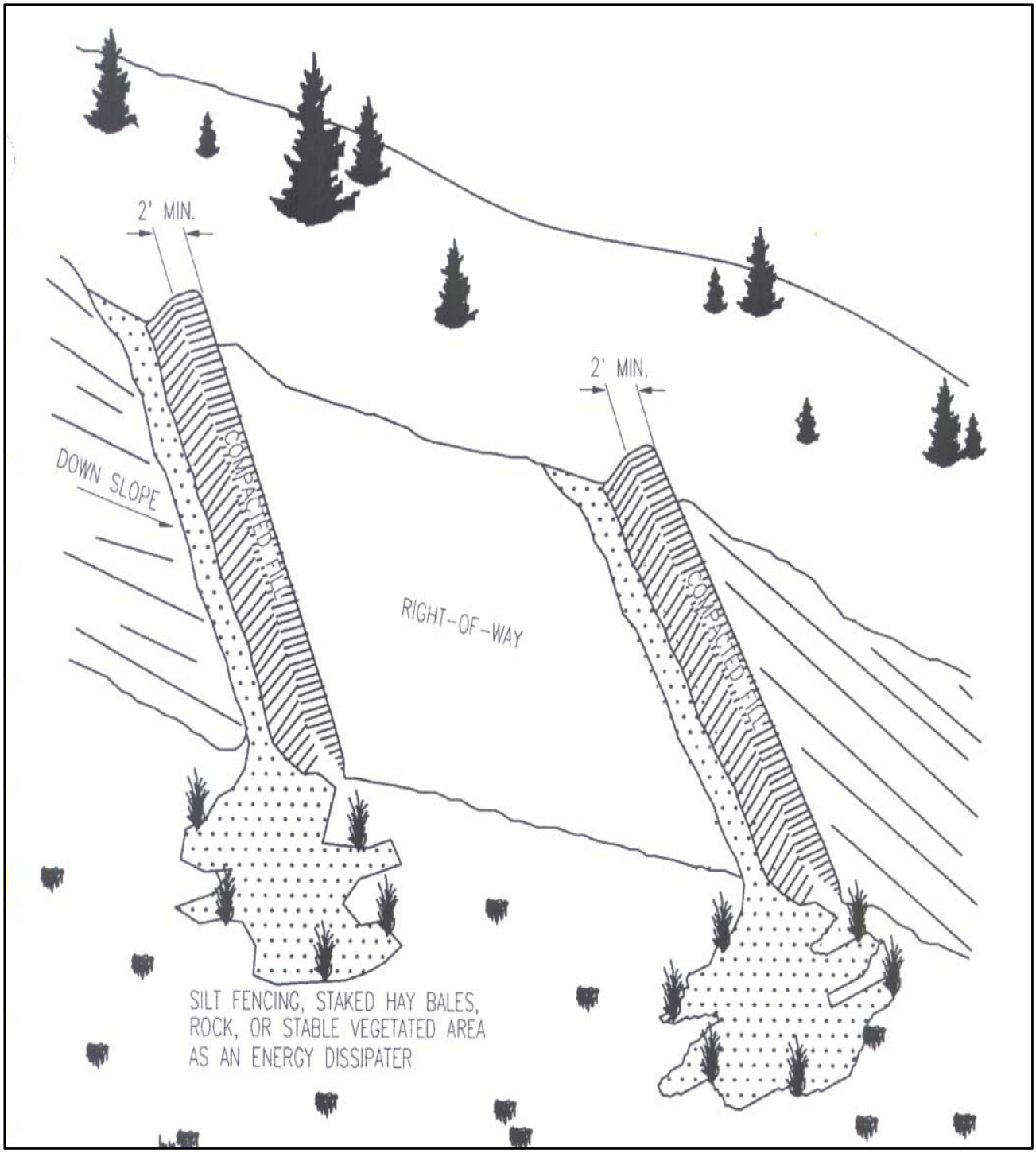


ILLUSTRATION 2A

Typical Straw Bale Sediment Barrier Erosion Control

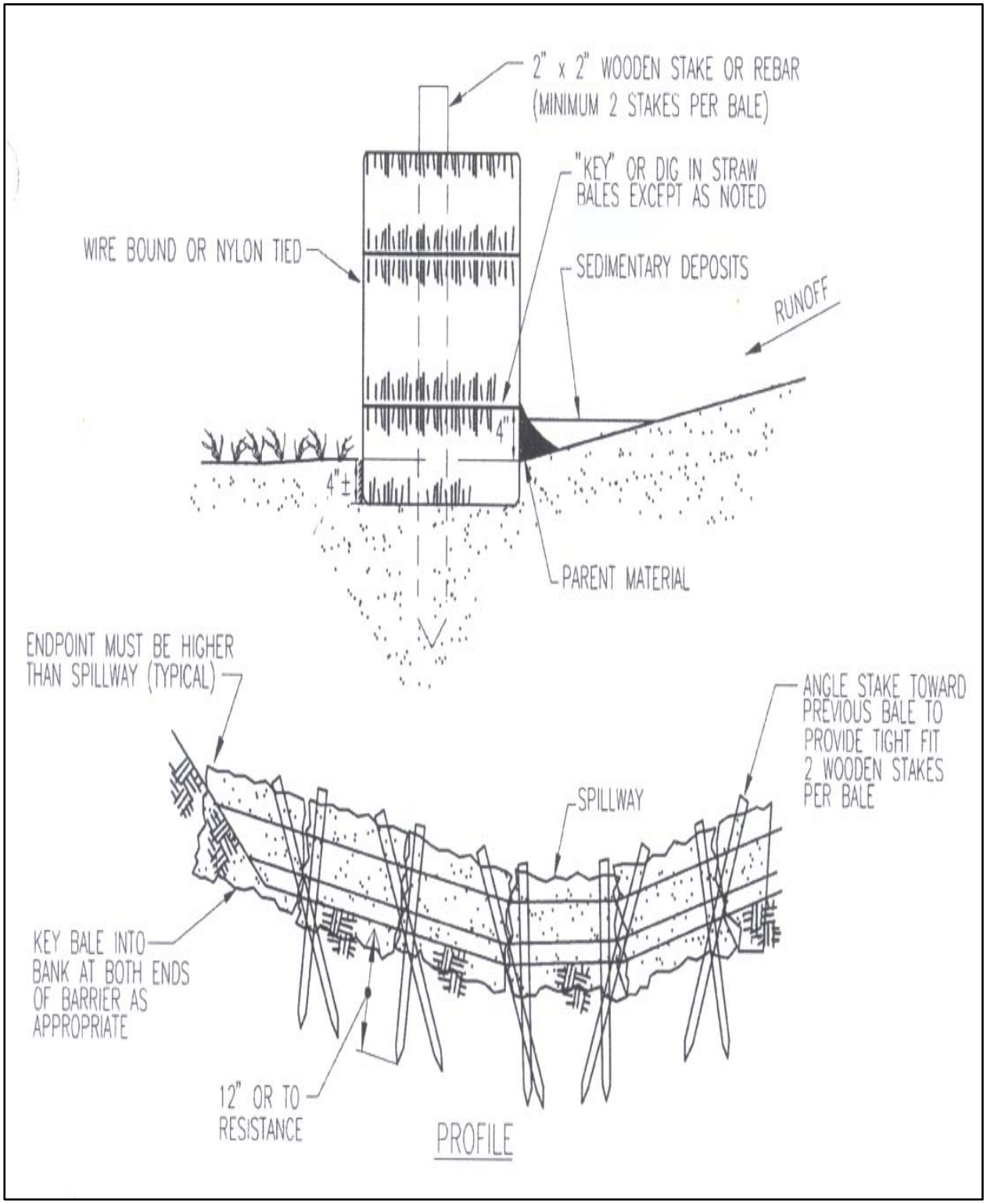


ILLUSTRATION 2B

Typical Straw Bale Sediment Barrier Erosion Control

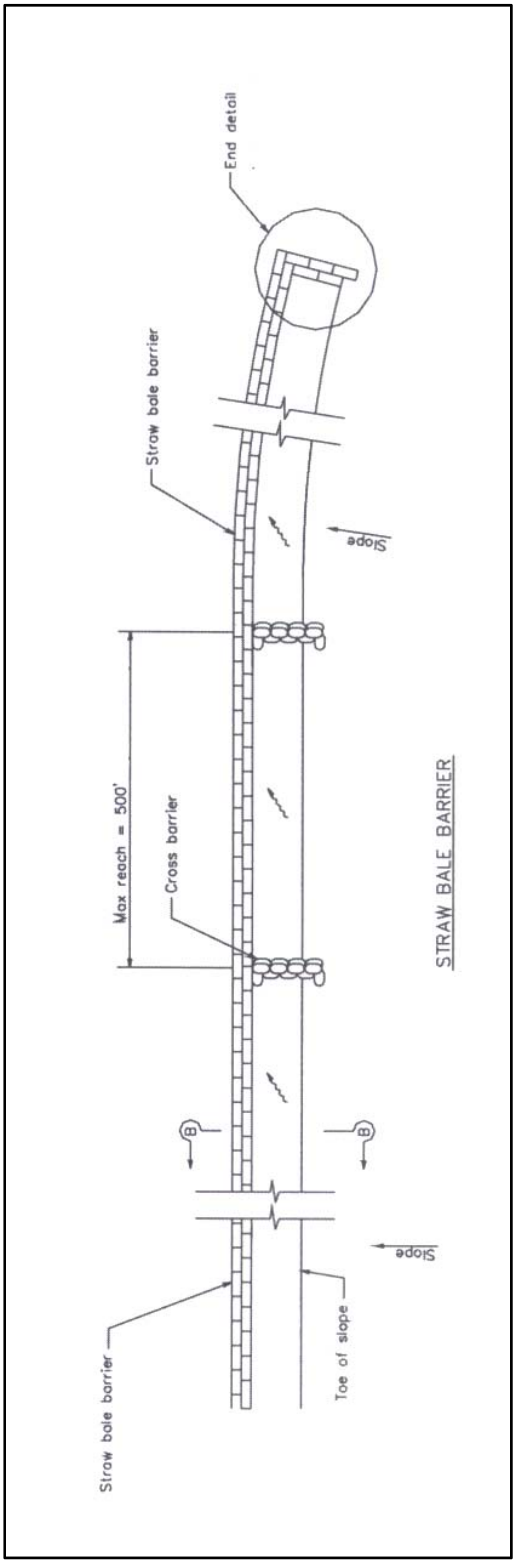


ILLUSTRATION 2C

Typical Straw Bale Sediment Barrier Erosion Control

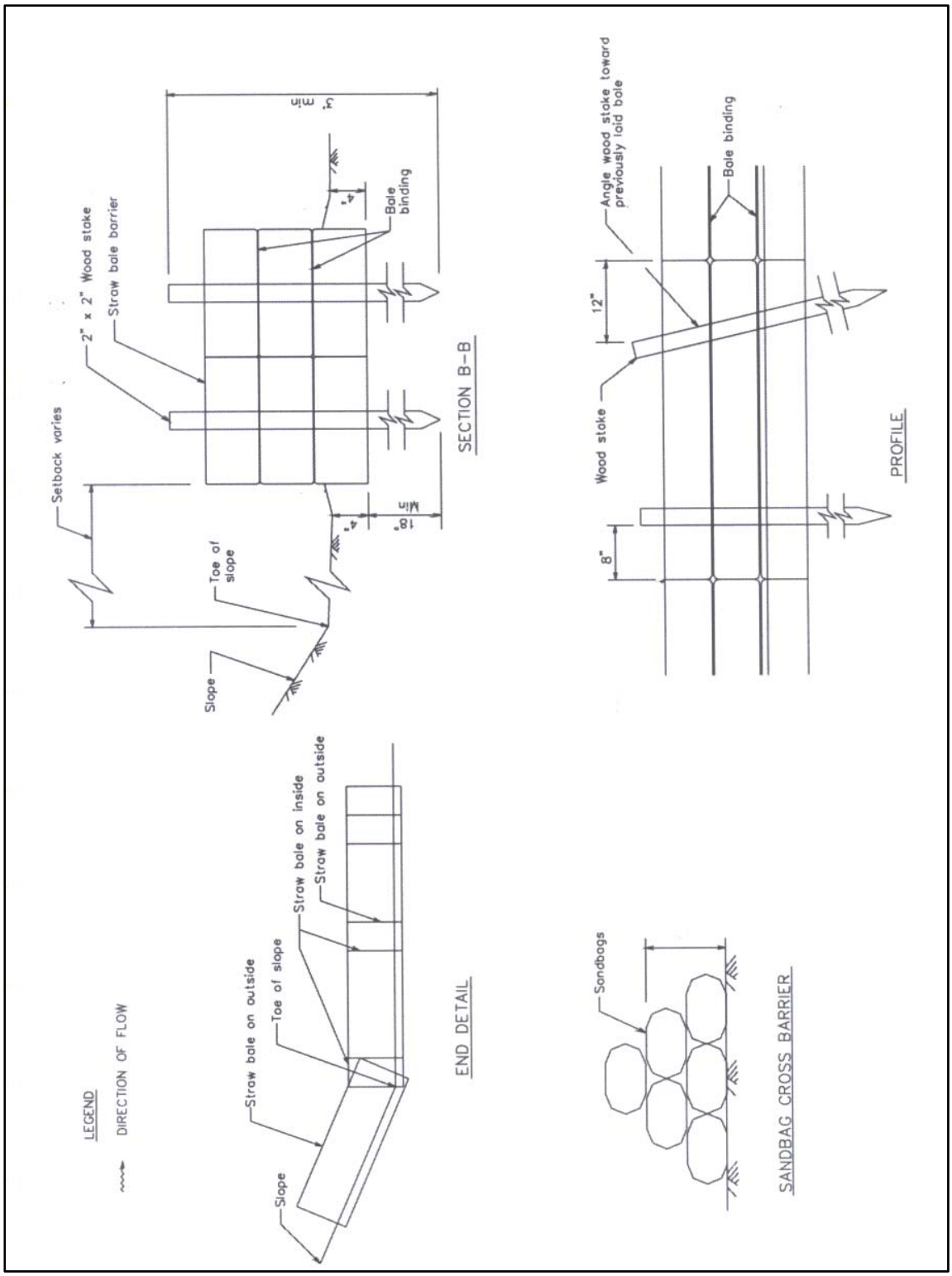


ILLUSTRATION 3

Typical Check Dam

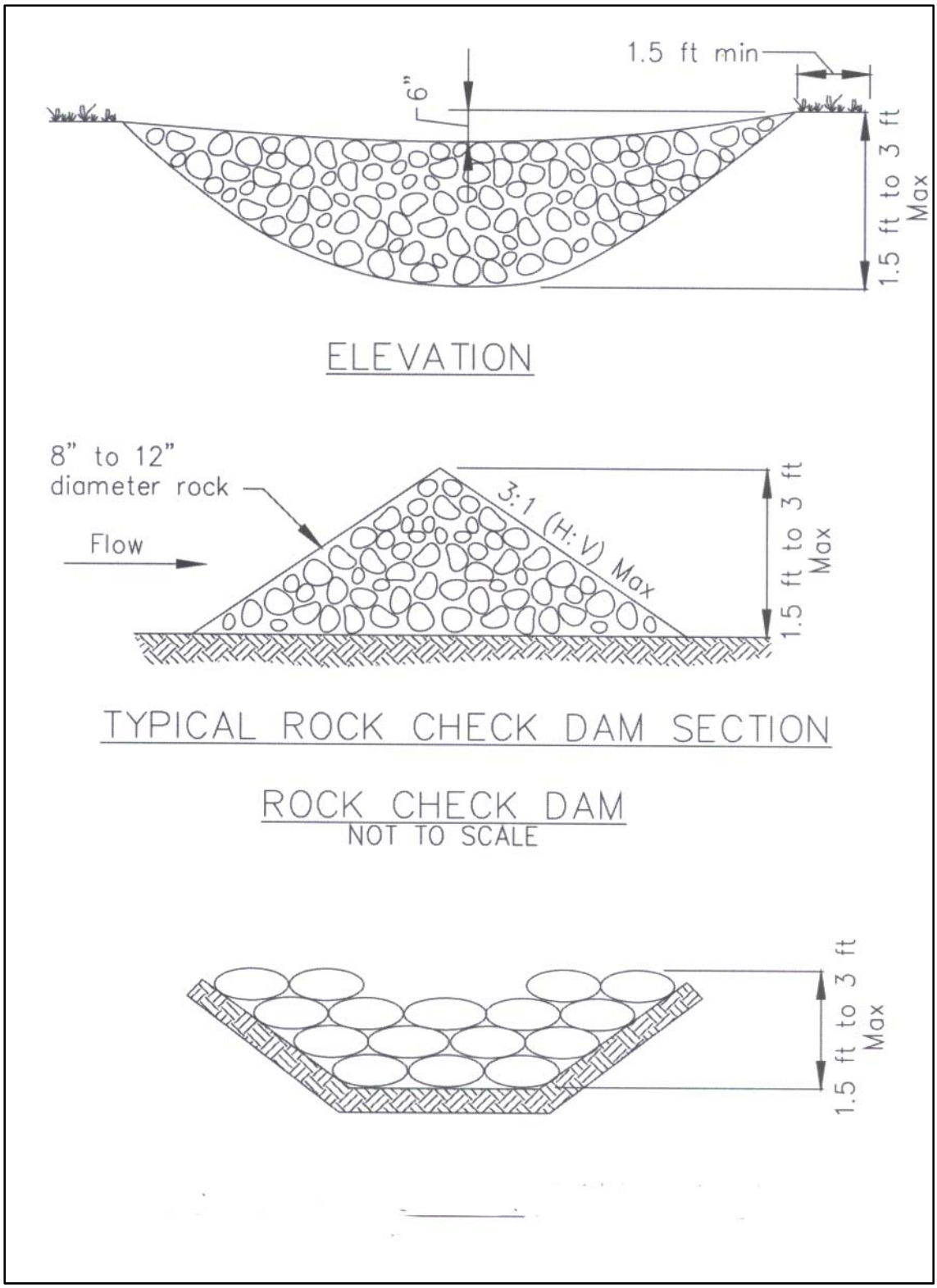


ILLUSTRATION 4A

Typical Silt Fence Sediment Barrier Erosion Control

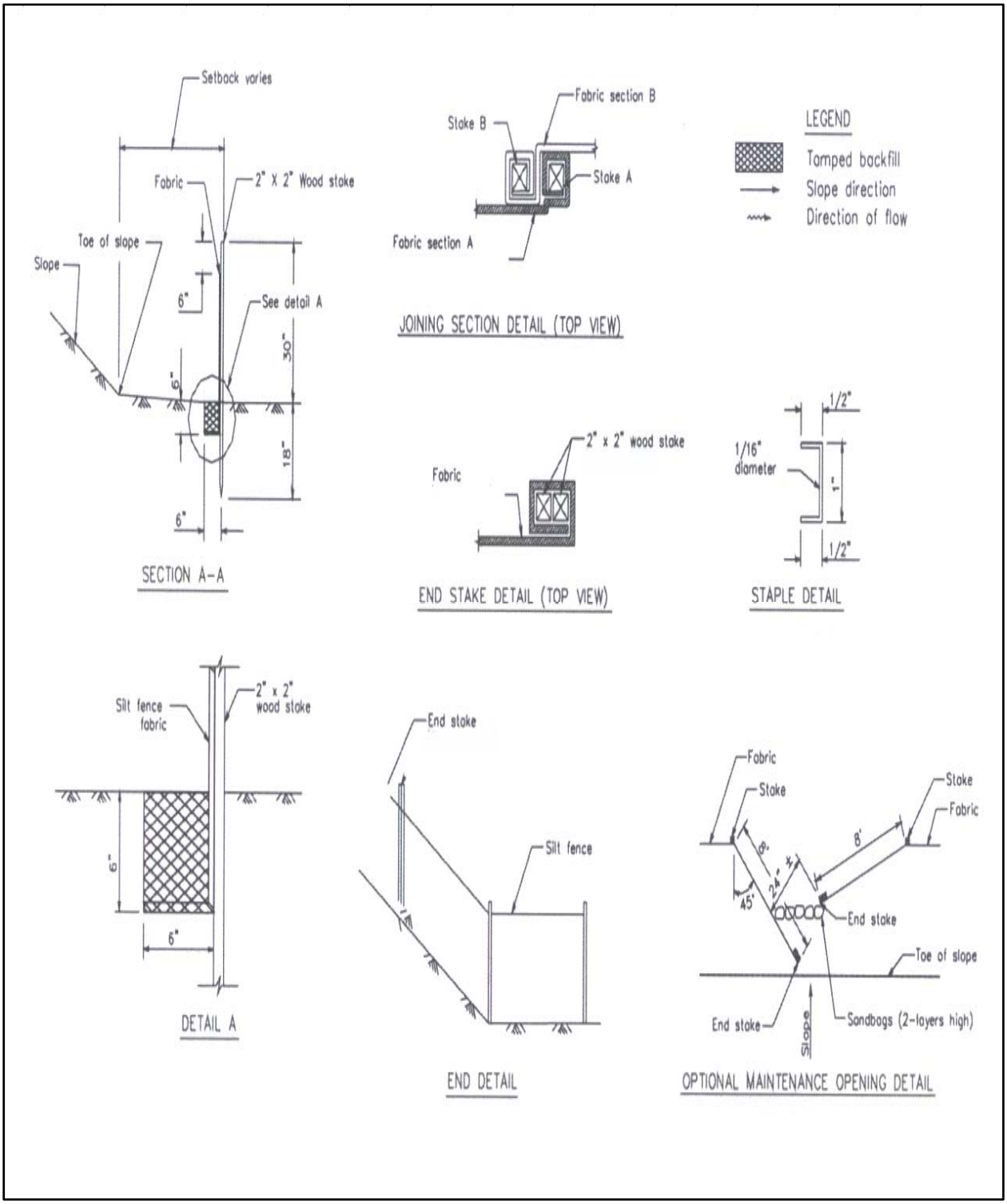


ILLUSTRATION 4B

Typical Silt Fence Sediment Barrier Erosion Control

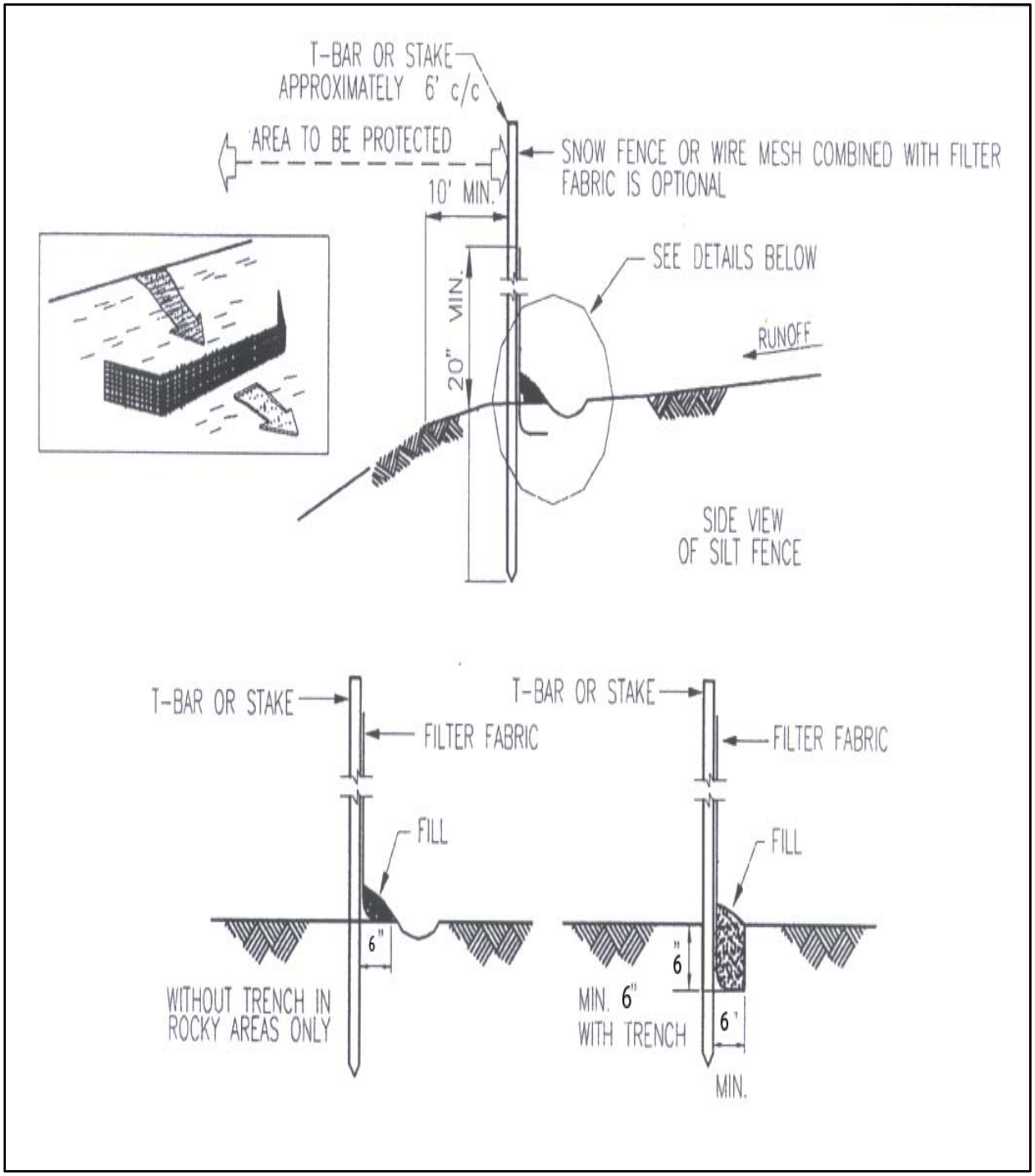


ILLUSTRATION 4C

Typical Silt Fence Sediment Barrier Erosion Control

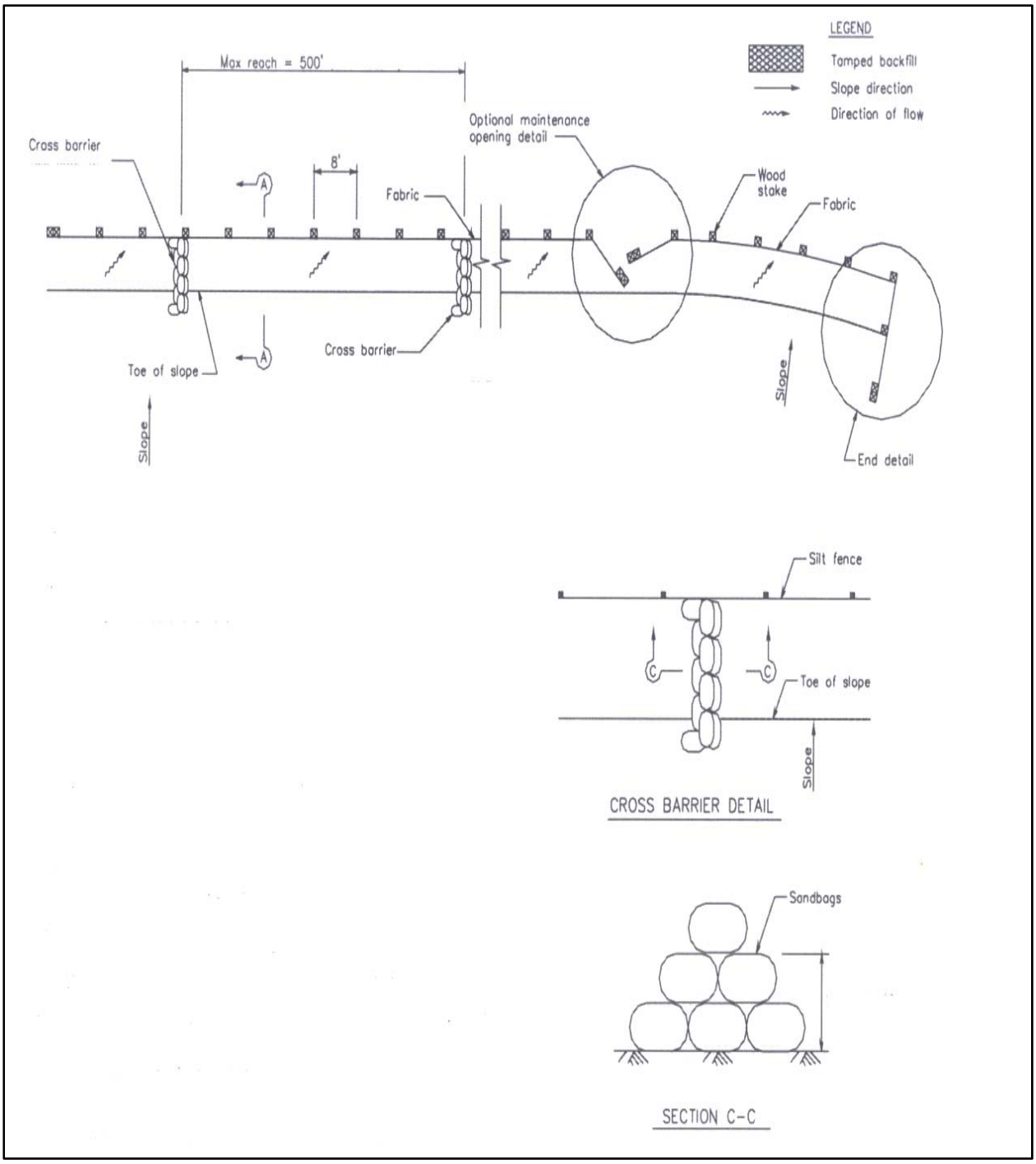


ILLUSTRATION 5

Typical Trench Breaker

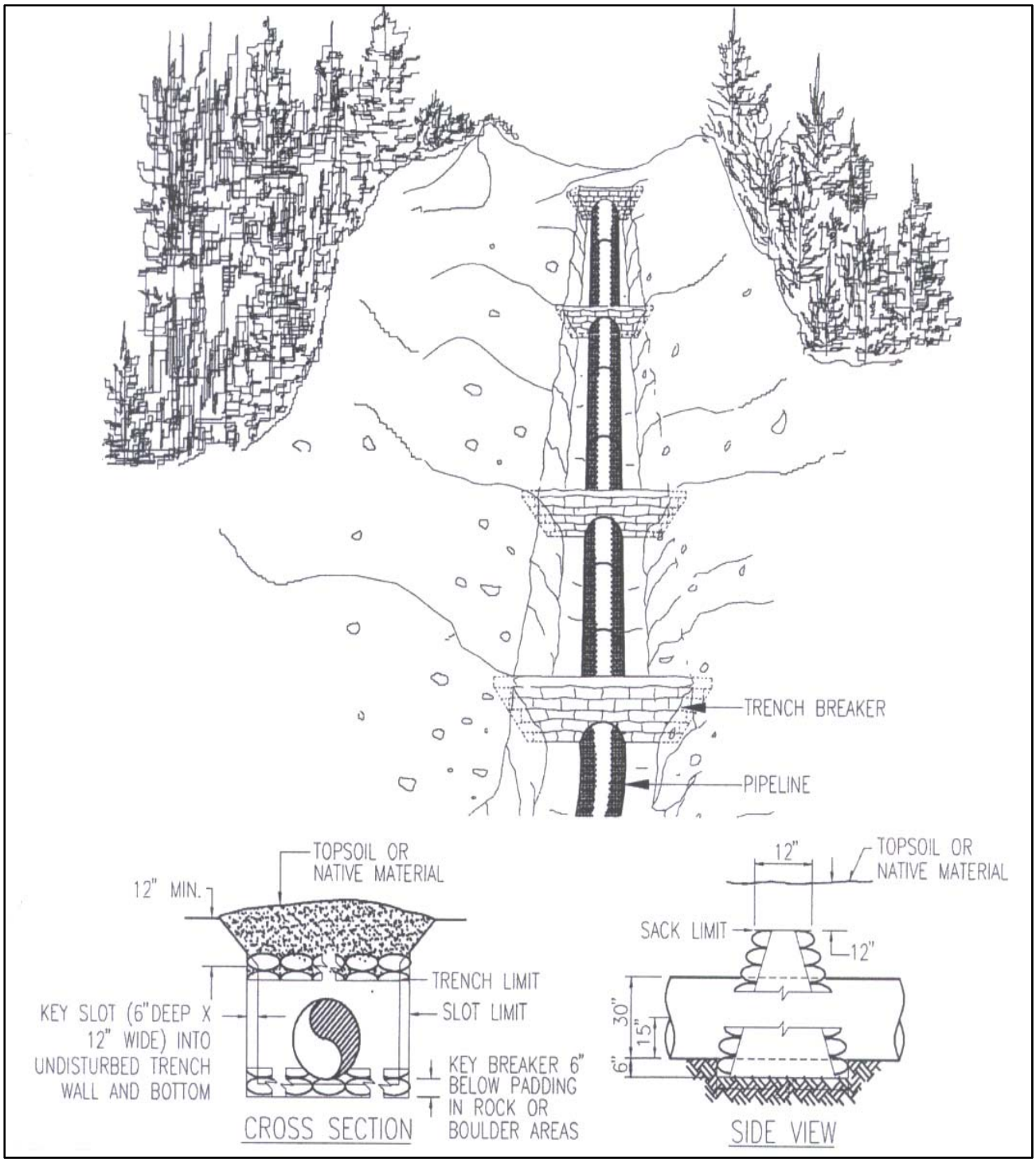


ILLUSTRATION 6

Water Body Crossing – Horizontal Directional Drill

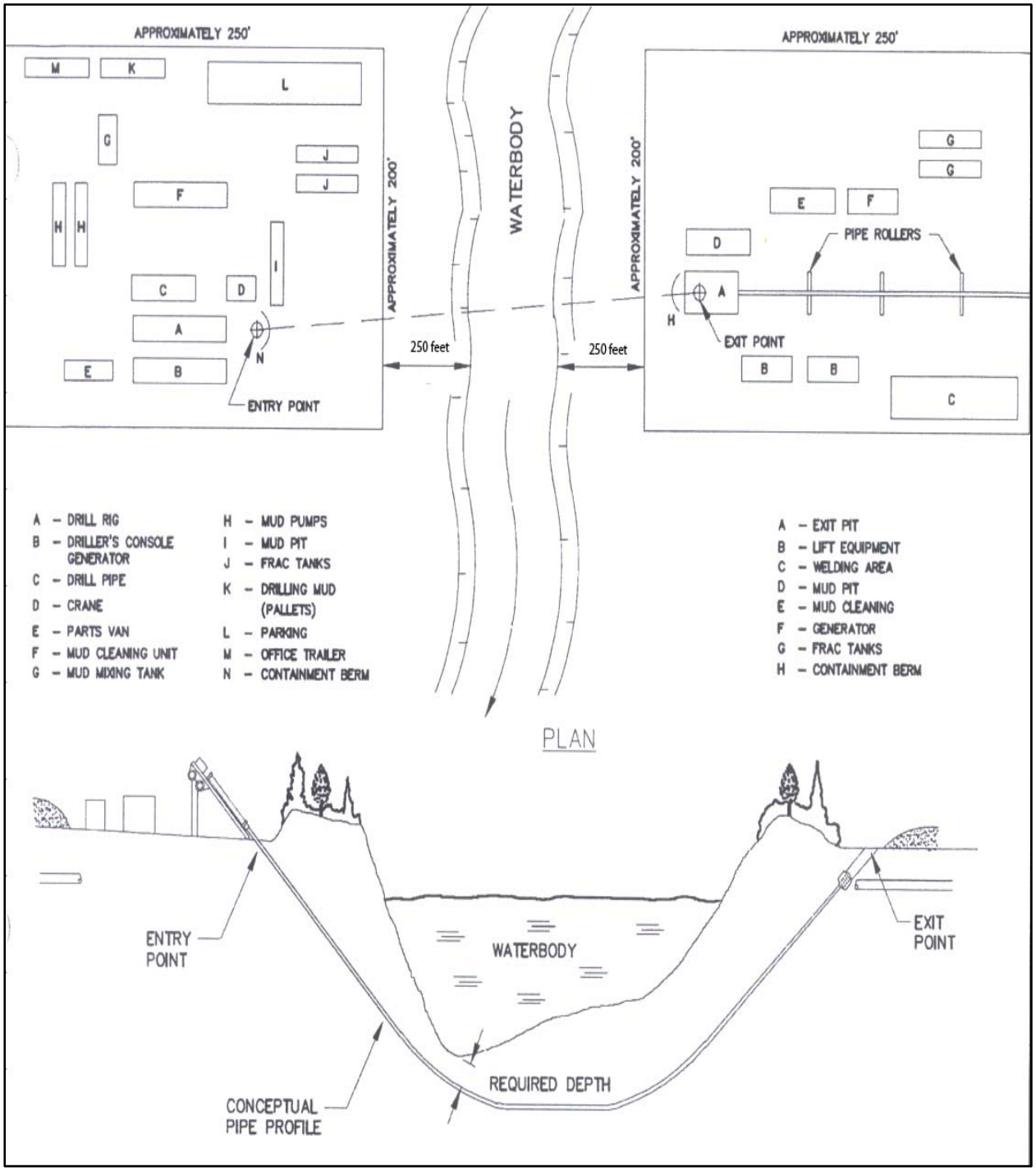


ILLUSTRATION 7

Typical Portable Water Body Bridge

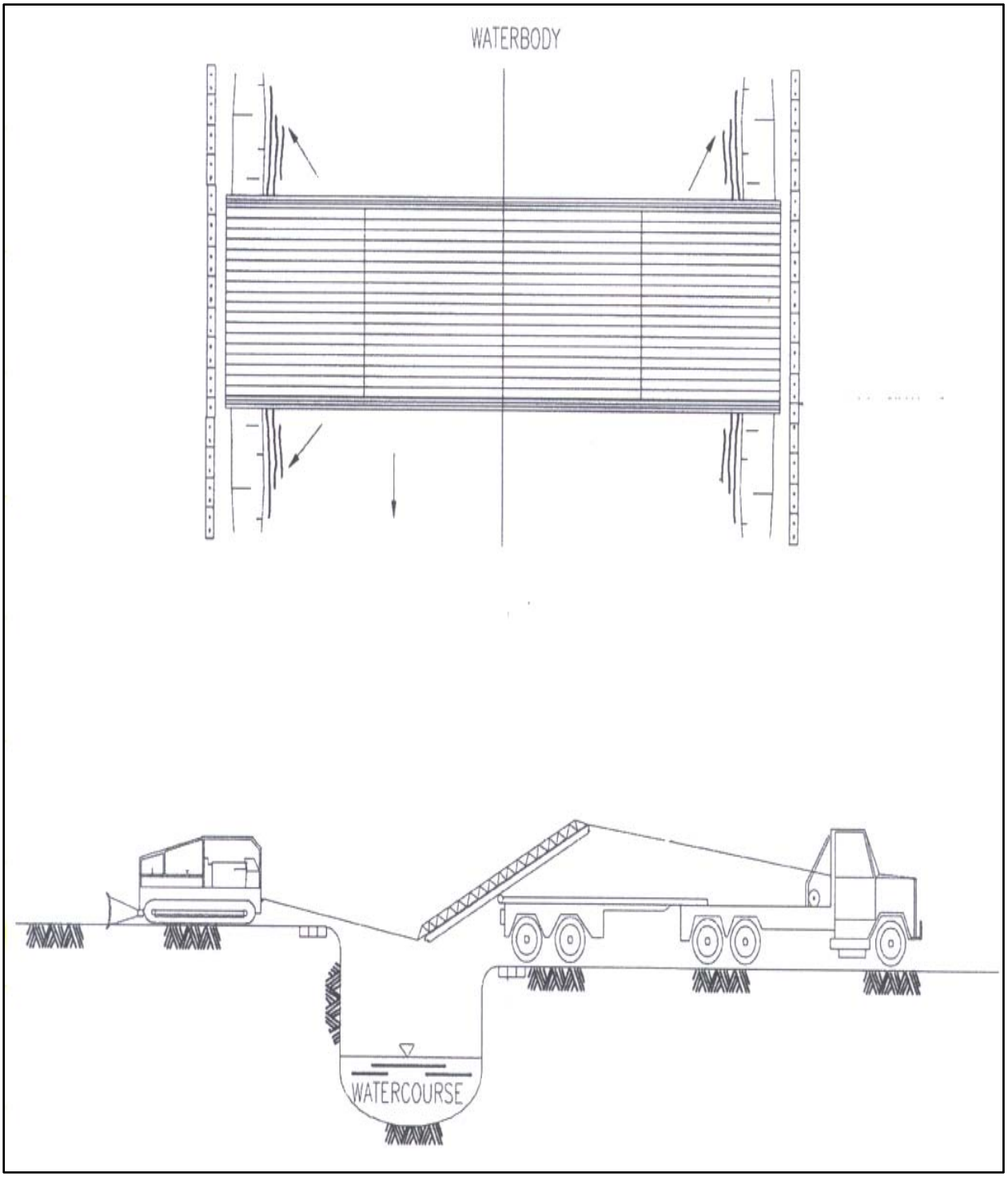


ILLUSTRATION 8

Typical Portable Water Body Bridge with Culvert Support

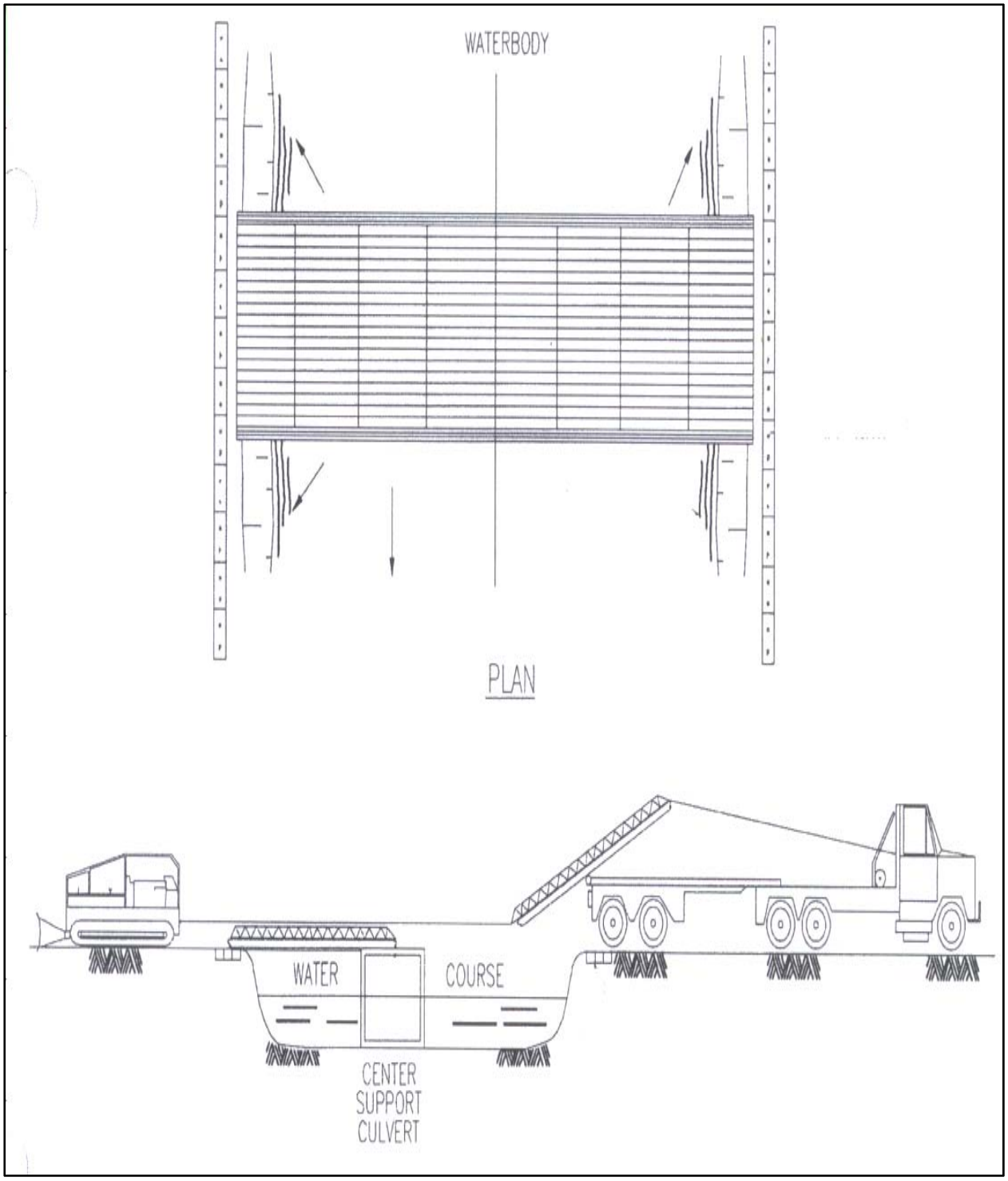


ILLUSTRATION 9

Typical Timber Mat Water Body Bridge

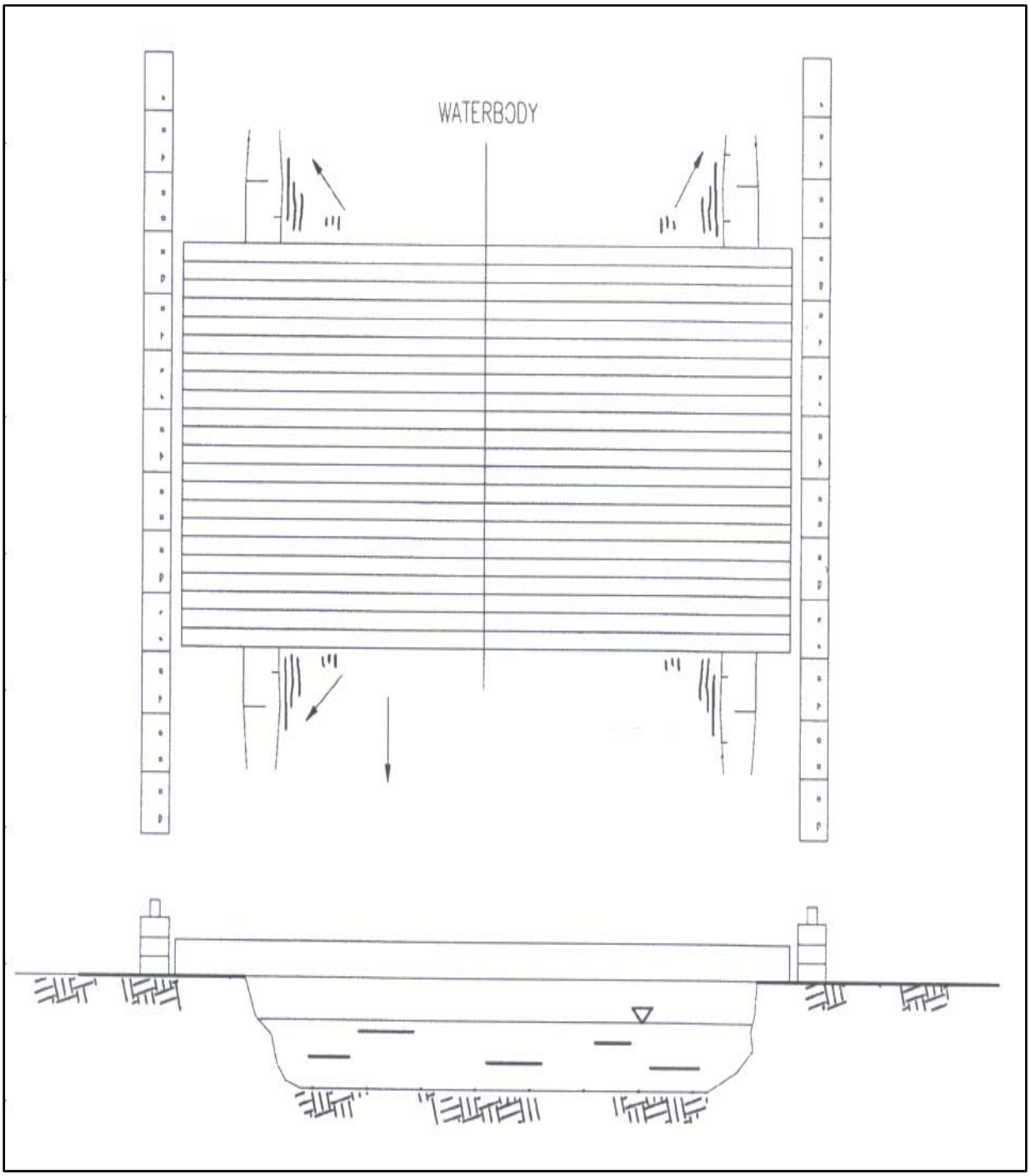


ILLUSTRATION 10

Typical Non-Flowing Water Body Crossing Open Cut Trench

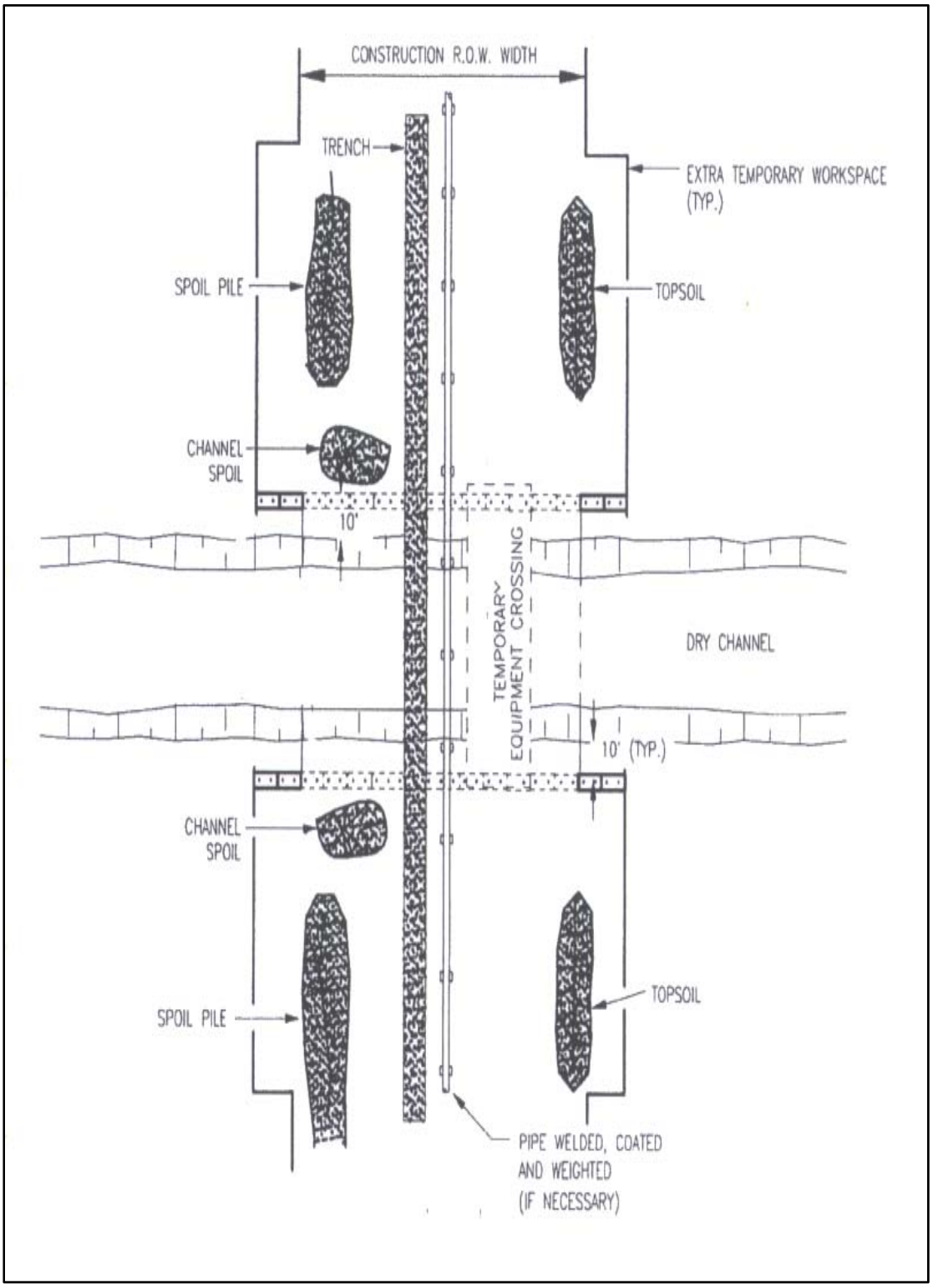


ILLUSTRATION 11

Typical Water Body Crossing – Open Cut Dam and Pump

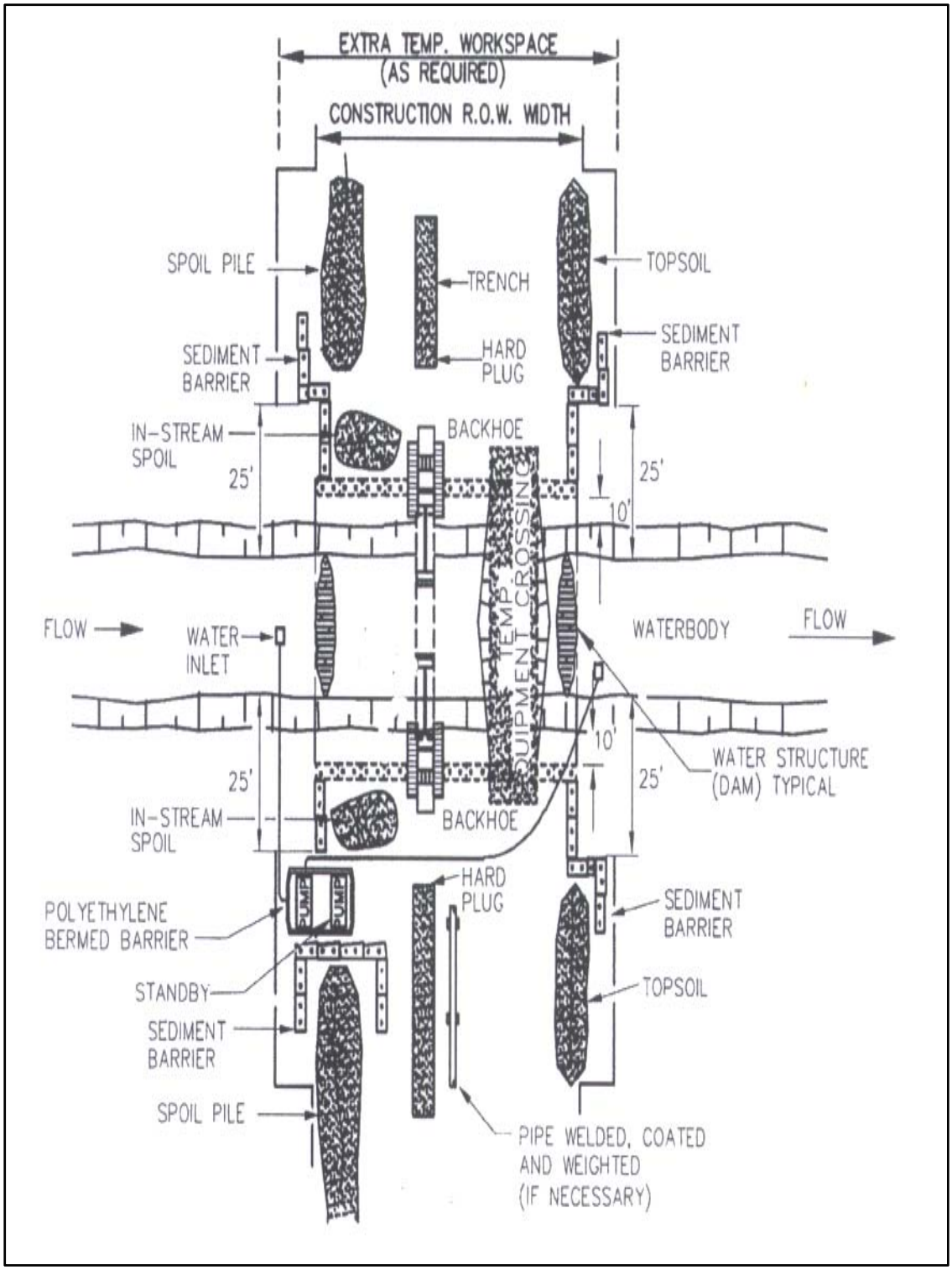
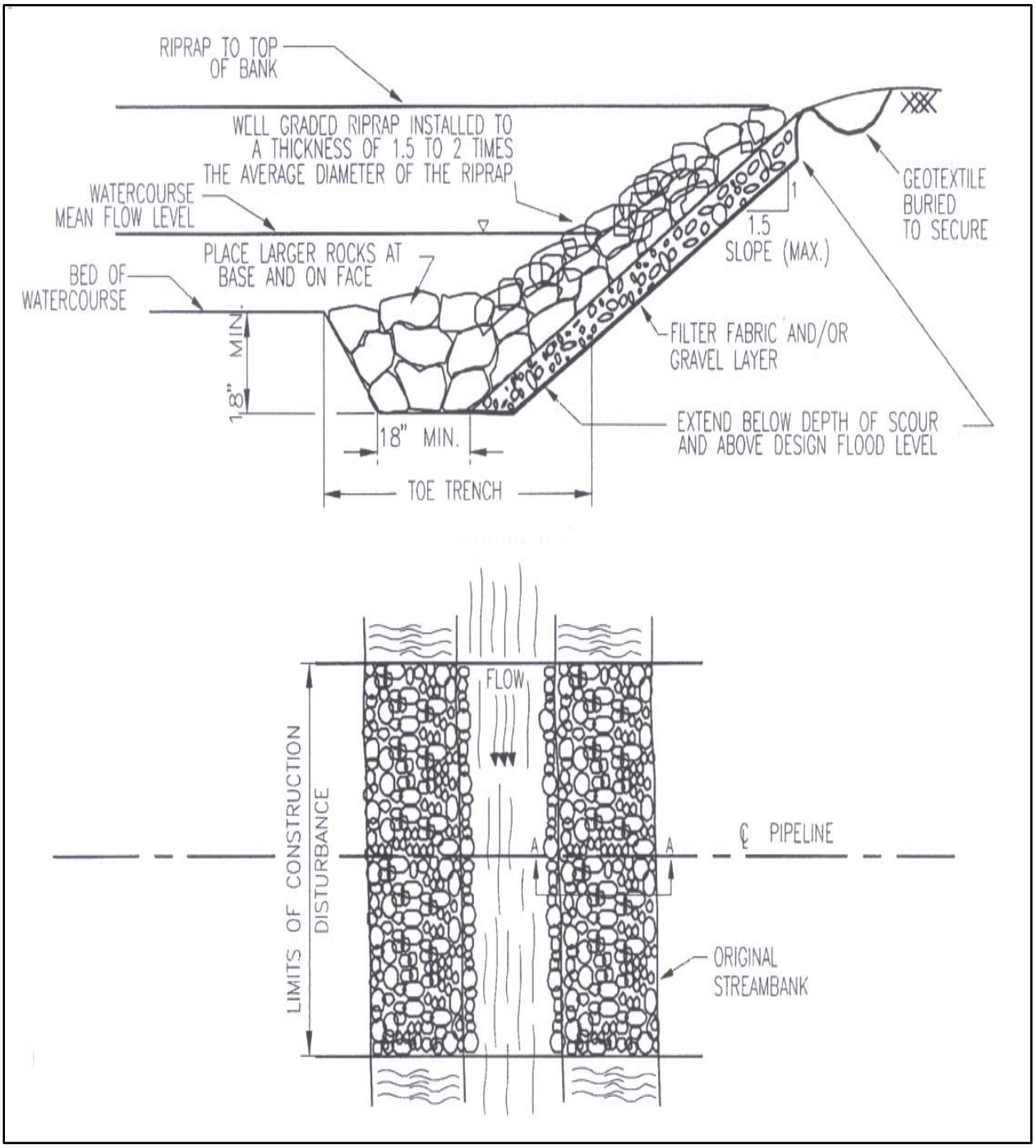


ILLUSTRATION 12

Typical Stream Bank/Water Body Riprap Erosion Control



APPENDIX 6

Definitions

Cave – A natural hole in the ground generally large enough for human entry. This covers the enormous variety of caves that occur, but eliminates artificial tunnels and galleries incorrectly named caves. It may consist of a single connected opening or a series of small or large chambers connected by galleries.

Clean Water Act – The primary federal law in the United States governing water pollution.

Clearing – Removing vegetation from the land surface, including trees and ground cover.

Ditching – The process of digging the trench that will hold the pipeline.

Ephemeral Stream – A stream with a defined channel, but sometimes lacks a defined bank, that flows only during storm events.

Endangered Species Act – The federal law that provides a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such species, and to take such steps as may be appropriate to achieve the purposes of the Act.

Environmental Compliance Inspector – Person responsible for inspecting sources of pollution to protect the public and environment and ensure conformance with Federal, State, and local laws, regulations, rules, and ordinances.

Fish and Wildlife Coordination Act – The federal law requires consultation with the U.S. Fish and Wildlife Service and the fish and wildlife agencies of States where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" by any agency under a Federal permit or license. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources."

Grading – Removing tree stumps and roots and surface rocks, creating a suitably flat working terrain for succeeding pipeline crews.

Intermittent Stream – A stream that has defined banks, generally is seasonally inhabited by aquatic species, and flows three to six months per year.

Karst – A landscape chiefly formed by the dissolving of rock, and characterized by sinkholes, losing streams, springs, subterranean drainage, and caves.

Karst Management Zone (KMZ) – An area surrounding karst features such as springs, sinkholes, losing streams, and around cave openings and over known cave passages that is managed considering the sensitivity of karst resources.

Losing stream – A karst feature where waters enter the subsurface from ephemeral and non-ephemeral surface streams, typically through geologic fractures below observable channels.

Perennial Stream – A stream that flows year round or at least maintains residual pools, has well-defined banks, and is inhabited year round by aquatic species.

Sediment Barrier – A structure constructed of various materials designed to trap sediment before it leaves a disturbed area and enters a stream, spring, seep, wetland, or karst features.

Sinkhole – The collapse of an underground void created by water dissolved rock.

Slope – The amount of elevation gain over a given distance (vertical rise to horizontal run). For example, a hill with 2 feet of elevation gain over 5 feet of horizontal distance has a slope of approximately 40 percent.

Spring – A discrete site where ground water flows naturally from the subsurface onto the land or into surface waters.

Vegetative Cover – For purposes of pipeline right-of-way reclamation, this term is described as the percentage of ground covered with primarily herbaceous vegetation (grasses, forbs, wildflowers). Herbaceous cover provides the greatest protection from soil erosion.