

TAHLEQUAH TRAILS CONCEPT PLAN

TAHLEQUAH, OK

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Prepared For:



Prepared By:



Prepared for: Tahlequah Trails Association



Prepared by: International Mountain Bicycling Association
Trail Solutions Program





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ABOUT IMBA TRAIL SOLUTIONS

IMBA Trail Solutions (TS) is the international leader in developing trails, with experience in over 500 projects in North America, Europe, and Asia. Our staff excels at planning, design, and construction of trail systems that provide high-quality experiences for local riders and destination visitors while simultaneously minimizing environmental impacts.

Trail Solutions is a fee-for-service based arm of the International Mountain Bicycling Association (IMBA), a 501(c)(3) nonprofit organization. IMBA’s mission is to create, enhance, and protect great places to ride mountain bikes. Based in Boulder, Colorado, and with staff distributed across the country and the world, IMBA meets its goal to create great mountain bike experiences through its Trail Solutions program. Trail Solutions employs approximately twenty professional trail planners and builders. In addition to being industry professionals and exceptional mountain bike riders, Trail Solutions staff hold a broad base of applicable skills and knowledge from planning, landscape architecture, and environmental sciences to GIS systems, CAD, and graphic design.

Our wealth of experience has allowed us to develop the gold standard guidelines for the creation of both sustainable and enjoyable singletrack trails. These guidelines have influenced all major federal land management agencies and a large number of state and local parks departments. We pride ourselves on the positive experiences Trail Solutions has provided to the millions of active trail users around the world and on the economic independence that communities have achieved through the development of destination trail systems.





TRAIL ACCELERATOR GRANT

The Trail Accelerator grant (TAG) is a competitive grant for communities interested in building better places to ride. Awardees receive professional trail planning, design, and consultation services to launch their trail development efforts, which can often help leverage more interest and investment for community trail projects.

The Trail Accelerator grant for the Tahlequah Trails project was awarded to the Tahlequah Trails Association for master planning, design, and educational services.

To find more information on award types and eligibility and to apply, please visit [our Trail Accelerator grant webpage](#).

PROJECT BACKGROUND

This plan assesses the feasibility of developing shared-use and mountain bike trails throughout the Cherokee County property off of S 550 Road (the project site). The report identifies potential trail corridors and explains the types of trails and experiences that are suitable for each. The addition of new trails and facilities at the project site will help Tahlequah and Cherokee County offer a diverse engaging activity that will bring a community together, provide a fun healthy activity for kids and residents, while attracting visitors to the unique recreational amenities.

Tahlequah, Oklahoma

Tahlequah is located in northeast Oklahoma, near the Illinois River just up river from Tenkiller Lake. The city was founded in 1838 and became the new capital of the Cherokee Nation in 1839, after their forced relocations from the east along the Trail of Tears.

Tahlequah is home to Northeastern State University (NSU), a public university founded in 1909 as a teacher's college that has grown into the fourth largest university in Oklahoma.

Tahlequah's population is around 15,000 people, while the NSU student population is approximately 8,500. The unique landscape of Tahlequah and northeastern Oklahoma are largely due to the Ozark Highlands and Springfield Plateau. Rugged rocky hills are common among the rolling fields and forests.

Tahlequah is supported by a number of businesses, with the Cherokee Nation the largest employer in the region. Two hospitals serve the city along with NSU, these are some of the most significant work force institutions in Tahlequah.

Tahlequah can easily be accessed via state highways with Tulsa being the closest major metropolitan area and airport, Tulsa International Airport, about an hour west of Tahlequah. Bentonville and northwest Arkansas are one to two hours east, a quickly growing region with its own international airport. Tahlequah is about 45 minutes north of I-40, a major east-west interstate connecting large cities such as Little Rock and Oklahoma City.

The "My Tahlequah Comprehensive Plan 2040" (Comprehensive Plan) lists many goals that can be met with natural surface trail development. The vision goals listed for "Parks, Recreation, Open Space, & Trails" are:

1. Identify park and recreational needs to keep pace with the growth of Tahlequah
2. Establish connections between parks, campus, neighborhoods, and downtown
3. Promote healthy living for all Tahlequah residents

The Comprehensive Plan specifically mentions trails and mountain biking numerous times. Under “Community Character” the plan notes:

Camping, hiking and mountain biking opportunities should be investigated and promoted in the area since they combine well with the demographics that enjoy river floating.

The implementation of mountain bike facilities can support the following objectives identified in the strategic plan.

1. Continue to grow the tourism opportunities with the desire to expand and diversify the economy.
2. The development of a trail plan throughout the city to promote healthy lifestyles and support alternative modes of transportation.
3. Continued expansion of recreational opportunities for all age groups, especially younger age groups.

Tahlequah has a strong Comprehensive Plan that recommends a number of action items related to trails and mountain biking. This report and the associated field design and education will help the community meet these goals.

Recently a group of avid trail users organized a 501(c)3, Tahlequah Trails Association (TTA). TTA was instrumental in obtaining permission to develop trails within the project area covered in this document. As part of the TAG award, IMBA TS provided on-site basic education to TTA crew leaders. This foundation of sustainable trail building will help TTA create the first trails at this location.



Existing Recreation Facilities and Trails

Tahlequah is rich in outdoor resources with the Illinois River providing a haven of activity, especially in the summer months. Fishing, rafting, kayaking, and tubing are popular river activities with residents and tourists. These activities support numerous local businesses.

Downtown Tahlequah has 11 small parks. The Greenbelt is a linear path connecting north/south from Norris Park and NSU to Keetowah Street.

The Anthis Brennan Sports Complex is the newest local park, offering traditional park amenities and sports fields. The City operates a golf course in addition to their extensive park system.

Beyond the Greenbelt, few trails exist in Tahlequah. Mountain bikers must travel to find riding opportunities, with the closest about an hour away.

North along the Illinois River lies the Sparrow Hawk Wildlife Management Area (WMA). Abundant hills and slopes are found within these 550 acres of typical hardwood and pine forests. Sparrow Hawk WMA currently contains natural surface trails for restricted public use, meaning visitors need appropriate hunting or fishing licenses or a state pass .

NWA is a nationally recognized trail community that is continually growing its offering of trail experiences. Tahlequah's proximity to NWA means trail enthusiasts have access to destination quality trails, yet they lack close-to-home experiences. The density of high-quality trails provides an excellent example for Tahlequah and TTA, while providing outstanding recreational opportunities.



PROJECT GOALS

#1 Create a model shared-use trail system

Due to the lack of natural surface trail systems locally, this project serves as an opportunity to showcase a contemporary shared-use trail network. Purposeful planning, design, and construction will help ensure a successful trail system that is enjoyed by many.

Tahlequah is brimming with natural resources and landscape conducive to natural surface trails. The Comprehensive Plan lists many goals and action items related to trail development. This project will provide a much needed model for the community and decision makers, ensuring future trail development is high-quality. In turn, this focus on well-thought out trails will dovetail with economic and community development.

#2 Provide a diversity of trail types and difficulty levels to appeal to riders of all ability levels

A diversity of trail types offers visitors a variety of trail experiences and adds interest. While NWA provides the exception, most of the trails in the area are traditional singletrack with a few bike-specific features. Adding mountain bike-optimized trails will offer residents and visitors trails specifically designed for bikes, with all the fun features and challenges of contemporary mountain biking. Ensuring shared-use loops will provide walkers and runners with outlets to the forest, while creating accessible trails will be important to getting non-traditional trail visitors outdoors. A diverse offering of trail types will provide better quality of life to residents and attract more regional visitors. A broad range of trails types will also address variations in ability levels and preferred style of recreation.

#3 Introduce bike-specific trails to help riders progressively build skills and provide a new recreational amenity

Trails specifically designed for bikes such as gravity runs or a short skills loop offer riders engaging and challenging riding experiences. These amenities offer different experiences and skill-building opportunities than can be experienced on singletrack trails. (These bike amenities are explained in more detail in the following section.) The introduction of these trail types to Tahlequah will offer residents and visitors a new type of riding experience.

These features can be designed for beginners, intermediate, and advanced riders allowing riders of all ability levels to progressively build skills. Bike facilities also provide outdoor community spaces that encourage public engagement and can help promote active and healthy lifestyles while promoting social integration. These amenities are particularly attractive to children and encourage families to share time together outdoors.

#4 Provide basic trail education to jumpstart volunteer efforts

TTA is a relatively new trails advocacy organization. While they secured access and funding to help initiate this project, they understand it will take knowledge and skills to develop the trail system. As part of the TAG award, during the kickoff of this project IMBA TS provided on-site field training for volunteer crew leaders, instilling the basics of sustainable hand-built trails.

In order to best provide advocacy and trail development, TTA should continue their education and learning regarding trail development. Specific skills for their terrain includes rock work and rugged landscape build techniques. Additionally, mechanized trail education in the long-term could help develop volunteer operators to help move projects along more quickly.

#5 Become a regional mountain bike destination

Tahlequah has a much larger opportunity than this one project site. The rugged and expansive landscape, proximity to northwest Arkansas' destination riding, and strong community support can develop regionally significant trails that could have far reaching effects on many people.

As bike amenities and trails are added to the community, Tahlequah would become known for their regionally unique trails and features. A diversity of features and trail types would invite a wide range of riders from families and beginner riders to advanced riders seeking challenge. Adding bike facilities such as tot tracks, bicycle playgrounds, and pump tracks will add to the diversity of experiences that will lead to becoming a strong attraction. Since many of these bike-specific facilities are not currently provided within the state, Tahlequah has the opportunity to introduce these features and become a destination.

Creating mountain bike-optimized trails will attract riders by offering more quality trail experiences. Many mountain bike enthusiasts will travel significant distances for riding destinations. With the world-renowned Arkansas riding close by, Tahlequah could build on this success and attract many of those travelers for a day or more. High-quality trails, well-connected trail systems, wide diversity of trail options, and a mix of bike-specific amenities/features that appeal to riders of all ability levels will attract riders from throughout the region.



TYPES OF MOUNTAIN BIKE FACILITIES AND TRAILS

The types of trails and facilities considered in this master plan are explained below. These narratives are meant to provide a brief description of the experience created by each type of amenity, the intended user, construction considerations, and approximate ranges of construction costs. The construction costs reflect the cost of retaining a professional trail builder and are provided for financial planning purposes only. The cost ranges do not include planning, design, and permitting needed to develop the facilities, typically estimated at 10-20% of construction costs.

Trail Types

Modern trail systems use specific trail types as a way of managing users and providing them with the best possible visitor experience. Extensive planning and design can be dedicated to the goal of maximizing a visitor's trail experience while simultaneously balancing the demands of physical, environmental and social sustainability. Various types of trails and trail planning strategies are explained below.

Traditional Shared Use Singletrack

These trails can serve walkers, hikers, runners, and cyclists. They are constructed and maintained according to sustainable trail construction practices and employ techniques that minimize user conflict. Since all user types travel these routes, care should be taken to avoid obstacles such as jumps, rollers, or water bars which may lead to an undesirable trail experience for an allowed user type. Turns are constructed sustainably but are not cambered like bike-optimized turns, which improve cornering traction. Keeping trail grades within certain ranges ensures both a positive trail experience for users and proper stormwater drainage with minimized erosion. Depending on soil conditions, these trails may need surface hardening techniques to provide a durable four-season trail.

- Approximate Construction Costs: \$30,000-\$60,000 per mile



Mountain Bike-Optimized Singletrack

These trails are purpose-built to optimize the experience of riding a mountain bike. The trails can either be unidirectional or bidirectional depending on the type of trail, preferred circulation of users, and management decisions. This type of trail is constructed with features such as rock gardens, berms, grade reversals, cambered turns (typically wider than turns on traditional singletrack trails), and modest jumps. These trails should make use of wheel-based momentum and forces, enhancing trail flow through rollers, camber, and optimized features. Bike-optimized singletrack can make use of gravitational forces, especially when directional, giving a unique trail experience. Flow, a specific sought-after riding feeling, is often attributed to these types of trails. These trails may need surface hardening to provide a durable four-season trail. They should be designed for a range of users from beginner to advanced skill levels. A range of riders can be accommodated within the same trail corridor by providing optional advanced features. This allows many skill levels to experience the full trail mileage, while providing for skill progression within a smaller trail footprint.

- Approximate Construction Costs: \$50,000-\$100,000 per mile



Tot Track and Bicycle Playground

A tot track is designed for smaller bicycles and beginner ability level users. The track is comprised of reduced-sized rollers as well as low-angle bermed turns that can accommodate balance bicycles as well as regular bikes with short wheelbases. These are essentially small versions of pump tracks, both of which can be constructed with dirt or hardened surfaces. Asphalt is the recommended surface material for tot tracks. Asphalt is more expensive to install, but greatly reduces maintenance costs. Most importantly, asphalt provides a consistent high-quality experience for the users.

Bicycle playgrounds incorporate play features such as prefabricated structures, rocks, berms, tunnels and other challenges to create a fun loop for children to practice skills and improve bike handling. The bicycle playground can range in size and configuration to best fit the site and desired features.

- Approximate Construction Cost \$10-\$25 per square foot (tot track)
- \$8-\$12/linear foot for trail surface (bicycle playground)
- \$1,000 - \$5,000 for prefabricated features (bicycle playground)



Mountain Bike Skills Trail

These are trails that have been specially designed for mountain bikers to develop the skills necessary for enjoying more challenging trails. This type of trail is built with different routes and features for a range of skill levels, allowing users to progress their skills with repetition and experience over time. Beginner riders and kids are especially fond of this type of purpose-built bike facility. They are typically constructed on nearly flat or gently sloping terrain and take up relatively little space. Features may include rocks, bridges, drops, rollers, and more. Typically, installed features include a mix of prefabricated structures and those built on-site with locally sourced materials.

Approximate Construction Costs

- \$8-\$12/linear foot for trail surface
- \$1,500 - \$10,000 for prefabricated features



Pump Track and Pump Parks

A pump track is designed to encourage cyclists of all skill levels to improve their riding skills in a manner that is fun and repetitive. Pump tracks are typically a bidirectional closed circuit or series of closed circuits made up of rollers and berms. Pump parks have an open design with a larger area of hard surfaces that allow users to create their own multidirectional routes through the rollers, berms, and jump features. A pump park will foster more organic and creative riding that stimulates both novice and skilled riders. Riding these facilities is an extremely anaerobic activity, so it is recommended that suitable seating and shade structures be installed for users to rest between sessions. Like the tot track, pump tracks and pump parks are recommended to have asphalt surfaces. With an asphalt surface, the track will allow users to enjoy year-round.

- Approximate Construction Costs: \$15-\$25/square foot



Dirt Jumps

Riders looking to practice jump skills in a low-consequence environment enjoy bike parks and dirt jumps. These consist of beginner to advanced, skill progression-oriented features through a mix of dirt jumps, berms, and prefabricated “slopestyle” features. These facilities are optimized for mountain bike and BMX riders of all levels. Dirt jumps provide a great workout, and an excellent practice area for building solid bike jumping skills.

Dirt jumps consist of features ranging in height from 3 to 6 feet, spaced to maximize a rider’s ability to flow from one jump to the next without having to pedal. Dirt jump areas are designed with a start hill that provides enough gravity to propel riders into the jump lines. They are designed to be ridden in one direction, eliminating potential cross traffic conflicts. Dirt jumps require soil with a high percentage of clay (60-70%) that compacts very hard, minimizing rolling resistance while standing up to heavy use and high shear forces.

- Approximate Construction Costs: \$10-\$15/linear foot



Bike Parks

The features explained up to this point are designed and optimized for bike-based experiences. A bike park combines all or a selection of these features to create an amenity that appeals to a wide range of riders and ability levels. The type and scale of features will be dependent on the community interest, ridership needs, goals of the project, the site's opportunities and constraints, and available funding. Bike parks range from small parks at 1-2 acres, medium sized parks of 5-15 acres in size, to larger parks over 15 acres. Bike parks serve local, regional, and destination ridership by offering a hub of activity to the cycling community through progressive facilities that are designed for riders to build skills and confidence while promoting a healthy, active lifestyle.



NICA Training and Racing

NICA, the National Interscholastic Cycling Association, develops mountain biking programs for student-athletes and coaches across the United States. Over 19,000 student-athletes in junior high and high-school participate in 31 state and regional leagues supported by over 9,000 volunteer coaches and 10,000 additional volunteers. Participant numbers continue to grow. In the last ten years, student-athlete participation has averaged 48% annual growth, and coach participation has averaged 75% annual growth.

The league's mission is to build strong minds, bodies, character, and communities through cycling with the values of fun, inclusivity, equity, respect, and community. Unlike some youth programs, there are no bench warmers. Every athlete participates, and the league offers a multitude of benefits: getting kids outside; promoting healthy lifestyles; exposing kids to cycling and outdoor advocacy; and providing social interaction, leadership opportunities, and life lessons such as self-awareness, discipline, success, failure, empathy, humility, and sportsmanship. In 2018, NICA launched GRiT (Girls Riding Together), a program focused on engaging more girls and women as student-athletes, volunteers and coaches. They also updated their Teen Trail Corps advocacy program to promote stewardship of the trails. Some leagues include Elevate programs for student-athletes with mental and physical challenges, making the sport more inclusive and integrated than many other high school activities. NICA is also helping to fuel more collegiate varsity cycling programs and clubs.

Beyond the many benefits for student-athletes, NICA leagues provide significant economic stimulus to their communities. As participation grows, so does the demand for trails and bike amenities. Teams need trails for training and racing. NICA racecourses require 4- to 6-mile loops of combined singletrack and double track with 300–600 feet of climbing per lap. Throughout the country, communities are building NICA racecourses from scratch or modifying existing trails. Along with the trails, the racecourses require venues that can accommodate, in some cases, thousands of spectators and participants who generate business in lodging, travel, restaurants, bikes stores, and other retail sales and services. This economic

activity can support jobs, provide sustainable growth in rural communities, and produce tax revenue. The bottom line: Growth in NICA leagues doesn't seem to show any signs of slowing down, and that means an abundance of benefits for individuals and communities.



NICA Facilities

NICA facilities come in a variety of loosely defined types, in general two types are most common for communities; practice areas and race venues.

Practice areas can be found almost anywhere appropriate singletrack trails are located. This plan outlines a shared-use trail system appropriate for a variety of mountain bikers, including youth and new riders. In addition to trail systems, bike amenities like bicycle playgrounds or skills loops will help NICA train riders for future competition and should be considered throughout Tahlequah where appropriate.

Race venues are largely constrained by the parking needs associated with events that draw 500-4,000 people. NICA races draw regional teams who often bring a contingent of coaches, family, and fans. To facilitate these large events, parking and spectator management are key. Currently the project site does not have the space requirements for a large event such as a NICA race. Working with the adjacent landowner, TTA and local NICA representatives may be able to secure access to the large field for special events, and this might help provide the infrastructure to host large races and events.



Experience Zones and Preferred-Use Trails

Experience zones and preferred-use trails are showing up in trail systems around the world. Experience zones divide management areas into special-use zones designed around specific activities: one zone may be preferred for mountain biking and another for accessible, interpretive trails. Implementation of such zones can provide a variety of visitor experiences and recreational opportunities that reduce conflict between differing user groups while providing sustainable, long-lasting trails.

Single use challenges the notion that all trails must be all things to all people. In this case, land managers designate certain trails as “preferred” for certain activities. For example, a trail that is single use for mountain bikers might be designed to be fast and flowing through open terrain, with swooping turns and dips. Hiking-preferred trails, meanwhile, may be more about travel efficiency with stairs, tight switchbacks, short distances, or other qualities that would be less attractive to bikers. Visitors will be drawn to routes that match their desired experience.

Each trail system should, of course, include a variety of trails. One way to include numerous types of trails is to have shared-use trails at the beginning of the network near parking lots, with preferred-use trails branching off farther along. The number of trails designated for each mode of travel should be based on the habits and needs of the user groups being managed.



APPROACH

IMBA Trail Solutions staff visited Tahlequah and the project site in early 2021. The visit included meeting key stakeholders while performing planning and design fieldwork. Prior to visiting the site, stakeholder meetings helped determine project goals and concerns. These meetings also shed light on possibilities and constraints for trails development. Desktop analysis using GIS helped determine key points of interest, zones of development, and important preliminary corridors. These findings were presented to TTA and stakeholders, and their comments and feedback helped to shape the final corridors presented in this report.

During the site visit, various features were reviewed to assess the suitability of the sites for the addition of mountain bike facilities. Environmental considerations such as low-lying areas or evidence of past flooding, soil types, rock content, vegetation, and the slope/terrain of the landscape were observed. This is especially important in the steep and rugged terrain of Cherokee County.

After gathering the field observations and data, this information was synthesized into recommendations and guidelines for developing a contemporary shared-use trail system at the project area. Existing infrastructure, current uses, environmental conditions, and adjacent properties were considered along with the size and terrain requirements for a variety of trail types, including modern bike-optimized gravity trails, to identify suitable locations for development. The recommendations identify the most suitable areas for trails including: shared-use singletrack and bike-specific gravity trails, as well as trail system amenities. A master plan is provided to demonstrate the layout of the trails. Recommendations for next steps and implementation of the features are provided.



ASSESSMENTS AND RECOMMENDATIONS

HYDROLOGY

The hydrology of the project site is typical for northeastern Oklahoma. An unnamed ephemeral tributary of the Illinois River is the major hydrologic feature on the site, crossing the entirety of the area from northeast to southwest.

The unnamed tributary is rarely flowing, mostly due to the karst geology of the site. The limestone formations contain many seeps and seams that encourages subterranean water flow. The unnamed tributary has characteristics that make it potentially regulated by the Army Corp of Engineers, a federal land management agency that regulates Waters of the U.S., therefore may require permit compliance to cross. The tributary is fordable, meaning a bridge or structure is not required for trail connectivity across the site.

Tahlequah receives an average of 50 inches of rain per year, a significant amount that typically comes in intense spring storms. Strong precipitation events can create flash flooding and cause severe erosion.

SOILS

The majority of the site soils are in the Clarksville series. Described as excessively drained soils formed from cherty dolomite or cherty limestone. The soils on the project site are cherty or flinty, a description of the quartz crystalline structure that yields sharp angular rocks. Slopes range from 1 to 100 percent, with a very plateau nature to site there are extremely flat locations and also rock bands creating steep cliffs.

The project site soils are described as very gravelly silt loams. Loams are an equal mix of clay, silt, and sand particles; this produces a good medium for trail building. Silt loams tend to have more silt or fine particles, while gravelly loams have more rock content.

The majority of the soil descriptions within the project areas share similar soil horizon structure, with soils becoming progressively gravellier and

containing more clay as one gets deeper. A restrictive layer of fragipan (hard rock that is impenetrable to roots and water) is present anywhere from 12-80" across the area of interest, and is generally more shallow in the flood plain and on steep slopes.

The rocky soils with bedrock in many locations will impact project development with additional costs and time in some places. However, the rocky content of the soils will create a natural all-weather trail in many cases, leading to reduced maintenance needs to preserve experience and drainage. Rocks are also a favorite riding surface for mountain bikers. With plentiful rocks, many styles and features can be created, meaning a wide diversity of sustainable trail experiences for visitors.

FLORA, FAUNA, AND HABITAT

The project site is a natural area; the addition of trails is intended to share that nature experience with the public. Care and thought should be given to all habitat and species. This master plan uses industry best practices and a high level of conservation ethos to limit impacts to wildlife.

A preliminary review of potential regulated species on the project site includes migrating birds such as Bald Eagles (*Haliaeetus leucocephalus*), Eastern Whip-poor-wills (*Antrostomus vociferous*), Kentucky Warblers (*Oporornis formosus*), Red-headed Woodpeckers (*Melanerpes erythrocephalus*), and Rusty Blackbirds (*Euphagus carolinus*)

Oklahoma has abundant habitat for federally listed endangered bats, including the Indiana Bat (*Myotis sodalis*), the Northern Long-eared Bat (*Myotis septentrionalis*), and the Ozark Big-eared Bat (*Corynorhinus townsendii ingens*); and this is likely the case at the project site. Typical bat mitigation efforts include only cutting trees during certain seasons (often winter) and not cutting hazard or dead trees unless necessary for protection of human life. Consultation with appropriate wildlife biologists is suggested during the design phase to ensure necessary bat mitigation.

PERMITTING

Trail construction projects must meet a wide variety of regulatory requirements. As this trails master plan is implemented, obtaining permits ensures following the local, state, and federal laws; and importantly, that we as trailbuilders and visitors are good stewards of the land. People seek trails for all kinds of reasons, but a priority reason among most visitors is to enjoy nature. Mass disturbance, erosion, and sedimentation not only impact our environment, water quality, flora and fauna; they are unsightly and if not mitigated will create a trail which visitors no longer want to visit.

This section provides a brief breakdown of anticipated permitting needs for this project. It is important to note: this list is general in nature and is intended to provide high-level planning for future trail development phases. Both landscape features and funding sources are key determiners of permitting needs, and should be identified during the design phases to ensure relevant permitting is completed

Clean Water Act – Sections 401 and 404

Wetlands, Streams, and Water Quality

The Oklahoma Department of Environment Quality (DEQ) is responsible for the 401 Certificate, required to ensure projects comply with water quality criteria of the state. Section 401 permitting is only required if triggered by another federal discharge permit, such as Section 404.

Section 404 of the Clean Water Act (CWA) establishes a program to regulate the discharge of dredged or fill material into waters of the United States, such as streams, rivers, and wetlands. Section 404 permits are issued by the Tulsa Army Corps of Engineers District.

Determination of the major drainage should be sought, to determine if applicable permitting is required.

Clean Water Act – Section 402

Construction stormwater

Construction stormwater management is managed through the National Pollutant Discharge Elimination System (NPDES) permit program, authorized by Section 402 of the Clean Water Act. NPDES permits are issued by DEQ. The purpose of NPDES permits, in light of construction, is to control the discharge of unmanaged stormwater associated with earth disturbance into streams, rivers, and other waterways. Disturbance of more than 1 acre triggers NPDES construction permitting.

Section 402 of the Clean Water Act will require a stormwater pollution prevention plan (SWPPP) and a notice of intent filed with the state to begin construction. This is due to more than 1 acre of disturbance through trail construction and potential trailhead construction.

Environmental and Cultural Review

Depending on funding sources, various levels of review may be required. For instance, Recreational Trails Program (RTP) grants will require environmental and historical reviews compliant with the National Environmental Policy Act due to use of Federal Highway Administration funds. Reviews may occur for federal or state listed threatened and endangered species, in conjunction with state historical preservation offices or for other unidentified reasons. Other grants or funding sources may require similar, less, or more review during the design phases prior to construction. It is possible consultation with United States Fish and Wildlife Service will be required depending final funding source and scope of construction.

Existing Conditions

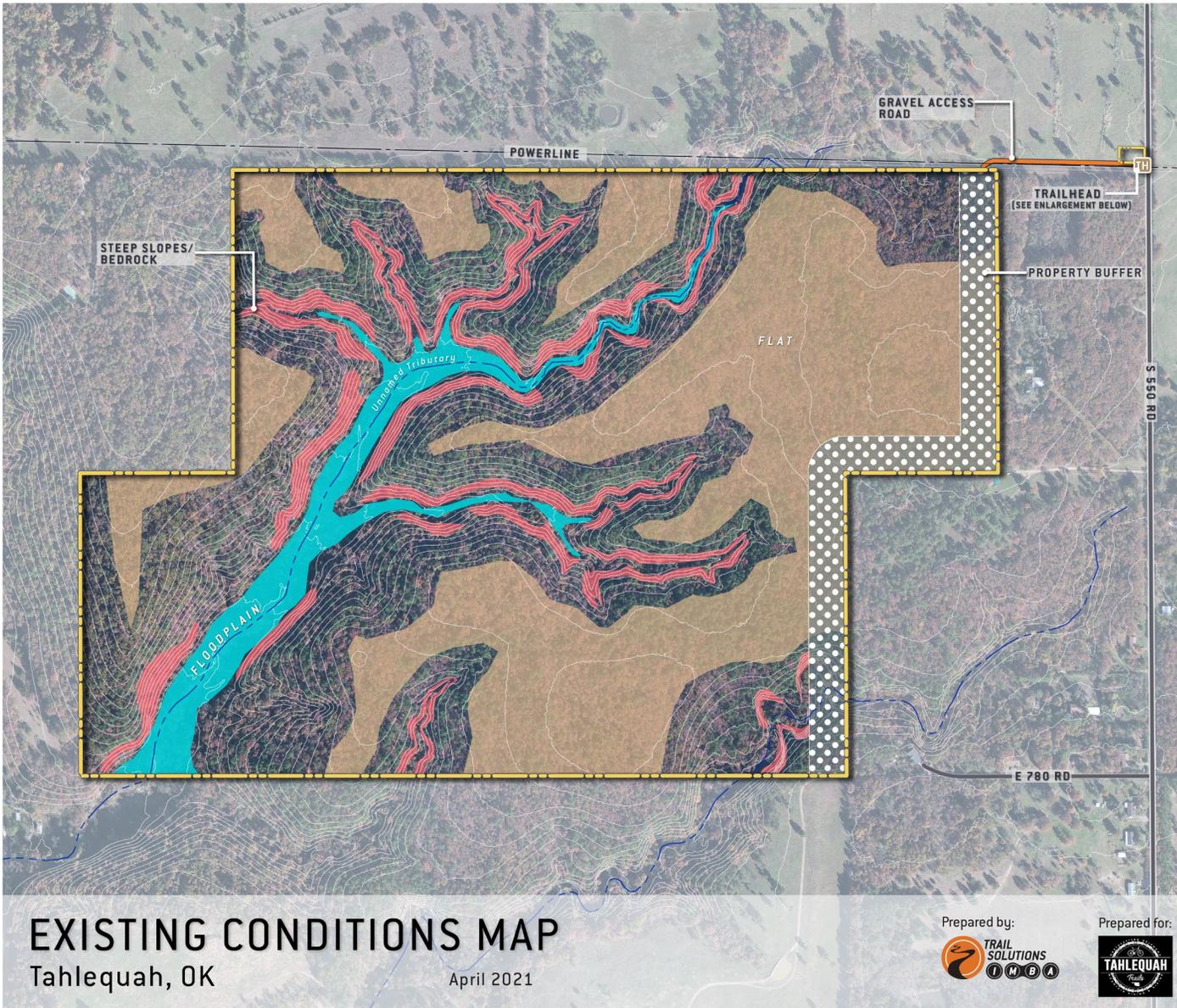
The project site is located east of Tahlequah, approximately a 15-minute drive from downtown. The site is currently accessed from a recently donated trailhead on S 550 Road, which is found off of S Welling Road. The trailhead is fenced and contains a gravel parking area for about 30 cars, as well as a metal container used for TTA tool and material storage. Currently a short 0.10-mile segment of an existing power line access road gets one to the project site itself.

The project site is just over 200 acres of typical northeastern Oklahoma terrain. Overall, the project site is covered by mature hardwood forest with small pockets of pine stands. Almost 40%, roughly 80 acres, is flat or relatively flat terrain. An unnamed tributary to the Illinois River drains through the site, creating steeply eroded relief down from the plateau-like flat areas. This relief provides the only elevation difference on the site, and much of the drainage's slopes are in the 50-100% range. Bedrock is exposed in many areas, typically on the inside of stream meanders. Where bedrock is found the slopes become excessively steep and vertical in some locations, with depth to bedrock very shallow. The steep slopes make up about 16 acres of the project site.

The unnamed tributary and its branches create flat gravel filled floodplains, which in some locations can be as wide as 200 feet and in total is about 12 acres of the site. These valley bottoms are also flat and the native soil largely contains gravel and rocks; creating loose footing and very low cohesion. In some locations the steep drainage slopes are scree like, similar to the floodplain areas, with loose unconsolidated rock slopes.

Neighbors abut the property on all sides, but homes are closest off of S 550 Road, along the eastern boundary. A 200-foot buffer was established to ensure visible and audible distance from the planned trails to homes. This buffer zone makes up about 12.5 acres of the site, all inside the very flat areas.





LEGEND

PROJECT AREA	EXISTING CONDITIONS
ROAD	FLAT
UNNAMED TRIBUTARY	STEEP / BEDROCK
GRAVEL ACCESS ROAD	FLOODPLAIN
POWERLINE	PROPERTY BUFFER (175')
TRAILHEAD	

REPRESENTATIVE SITE PHOTOS



Note: This map is intended for planning purposes only.
 Property boundaries are approximate.
 Do not use for design development or construction estimates.
 ver210430

EXISTING CONDITIONS MAP
 Tahlequah, OK April 2021

Prepared by: Prepared for:

Trail Suitability Assessment

The Existing Conditions map shows constraining landscape types on the property. While conducive to beginner friendly trails with mellow grades, flat terrain is often difficult for creating sustainable trails which do not puddle, cup, or degrade over time and with use. Additionally, the flat areas do not provide enough landscape variation to create trail networks with appropriate trail densities to meet the project goals. Combined, the flat lands provide good beginner trail terrain that will require long-term maintenance, and certain constraints limit the trail potential of much of the flatter parts of the site.

The elevation difference across the property is about 150 feet, this is a reasonable amount to create both cross-country style trails with elevation gain and loss throughout, and bike-specific gravity trails.

The steep drainage slopes can be utilized for both intermediate and advanced trails. The steeper the slope, the more exposure is created and the more difficult the trail becomes. Areas of bedrock or very steep slopes with shallow bedrock are not feasible for trails construction.

The floodplains along the unnamed tributary and its branches are not ideal for trail development. The gravelly soils contain very little small or fine particles, leading to an undesirable trail tread experience (loose, chunky, and sharp). The drainage and any flat floodplain areas should be crossed in a perpendicular manner along short trail segments lengths.

The abundance of rock throughout the site is desirable for many trails and features. Rocks can help armor trail, both for enhanced experiences and to produce a more durable tread. However, in many places the rocks are small (less than 50 pounds) and therefore not ideal for trail tread, retaining walls, or armoring. They can be utilized as anchors in many places to help corral the trail or for foundation armoring techniques in some instances.

Overall, the site provides different terrain types to create a great shared-use trail system. The scenic views into the drainages with steep relief and beautiful exposed rocks make for memorable experiences by all. Flatter areas, while not perfect, can help support accessible trails that can be used by many different trail users. Steeper slopes and abundant rock content will help create sustainable long-lasting trails, as well as challenging and diverse experiences for riders to progress their skills.





Field Designed Trail Segments

Segment 100 – Easiest

Segment 100 provides the access and backbone for the entire trail system, which begins at the power line easement with a small two-way hub. Segment 100 is a complete loop, beginning and ending at the entrance with the rest of the trail system building off of it via intersections further out.

Segment 100 is intended as the most beginner friendly trail, appropriate for very young or new riders and walkers. The short length, about 1.75-miles, is a comfortable experience in the woods providing an easy way to experience outdoor recreation for non-traditional visitors.

Segment 100 was sited to avoid the neighbor buffer and provide interesting and engaging scenic views over the drainage channel. Much of the trail crosses the flattest terrain of the project site. Long-term maintenance or enhancement will be required to ensure Segment 100 remains stable and enjoyable.

Segment 100 was also the focus of the field training and mentoring IMBA TS provided while on site in early 2021. TTA volunteer crew leaders were given basic education and guidance in hand building techniques specific to the project site's terrain.

Segment 101 – Easiest

Segment 101 builds off of Segment 100, creating the beginner loops intended as the easiest trails on the site. Segment 101 stems from a four-way intersection with 100 near the southern third of the property. Segment 101 is similar to Segment 100, envisioned as providing additional beginner experiences to those who want more than Segment 100. Segment 101 adds about 0.75-miles, creating a 2.5-mile figure eight loop great for new mountain bikers or those seeking an easy walk in the forest.

Segment 101 provides additional mileage for NICA training or youth programming. Segment 101 will also provide the connectivity to the beginner bike-only gravity zone, where planned Segments 150 and 151 could provide the first of its kind trail for the area —purpose-built bike-only

descents. These trails will help with engaging youth in a lifetime sport, since beginner gravity trails are often fun-filled, roller-coaster feeling experiences. Since this type of recreation would be new to Tahlequah, a beginner gravity zone will help all visitors gain skills to tackle larger gravity runs planned on the site.

Segment 102 – More Difficult

A very short, one-tenth of a mile intermediate trail about a quarter mile into Segment 100, heading counter clockwise from the entrance. This short experience will be ideal for visitors to try a harder trail, before committing the longer Segment 103.

Segment 102 contains decent elevation gain and loss across its short length, testing trail users' physical strength to give them a taste of the more-difficult options in the network.

This segment should be well anchored and signed, so that users understand its purpose and don't short cut intersections. The trail also serves to divert visitors seeking more advanced experiences, taking them off of Segment 100 so it can be better enjoyed by others.

Segment 103 – More Difficult

A continuation of Segment 102, Segment 103 departs the four-way with Segments 100 and 102 to continue an intermediate shared-use trail on the eastern side of the major drainage channel. Segment 103 will add 1.4-miles of more-difficult experience. This shared-use trail plays along the upper contours of the drainage channels, giving great views, slight exposure, and physically demanding climbs and descents. This trail is sure to be popular with hikers, trail runners, and mountain bikers.

Segment 103 is the backbone for the rest of the intermediate and advanced trails which will all branch off of Segment 103. After departing Segment 100 and 102, this trail will play along more of the drainage channel slopes until it drops and crosses a major branch of the tributary. This crossing is necessary to build a more-difficult trail, since higher in the drainages the terrain becomes very rocky with a lot of exposed bedrock.

After the crossing, Segment 103 climbs steadily towards the beginner gravity zone. It passes the intermediate-advanced gravity zone, marking the high point where the descents will begin. Near the end, as it comes closer to Segment 100, the terrain becomes flatter and will require more tread development to create a fun intermediate experience.

Planned Future Trail Segments

Planned trails are those not specifically field designed, but rather planned using mapping and site understanding

Segment 104 – Most Difficult

Segment 104 is a nearly third of a mile advanced trail which ties into Segment 103 very close to the drainage crossing. Segment 104 would make use of the higher parts of the drainage, where more bedrock is exposed and the rockier soils and difficult terrain are conducive to advanced trail experiences.

Segment 105 – Most Difficult

Segment 105 is about a quarter mile, intended as an extension of 104. This trail will wrap the lower edge of the main drainage, acting as a collector trail for future gravity runs, tying them all back into Segment 106 and the main shared-use loop. Parts of Segment 105 may be further delineated as more-difficult during design depending on the final gravity zone layout. It is important to ensure any intermediate gravity descents use intermediate trail to tie back to the core shared-use loop.

Segment 106 – More Difficult

This half mile connector, along with Segments 103 and 200, will form the core intermediate shared-use loop. Segment 106 will traverse the long slope down to the lowest point of the trail system, meeting with Segments 105 and 200. Segment 106 should be an efficient climb, a more difficult version of Segment 107, as it will provide the most direct return for riders utilizing the intermediate-advanced gravity zone.



Segment 107 – Easiest

A short quarter mile climb, Segment 107 is the return trail for the beginner gravity zone. This trail should be an efficient and fun climb, getting riders back to the exciting descents. Turns should be wide and gradual, appropriate for easy climbing.

Segment 108 – Most Difficult

Segment 108 forms a nearly continuous advanced trail when combined with Segments 104 and 105. Part of this route would use Segment 103, an intermediate trail. Segment 108 should be similar in character to Segments 104 and 105, as a challenging, rocky, technical shared-use trail. Segments 104, 105, and 108 will be popular with hikers, runners, and riders seeking technical challenge.

Segment 150 – Easiest

Segment 150 is the intended as the easiest gravity bike-only trail in the entire network. This short quarter mile descent should be filled with bike-optimized features such as rolling contour alignment, insloped tread, bermed turns, and dynamic cambering.



Segment 150 will be a great trail for children’s programming or NICA practice, engaging youth in the fun sensation of flowing downhill on a bike. This trail will also serve to help new riders build skills to work up to more difficult gravity trails.

Segment 150 traverses a rocky slope which will require more earthwork than other trails to create the smooth rolling feeling desired. The proximity to the trailhead and short distance will help ensure this trail’s success.

Segment 151 – More Difficult

The steep slopes near the beginner gravity trail can be utilized to create a short intermediate bike-only descent. Segment 151 will be about a quarter mile as well, with some flat and uphill near the end to tie back to Segment 107, the collector/climb trail for the beginner gravity zone. The style of Segment 151 should be technical with some flow; large jumps or features are not ideal for this segment.

Segment 151 should provide a step up from Segment 150, offering some progression in this small zone. By having a slightly more difficult trail near



the easiest gravity run, children and new riders can be inspired by those riding Segment 151. Often mountain bikers learn best by watching or following other riders. Coupled with Segment 150 these trails offer a great space to grow confidence and skills.

Segment 152 – More Difficult

Segment 152 is the longest gravity trail in the system, at nearly a third of a mile. This trail should provide a level up in intensity from Segment 151. The terrain which Segment 152 uses is steeper and rockier, with a deep drainage that can be utilized to create a flowing effect with “g-outs” (the experience of a steep trail abruptly changing to uphill).

Segment 152 will act as a collector for other gravity lines, including Segment 153, eventually feeding into Segment 105 at the slope bottom above the main channel floodplain.

Segment 152 should include technical challenges and a thrilling gravity experience. It should complement Segment 153, providing a different flavor of downhill riding to add diversity in trail experiences to the network.

Segment 153 – More Difficult

Segment 153 is a short quarter-mile descent that will merge into Segment 152, creating a longer experience. Segment 153 traverses some mellower slopes at the top of the project site as it winds downhill. This trail should provide a jump experience to the extent practical. A small intermediate jump line will work nicely with the more technical-oriented trails of Segments 151 and 152, offering a new opportunity for riders to build different skills. This trail will also be popular with a variety of mountain bikers, helping build a strong, varied community of trail visitors.

Segment 154 – Most Difficult

The only advanced gravity trail planned in the system, Segment 154 would depart the same major gravity hub that Segment 153 does. The trail experience should be technical and difficult, with features that match the landscape and terrain and create the most challenging downhill in the

system. Segment 154 will tie into Segment 105 or possibly 152, depending on the final field design.

Segment 200 – More Difficult

Segment 200 utilizes the far western side of the property. This trail will create the large shared-use loop that circumnavigates the property. It will measure nearly 2 miles in length, and when combined with Segments 103 and 106 they will create a nearly 3.5-mile intermediate loop. This long more-difficult experience will be sought by walkers, runners, and riders alike.

Segment 200 should climb from the main drainage and create enough space for Segment 201 and any other future identified alignments. Similar to Segment 103, Segment 200 will ride the upper edge of the slope above the drainage channel. This will create scenic views and slight exposure, while providing a rolling contour cross-country style trail. Segment 200 will cross the channel again to the north and climb the slopes to tie into Segments 100 and 103. Segment 200 is the only trail planned to cross the unnamed



tributary, two crossings will allow an efficient and enjoyable loop while minimizing impacts from trail crossings in the floodplain.

Segment 201 – Most Difficult

Segment 201 is the counterpart to Segments 105 and 108, an advanced shared-use singletrack on the steep slopes of the western side of the main drainage. This narrow, exposed, and rocky trail will offer a most-difficult experience in the network for hikers, runners, and riders seeking a challenging physically demanding trail. Segment 201 will tie into Segment 200 and utilize its drainage crossings to create stacked loops for visitors.

Other Potential Alignments

While many alignments are described and recommended in this report, a complete design of the trail system may identify alignments not listed in this initial planning. Care should be taken to not oversaturate the system with dense trails, this will take away from the experience and likely lead to further management and maintenance issues. Instead, careful design by professional trail builders is recommended, which may lead to one or two additional trail corridors being found.

Trailhead Potential Amenities

The existing trailhead has a large grassed area currently covered in fill excavated during the parking lot's construction. This fill and the open area should be utilized to develop small bike playground features. A short skills loop would be an excellent choice. This type of infrastructure will allow for more progression and opportunity, giving kids somewhere to play while parents watch or allowing adults to practice skills while waiting in the parking lot for friends.

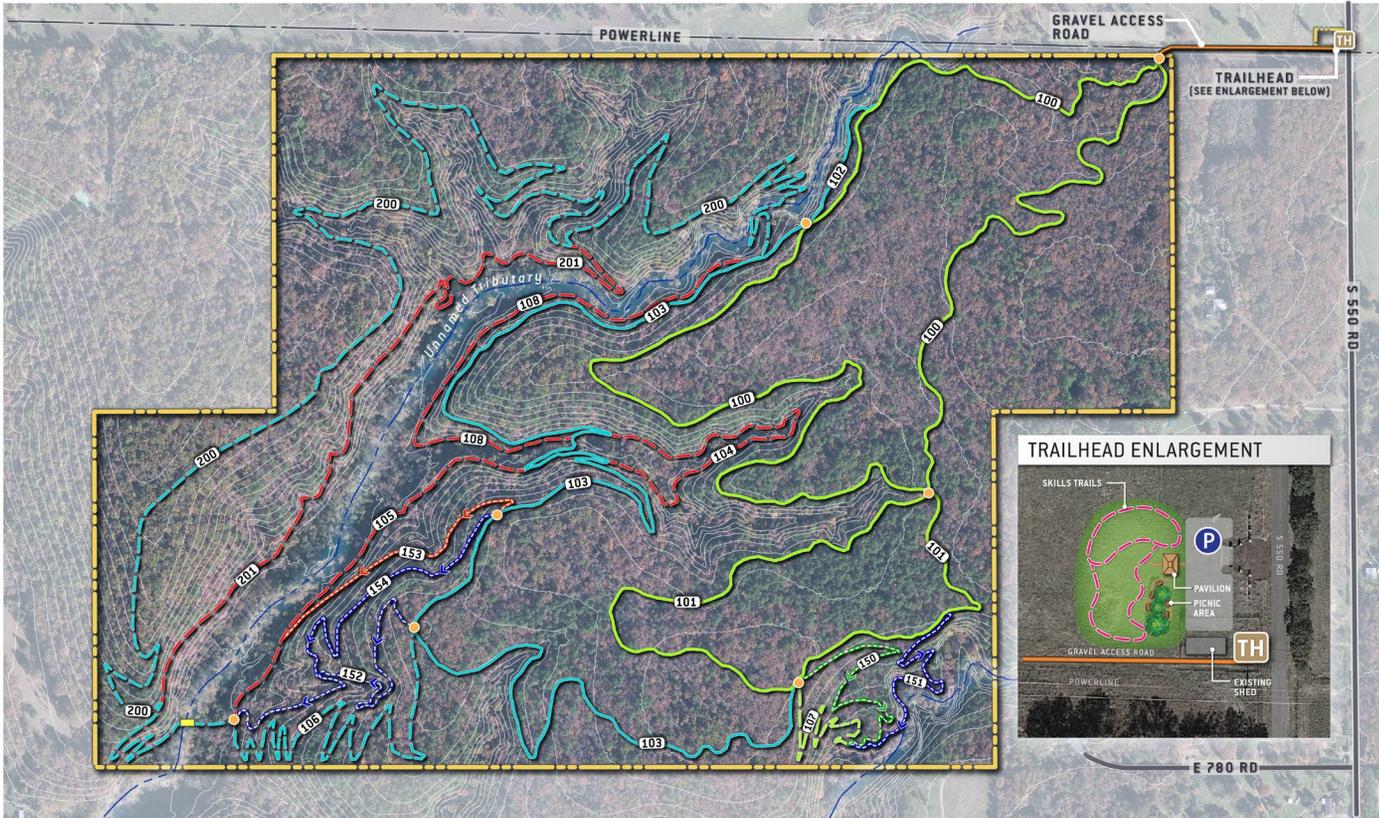
Necessary Amenities / Access

Successful trail systems require additional supporting infrastructure and amenities beyond quality trails. In addition to appropriately sized parking areas; restrooms and a trail kiosk should be placed at the trailhead prior to opening. A portable toilet is satisfactory; shade structures are recommended to allow those to escape the hot summer sun. Additional

shading should be provided in the long-term, and this could be a simple pavilion roof. No structures should remove the existing mature tree at the existing parking area/trailhead, as it provides excellent natural shading during the summer.

Entry signs, trail wayfinding, and informational signage should be developed and implemented to guide users through the trail networks and bike amenities. An interpretive kiosk with a trail system map should be provided to orient new visitors, route planning information, any necessary safety information, user etiquette, and park rules. Please see the "Signage" section included in the Appendix for more information on other recommended sign types.





LEGEND

- PROJECT AREA
- ROAD
- UNNAMED TRIBUTARY
- GRAVEL ACCESS ROAD
- POWERLINE
- TRAILHEAD
- PARKING

FLAGGED TRAILS

- EASIEST, TRADITIONAL
- MORE-DIFFICULT, TRADITIONAL

PLANNED TRAILS / AMENITIES

- EASIEST, TRADITIONAL
- EASIEST, GRAVITY
- MORE-DIFFICULT, TRADITIONAL
- MORE-DIFFICULT, GRAVITY
- MOST-DIFFICULT, TRADITIONAL
- MOST-DIFFICULT, GRAVITY
- SKILLS TRAILS
- TRAIL HUB
- ARMORED STREAM CROSSING

TRAIL DATA CHART

Segment	Skill Level	Type	Status	Length (ft)	Length (mi)
100	GRN	TRADITIONAL	FLAGGED	8601	1.63
101	GRN	TRADITIONAL	FLAGGED	3715	0.70
102	BLU	TRADITIONAL	FLAGGED	566	0.11
103	BLU	TRADITIONAL	FLAGGED	7600	1.44
104	BLK	TRADITIONAL	PLANNED	1779	0.34
105	BLK	TRADITIONAL	PLANNED	1571	0.30
106	BLU	TRADITIONAL	PLANNED	2862	0.54
107	GRN	TRADITIONAL	PLANNED	1162	0.22
108	BLK	TRADITIONAL	PLANNED	2238	0.42
150	GRN	GRAVITY	PLANNED	1328	0.25
151	BLU	GRAVITY	PLANNED	1290	0.24
152	BLU	GRAVITY	PLANNED	1709	0.32
153	BLK	GRAVITY	PLANNED	1140	0.22
154	BLU	GRAVITY	PLANNED	1332	0.25
200	BLU	TRADITIONAL	PLANNED	10319	1.95
201	BLK	TRADITIONAL	PLANNED	3341	0.63

CONCEPTUAL TRAILS PLAN

Tahlequah, OK

April 2021

Prepared by:



Prepared for:



Note: This map is intended for planning purposes only. Property boundaries are approximate. Do not use for design development or construction estimates.

ver210430

Recommended Phasing and Construction Guidelines

Phase 1: Continue the volunteer construction of Segments 100 and 101. While TTA has a strong interest in utilizing mechanized equipment for construction, it is recommended they continue by hand to further develop basic skills without creating unnecessary issues. In the long-term, a professional trailbuilder should be contracted to provide a tune up on Segments 100 and 101 as they wear from normal use.

Additionally, the power line easement should be enhanced with more gravel, tying the existing gravel into the trail entrance at the forest edge. TTA should develop a signage guideline and plan specific to this property, then procure the necessary materials to install wayfinding and kiosk signage before opening the trails to the public.

Phase 2: Volunteers from TTA should construct Segment 102 once they have finished Segment 100. Additional training focusing on rock work and advanced skills is recommended to complete Segment 102. In addition, this site visit could provide more trails design, to ensure TTA is ready to tackle the next phases as they come to fruition.

Phase 3: Segment 103 is a longer intermediate trail, with several difficult construction cruxes that require experience and knowledge of advanced trailbuilding. Segment 103 should be contracted to a professional trailbuilder, this will provide the opportunity for TTA and the community to better understand professional trails contracting and the benefits it provides.

Phase 4: The beginner gravity zone should be the next area developed. Segments 107, 150, and 151 would ideally be built together to create a succinct new experience. Segments 107 and 150 are the bare minimum, as Segment 151 only provides additional progressive growth and challenge and could be saved depending upon financial planning.

Phase 5: This phase should focus on completing the shared-use loop and adding the most-difficult trails. Segment 106 and 200 are the highest

priority in this phase, creating the largest loop in the system and giving all trail visitors a new experience of a remote and deeper-into-nature feeling. Segments 104, 105, and 108, or some combination, provide the next evolution in the network. Developing these advanced trails is important to continue creating a robust trails community and attract destination riders. These most-difficult trails could be built by hand by TTA volunteers, but would require additional training to do so.

Phase 6: The last phase should fill in the missing pieces and include the intermediate-advanced gravity zone. This phase could be split into additional pieces, like all phases, depending on actual fundraising and financial planning. Segment 105 is required as a collector trail prior to gravity trail development. Segment 152 must also be built prior to Segments 153 and 154. Segment 201 represents one of the last trails to be development, creating a larger advanced loop.

Regional Opportunity

Tahlequah, Cherokee County, and northeastern Oklahoma in general have a fantastic opportunity to develop more trails which will provide numerous benefits. Tahlequah, the Cherokee Nation, Cherokee County, and TTA should seek to identify and plan for future trails projects to create a regional draw and provide outdoor recreation to their citizens. The topography and landscape offer great chances to create fun and interesting trails, as well as provide modern connectivity to drive active transportation, equitable access, and destination experiences.

The Comprehensive Plan makes many mentions of trails, outdoor recreation, and mountain biking.

Between the Eastern boundary of Tahlequah and the Illinois River is a unique landscape that would be ideal for walking trails, mountain bike trails, nature walks, and a variety of other recreational activities. This area is not developable due to the steep terrain, and largely inaccessible by motor vehicle. The only practical use of this area is as a nature preserve and passive recreational activities that could supplement development of the greenways, river activities, and downtown restaurants and shops. Access to this area can occur at various points along the Illinois River; to the north along State Highway 62, near the end of East Ross Street, and along the South at Powell Road.

In general, the above statement can apply to almost any “unbuildable” terrain. Tahlequah is rich with steep landscapes that cannot be developed traditionally, and likely provide more economic benefit as conservation areas and natural surface trail networks. The Comprehensive Plan provides vision goals for economic development:

1. Champion existing local businesses that are consistent with the expressed vision
2. Promote job creation to capture and maintain college graduates
3. Encourage tourism that supports the community character of Tahlequah

These goals can all be met in part by trail development. Transportation vision goals include, “focus on safe accessible routes for all users”. Natural surface trails can provide enjoyable and accessible transportation options in Tahlequah with professional planning and design. The Comprehensive Plan goes on to describe the community character and recommends branding the unique landscape with mountain biking, “The rolling hills and wooded areas of this region offer hikers and campers as well as mountain bikers a great opportunity to visit the area.”

Furthermore, the Comprehensive Plan lists the below as an action item under Parks, Recreation, Open Space, and Trails:

Consider the acquisition and development of a mountain bike course in large natural areas on the Northeast and East sides of town.

The Comprehensive Plan also makes many mentions of the shared-use pathway intended to connect downtown to the project site. Together these all show a fantastic opportunity to develop a regionally significant trail system across the city which appeals to tourists yet provides contemporary recreation and nature experiences to Tahlequah residents.

It is recommended a strategic master plan be developed regarding natural surface trails for the city. This plan should identify current public lands and open space ideal for trail systems and future private parcels of high priority for easements or acquisition to develop trails. The plan should work with the diverse stakeholders and interest groups to focus on equitable access and progressive experiences that build community and provide real economic benefits.



IMPLEMENTATION

Community Outreach and Visioning

The master plan reflects the identified suitable corridors for trails. Public outreach, such as community and stakeholder meetings, is necessary to gather input on the concerns and feedback on the plan and help build support throughout the city and county. The outreach is paramount to ensure residents are engaged during this process and informed of the vision. This will generate excitement and support for the plans and create a stewardship base of future trail users and a sense of ownership and pride of the trails and bike facilities. In addition to reaching out to residents, communication with local bike groups and other mountain bike enthusiasts will help build an understanding of the existing ridership and their interests and concerns and create connections. These mountain bike enthusiasts can share local knowledge of trails, construction experience, and lessons learned on past projects.

Since the contemporary trail system presented in this document would be a new type of recreational amenity to the area, the facilities and the benefits of providing trails may be unfamiliar to residents, stakeholders, and community leaders. Continued education, through community meetings, field trips to trails and bike facilities, and demonstration projects will help residents understand the potential of these facilities and generate support for future projects.

While the scope of this master plan is focused on a selected site within Cherokee County, other opportunities for bike facilities may exist throughout the region. Coordination among the individual municipalities, the County, the Cherokee Nation, the State, and potentially Army Corps of Engineers will be necessary to identify other sites of interest and create a unified vision for bike amenity development.

To create a regionally significant destination, coordination early on with the tourism bureau and community development organizations will help generate a plan for future development, assist with the necessary branding,

and create the content/platforms to spread the word about bike facility development.



Funding

The availability of funding for trails will vary widely depending upon many factors. Planning for these amenities in yearly recreational budgets will begin the process of designating funds for trail facility projects. Some municipalities employ a voter-approved recreational and trails sales tax to generate funding specifically for recreation improvements. In addition, a range of federal, state, and local grants are available that support trail development and recreational amenities. Coordinating with local organizations with allied interests may offer financial support and increase the base of supporters.

TTA should research and apply for recreational community development, or health-focused grants. It is important to consider funding sources during the design phase as different funding sources may require more stringent environmental or workplace compliance.

Risk Management

Outdoor recreation in natural areas, including hiking, running, walking, and mountain biking on trails, as well as bicycle facilities, inherently results in some risk to the visitor. It is impossible to fully remove the risks associated with natural landscapes without an undesirable level of impact. These risks are widely known and understood among the recreation and land manager community and a set of industry best practices has been used throughout this planning process to reduce risk of injury to visitors. The next phases of trail development — design and construction — require continued knowledge and mitigation of trail recreation risks. During and after implementation land managers, owners, and operators of trail systems should:

1. Design and construct the trail appropriately
2. Inspect and maintain the trail appropriately
3. Address unreasonable hazards and post warnings
4. Anticipate foreseeable activities and take reasonable steps to protect users

This plan sets forth a foundation designed to lower risks associated with trails. Trail design should further this mitigation strategy by utilizing professional consultants and contractors as necessary, and continually revisiting risk as a known issue needing to be addressed through all stages of trail development. By providing a diverse set of trail opportunities, including a spectrum of challenge, on a well-signed network that allows visitors to make informed choices, the risk to visitors and operators is greatly reduced.

As the trails and bike facilities would introduce a new type of recreation with some liability concerns to Tahlequah, an assessment and clear understanding of recreation protections, laws, and precedents is advised to ease concerns and create a plan to mitigate risk. Professional legal advice, especially during signage implementation, is recommended to ensure all liability concerns are understood and create a plan to mitigate risk.

Warnings of the inherent risk of trail use and mountain biking should be clearly provided on park signage and should be reviewed by a legal professional.



Maintenance

Trails should be managed according to recommended difficulty guidelines, trail type guidelines, and respective trail narratives. Master planning and design will provide these detailed guidance documents. Maintenance is an ongoing cost and should be included in annual maintenance budgets. Typical annual maintenance budgets for traditional and mountain bike-optimized trails are 10%-15% of the installation cost, and gravity trails can be closer to 20%-25% of the construction cost. Some of the annual maintenance for all trails can be performed by adequately managed and trained volunteers. These tasks will include corridor trimming, downed tree removal general clean up (branches, leaf litter, etc.), and minor drainage work

Professional assistance will occasionally be required. The frequency will depend upon ongoing maintenance as well as weather patterns and use. Typically for cross-country trails, professional maintenance will be required every 10-20 years and will involve small reroutes, major drainage work, or other large tasks. Flow trails can be expected to need professional help every 5-10 years as trails wear through weather and use. This will typically come in the form of rebuilding large dirt features and upgrading trails to provide slightly new experiences which help continue to draw regional riders, give locals something new, and help all riders progress in their skills. Increasingly, destination mountain bike trail systems are funding and hiring part- or full-time staff to provide maintenance to trail systems. Ensuring a quality, consistent riding experience is key to attracting visitors and keeping a local riding community satisfied and growing.



Programming

To fully activate and create a community around outdoor recreation, trails, and mountain biking; certain programming is necessary. While Oklahoma does not have a current NICA league, some schools participate in adjacent state races and Tahlequah's public schools offer an after school bike club for youth. Beyond high-school racing, many other programs can engage the community. The trails could be programmed with guided and interpretive hikes and outdoor education. Mountain bike skills clinics and/or scheduled and guided rides can be provided to help introduce the sport to new riders and help them improve skills. Many times, local clubs and/or bike shops will schedule weekly rides that can be tailored for beginners, intermediate, or advanced riders. These rides encourage riders to connect with the local riding community. Having scheduled volunteer days keeps the community engaged, invested in their local trails, and helps improve the conditions of the trails while reducing the maintenance workload of land managers.

Riding or running races, charity events, and bike festivals would greatly attract riders. Hosting a race regularly can attract visitors year after year. The bike facilities, especially the pump tracks and jump lines, could host local or regional competitions. Events and programming could help keep visitation numbers high throughout the year.



CONCLUSION

Next Steps

To bring these concepts and ideas to fruition, the next step is to share the findings of this report with the appropriate city and county officials and staff to gather their feedback, strategize the next steps, and identify funding sources. Next, public meetings with community leaders, residents, adjacent property owners, local riders, and other stakeholders will help inform them of the vision and potential. After considering feedback, the plans should be refined during design, leading to production of construction documents to guide implementation. Continued education of residents, key community leaders, and stakeholders through public meetings and outreach events will help build project support that may open new funding opportunities. TTA should continue to receive professional trail building education, to help strengthen their skills and develop robust volunteer teams.



Summary

This document presents the feasibility, key opportunities and constraints, and recommendations for the development of a trail system outside Tahlequah, OK. The terrain and landscape lend themselves to contemporary sustainable shared-use and bike-optimized trails. These trails and associated amenities would provide an engaging and exciting activity that can be enjoyed by residents of all ages and abilities. They would increase physical activity and utilize open space, while building a stronger community. Mountain bike specific trails will encourage children to explore the outdoors while socializing, improving their physical fitness, and building skills that support their growth and development. Shared-use loops will offer runners and hikers a welcome respite from the city in a scenic natural landscape. The development of this trail system will help draw tourists to Cherokee County for outdoor recreation. Lastly, Tahlequah and the surrounding region have immense opportunity to develop interconnected and modern trails that would provide many benefits and spread them throughout communities.





APPENDIX A: COST OPINION TABLE

Tahlequah Trails Cost Opinion									
Segment	Skill Level	Tril Type	Length (LF)	Length (MI)	Design	Construction	20% Contingency	Subtotals	
100	Green	Shared-use Singletrack	9461	1.79	COMPLETE	\$60,000	\$12,000	\$72,000	
101	Green	Shared-use Singletrack	4087	0.77	COMPLETE	\$25,000	\$5,000	\$30,000	
102	Blue	Shared-use Singletrack	622	0.12	COMPLETE	\$5,000	\$1,000	\$6,000	
103	Blue	Shared-use Singletrack	8360	1.58	COMPLETE	\$75,000	\$15,000	\$90,000	
104	Black	Shared-use Singletrack	1957	0.37	\$12,000	\$22,000	\$4,400	\$27,400	
105	Black	Shared-use Singletrack	1728	0.33		\$20,000	\$4,000	\$25,000	
106	Blue	Shared-use Singletrack	3149	0.60		\$25,000	\$5,000	\$31,000	
107	Green	Shared-use Singletrack	1278	0.24		\$12,000	\$2,400	\$15,400	
108	Black	Shared-use Singletrack	2462	0.47		\$30,000	\$6,000	\$37,000	
150	Green	Bike-only Gravity	1461	0.28		\$15,000	\$3,000	\$19,000	
151	Blue	Bike-only Gravity	1419	0.27		\$17,500	\$3,500	\$22,000	
152	Blue	Bike-only Gravity	1880	0.36		\$22,500	\$4,500	\$28,000	
153	Black	Bike-only Gravity	1254	0.24		\$20,000	\$4,000	\$25,000	
154	Blue	Bike-only Gravity	1466	0.28		\$22,000	\$4,400	\$27,400	
200	Blue	Shared-use Singletrack	11350	2.15		\$110,000	\$22,000	\$133,000	
201	Black	Shared-use Singletrack	3675	0.70		\$45,000	\$9,000	\$55,000	
Totals	N/A	N/A	55,610	10.53		\$12,000	\$526,000	\$105,200	\$643,200

Notes: Costs estimates are for planning purposes only. Design costs assume one (1) site visit, design costs will increase if multiple site visits are required. Permitting costs are not included and can vary based upon local, state, and federal regulations (i.e. stormwater, NEPA, wetlands, land disturbance, etc.) Construction costs assume professional trail contractors perform the work. Contingency is assumed to allow for adjustments during design and permitting.

APPENDIX B: GENERAL TRAIL PLANNING AND DESIGN GUIDELINES

The following are guidelines for the construction and maintenance of trails. The natural environment is dynamic and unpredictable. The nature of recreational trails and roads, the desired user experience, and the constant forces acting on natural surface trails and roads make strict standards untenable and undesirable. As such, the guidelines below are simply that: best management practices that should be followed within environmental constraints.

Trail System Design

Mountain Bike-Optimized Trails and Preferred Direction Trails

Mountain bike-optimized singletrack trails are designed and constructed to enhance trail experiences specifically for mountain bikers. Mountain bike-optimized trails might differ from traditional trails in several ways: enhanced tread shaping, directional or one-way travel, and the addition of man-made technical trail features (TTFs). Bicycles move differently along a trail than other modes of transportation. The movement of the wheel, the use of gravity and friction, the transfer of energy from the rider to the wheel – these offer both opportunities and constraints for trails and trail features that may differ from those of other users.

Mountain bike-optimized and one-way trails that harness gravity are a growing area of interest for mountain bikers. These trails can be designed and built at any level, from beginner friendly flow trails to extremely difficult race-oriented downhill trails. Riders cherish the feeling of flight that a bicycle provides while coasting through a succession of bike-optimized features from top to bottom. A consistent trail is not necessarily a boring or easy trail (though it can be), it's one that is designed such that a preceding section of trail prepares users for the subsequent sections. This is a hallmark of flow trails and can be particularly important for beginner trails, as well as for higher speed trails with gravity features, such as jumps and drops.

As trail systems grow and become congested, one-way trails help to take the pressure off popular shared-use trails. Riders looking for speed, thrill, and challenge will have their own designated areas, and users travelling at slower speeds will have their own trails. Well-designed mountain bike-optimized singletrack and gravity singletrack are exciting for mountain bikers but are also designed to help manage risk and minimize user conflict.



Rolling Contour Design

Providing consistent climbs and extended descents is a design priority. Trails may contour gently up or down for consistent lengths to maximize climbs and descents. This is known as rolling contour design. All shared-use trails should be of rolling contour design to minimize impact and sedimentation in the watershed.

Stacked Loops

A stacked-loop system is a series of loops somewhat like links in a chain. The loops can vary in length and difficulty. In a stacked-loop system, the loops that are closest to the trailheads are more inviting to novice riders, and the loops further out cater to more advanced riders. This creates a progression of experiences and challenges as users explore the trails in more depth.

Progressive Hubs and Clusters

A trail system of hubs and clusters looks more like spokes radiating out from a central junction and intersecting at various points. A trailhead or major intersection is a hub. A cluster is a concentration of trails radiating out from the hub. Like a stacked loop system, hubs and clusters are designed with skill level progression in mind. Hubs and clusters give users more trail options for varying skill levels at each hub, allowing for skill level diversity. At many intersections, riders have the option to change trail difficulty or continue on the same difficulty level.

With progressive trail features, a mountain biker may become a better rider by gradually moving up in trail difficulty. This practice also spreads out visitors and helps reduce trail user conflict. This is also a proven risk management tool. Signage shows difficulty levels at every hub and wherever necessary in the trail system to help users choose trails based on their skill levels and desired experience. Giving riders the option to warm up before hitting more technical segments provides a level of safety in the system.

Loops and clusters are often favored over out-and-back routes because they offer variety. People love the adventure of starting down one path and returning to the same point by way of a different trail. With loops or clusters

in a trail system, visitors can choose a short route, a combination of routes, or a long outer route.

Progressive design and construction also allow users of different levels to ride the trails in the same system, so families and groups can enjoy being together in one place and riders can find a trail that matches their skills and progress.



Trail Difficulty Rating System

In order for a trail system to provide the varied riding experiences and skill progression which trail users seek, the trails must be built to provide relatively specific challenges and riding characteristics. For the purposes of this conceptual trail plan, the difficulty rating system has been simplified into three levels:

- Easiest Trails, Green Lines (green circle) – For beginners, these trails have a smoother and wider tread, lower trail grades, and less exposure.
- More Difficult, Blue Lines (blue square) – For intermediate riders, these trails can be steeper, more technically difficult, or longer.
- Very to Extremely Difficult Trails, Red Lines (black diamond or double black diamond) – For advanced riders, these trails offer a combination of difficult trail tread, technical features, and long distances for those looking for challenge and endurance-oriented experiences. Generally, they have significant exposure and have less predictable surfaces.

This system was adapted from the International Trail Marking System used at ski areas throughout the world. Many trail networks use this type of system, most notably resort-based mountain biking trail networks. The system applies well to mountain bikers and is also applicable to other visitors such as hikers. These ratings should be posted on trail signage and in all maps and descriptions. Following is a summary of criteria to be considered when implementing a trail rating system.

Tread Width

The average width of the active tread or beaten path of the trail.

Tread Surface

The material and stability of the tread surface is a determining factor in the difficulty of travel on the trail. Some descriptive terms include hardened (paved or surfaced), firm, stable, variable, widely variable, loose, and unpredictable.

Trail Grade (maximum and average)

Maximum grade is defined as the steepest section of trail that is more than approximately 10 feet in length and is measured in percent with a clinometer. Average grade is the steepness of the trail over its entire length. Average grade can be calculated by taking the total elevation gain of the trail, divided by the total distance, multiplied by 100 to equal a percent grade.

Natural Obstacles and Technical Trail Features

Objects that add challenge by impeding travel. Examples of natural obstacles include rocks, roots, logs, holes, ledges, drop-offs. The height of each obstacle is measured from the tread surface to the top of the obstacle. If the obstacle is uneven in height, measure to the point over which it is most easily ridden. Technical trail features are objects that have been introduced to the trail to add technical challenge. Examples include rocks, logs, elevated bridges, teeter-totters, jumps, drop-offs. Both the height and the width of the technical trail feature are measured.



Trailheads

Well-placed trailheads and parking lots contribute to a successful trail system. Trailheads should be located in areas of lower elevation, as most trail users prefer outbound climbs with inbound descents back to the parking area. This also helps mitigate risk by allowing fatigued riders an easier route back to their starting point. This is especially true for mountain bikers, and necessary for families and beginners. Trailheads should offer information useful for the trail users, including trail maps, location information, emergency contact details, and volunteer information.

Sustainable Trails

A sustainable trail balances many elements and is designed to have little impact on the environment. Sustainable trails resist erosion through proper design, construction, and maintenance and blend with the surrounding area. A sustainable trail also appeals to and serves a variety of users over many years. It is designed to provide enjoyable and challenging experiences for visitors by managing their expectations effectively. Following sustainable trail design and construction guidelines allows for high-quality trail and education experiences for users while protecting the land's sensitive resources. For additional trail design, construction, and maintenance techniques, refer to *Trail Solutions: IMBA's Guide to Building Sweet Singletrack*. These guidelines are appropriate for any hike or bike trail.



Signage

The development of a mountain bike trail network requires the development of a comprehensive system of signs. Signs are the most important communication tool between land managers and trail users. A well-implemented and maintained signage system enhances the user experience by helping visitors navigate the trail network and providing information about the area. Signage also plays a critical role in managing risk and deploying emergency services.

Recommended signage for the trails should be simple, uncluttered, and obvious with a sign at every major intersection to help users stay on track. Signs should meet the needs of all users, from the daily trail user to someone who is experiencing the trails for the first time. In order to serve the variety of visitors, sign placement should be strategic and frequent. Because signs can intrude on the natural outdoor experience, too much signage can be unsightly. Balancing competing interests is key to developing a successful signage program.

Sign Types

A variety of signs can be created to help users identify trails and their location, select routes, remain confident in their trail choices, find destinations and key points of interest, and understand regulations and allowed uses. Signage can also be interpretive, helping visitors learn about responsible recreation, trail etiquette, and resource protection, as well as how to reduce risk and hazards.

Informational signs

Usually positioned at the trailhead and major intersections, informational signs provide details such as trail length and difficulty. These include signs that identify a trailhead from a road, signs at a trailhead kiosk, trail intersection signs, waymarks, difficulty rating signs, and trail length or elevation gain and loss signs.

Regulatory signs

These types of signs delineate rules, such as prohibited activities, direction of travel, or other restrictions.

Directional signs

Directional signs provide navigational information.

Warning signs

Often incorporating highly visible designs, these signs warn trail users of upcoming hazards or risks. These include visitor rules and regulations, allowed activities, road and trail intersections, and emergency signs.

Educational signs

Educational signs can provide a variety of information for trail users, such as guidelines for responsible recreation, descriptions of natural or cultural resources, trail etiquette, and bike skills.



APPENDIX C: BENEFITS OF MOUNTAIN BICYCLING TRAILS

Promoting Active and Healthy Lifestyles

The benefits of mountain biking may start on the trails, but they don't end there. Learning to ride a bike is a rite of passage. Bikes and the sport of mountain biking provide a multitude of opportunities to teach children valuable lessons that will carry into adulthood.

Obesity is at a high, while activity levels among Americans are plummeting. With its progressive nature and way of stimulating the senses, mountain biking is appealing, especially to youth, and provides an excellent form of recreation for reversing the trend toward poor health. Since riding a bike provides excellent cardio conditioning, improves strength and coordination, and burns several hundred calories an hour, it is an activity as appealing to parents as it is to kids.

The unstructured play that mountain biking provides inspires people to explore and appreciate the natural world, leading to positive associations with outdoor activities and exercise.

Mountain biking allows individuals to advance at their own pace, so kids looking for a challenge can have just as much fun as children who are more interested in exploring the scenery. Riding in nature provides an environment where children can work on their skills, have fun, and pedal their bikes without parents having to worry. Mountain biking is a cross-generational endeavor, accessible to all ages and levels of physical fitness. Going for a trail ride is an excellent way for parents to do more than support their children's activities, it's a way to share the experience. Every ride is an opportunity to create a healthy lifestyle and pass on lessons that are best learned through experience.

Several studies on physical activity have indicated that proximity to recreational facilities, such as trails, is a predictor for physical activity.

Simply put, if there are walking and biking trails nearby, then residents are more likely to use them and therefore be healthier. Physical health and exposure to nature also benefit mental health, reducing stress and increasing happiness. In addition, individual and community health translate to economic benefits by decreasing health care costs.



Contributing to Economic Growth

A well-designed trail system can stimulate economic growth by increasing activity within the local population as well as attracting visitors from outside. Trails can generate business in retail sales and services, support jobs, provide sustainable growth in rural communities, and produce tax revenue. Access to trails also correlates to a higher quality of life, thus making the community more desirable and capable of attracting new businesses and workers to an area.

IMBA assists local communities in increasing mountain bicycling tourism as a sustainable, renewable source of economic development. A mountain biking destination is one that attracts tourists to an area for the benefits of the mountain biking experience; provides visitors with all of the amenities needed to compliment, ease, and enhance their visit; and in turn creates word of mouth about the community that will draw new and repeat visits.



According to the Outdoor Industry Alliance, mountain bicyclists represent approximately 3.4% of the U.S. population, or nearly 10.6 million participants. IMBA's own research indicates that enthusiasts, who represent a portion of this overall number, travel extensively within a four-hour range and will typically devote one week per year specifically to travel to reach mountain bicycling destinations. Same-day visitors spend approximately \$35 per day in local communities while destination visitors spend closer to \$193 per day (due in part to lodging and increased meal purchases).

While mountain bicyclists are certainly willing to travel to ride, they will only do so if their destination contains a key ingredient: high-quality trails. These trails must be of a sufficient length and contain a variety of experiences, such as traditional singletrack, bike-optimized singletrack, bike parks, and shuttle options. The competition for these destination-quality locations is slowly increasing over time.

A case study in Cable, Wisconsin, clearly illustrates how a community can benefit from offering a world-class bicycling experience. Construction of new bicycle trails in Cable resulted in:

- Increased property values.
- Increased spending on bicycle related goods.
- 35 jobs created annually, adding \$523,000 to total employee compensation.
- Nearly \$1.3 million impact related to spending from mountain bicyclists.

Fostering Community Pride and Identity

Involving community members in the planning, building, and maintaining of trails fosters community pride. In order to maintain sustainable trails, care of the trail system should be managed by local enthusiasts and rely on an organized membership base. Volunteering to help with trails provides an opportunity for area residents to connect with each other and with the terrain and land that surround them. IMBA members donate nearly one

million volunteer hours to trails throughout North America every year, making volunteerism a large part of mountain bike culture.

Trails and parks also provide informal opportunities for people to meet and interact with others in a natural setting. Connection to nature is paramount to maintaining the health of the environment and making the outdoors relevant and accessible to all. Trails serve a diverse population and cultivate unity and stewardship in the community. Trails can even revitalize blighted areas, for example, turning landfills into bike parks or gravel pits into trailheads.

Preserving Open Space

Trails make communities better places to live by preserving and creating open spaces for recreation. Greenways function as hands-on environmental classrooms for people of all ages, providing opportunities to enjoy nature close up. With its abundant plant life, open spaces can decrease pollution, protect water quality, and reduce soil erosion. Economic growth and property values are also tied to open space as buyers are generally willing to pay more for property located close to parks and open space. The recreation, health, economic, and environmental benefits of trails can contribute to an overall enhanced quality of life in nearby communities.

Encouraging Positive Recreation Use to Displace Negative Use

Without a plan, undeveloped areas are often haphazardly transformed by users, creating unauthorized sites to suit their personal wants. Purposefully designing trail systems can help create diverse recreational opportunities, encourage safe use, and meet the needs of the entire community. Unauthorized trail building and dumping or other unacceptable activities can damage ecology, cause safety hazards, and leave behind debris that is both unsightly and illegal. The best way to encourage positive use is to displace negative use. A well-planned trail system can discourage and displace destructive activities with healthy recreational use that attracts visitors of all ages.

