GATEWAY OFF-ROAD CYCLISTS

Trail Proposal

Babler State Park:

Mountain Bike Trails

Presented by: The Gateway Off-Road Cyclists

GATEWAY OFF-ROAD CYCLISTS

OVERVIEW

The Gateway Off-Road Cyclists (GORC), a 501(c) 3 non-profit corporation dedicated to advocacy, design, construction and maintenance of mountain bike trails proposes to add mountain bike specific natural surface trails to **Babler State Park** in **Wildwood MO**. The trails would include two, one-way gravity trails and one, two-way trail in approximately 400 acres circled by Wirth and Guy Park Drives. This trail system would capitalize on the growing demand in the Midwest region for trails that are optimized for mountain biking. It will also enhance the recreational opportunities provided by Babler State Park by adding bike optimized trails for all ages and abilities.

BENEFITS

- Establish Babler State Park as a Destination for Mountain Biking with Purpose Built Singletrack Trails
- Utilize the Infrastructure Already in Place like Parking, Paved Trails and Camping
- Increase the Number of Park Visitors
- Promote Active and Healthy Lifestyles
- Create a Cross-Generational Activity that Provides Shared Family Activity
- Encourage Volunteerism
- Increased Local Property Values
- Creates Mountain Bike Tourism as a Sustainable, Renewable Source of Economic Development to the St. Louis Region

GOALS AND OBJECTIVES

The goal of this project is to develop a trail network that offers the beginner to advanced mountain biker purpose built trails. The plan has been crafted with the idea of developing an expanded network of bike-specific trails and skills development area. The trails and features will be designed and built in a sustainable manner, and meet conservation, education and recreation objectives. The trails will provide a progression of experiences and challenges for users to explore. These characteristics will appeal to a broad cross-section of off-road bicyclists.

ECONOMIC BENEFITS QUICK FACTS

According to the Outdoor Industry Alliance (OIA), mountain bicyclists represent approximately 3.4% of the US 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).

A 2018 economic impact study released by the Walton Family Foundation describes in detail the $137 million benefit from Northwest Arkansas to the Arkansas economy in 2017, of which that $27 million came from tourism

OAI also suggests that 60 million adult Americans ride a bike each year, and bicycling creates major economic growth in the United States:

- Contributes $133 billion annual contribution to the U.S. economy
- Supports nearly 1.1 million jobs across the U.S.
- Produces $53.1 billion annually in retail sales and services
- $6.2 billion in bicycling gear sales and services
- $46.9 billion in bicycling trip-related expenditures
- Generates $17.7 billion inannual federal and state tax revenue
- Provides sustainable growth in rural communities

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PROJECT DETAIL

The two one-way gravity trails will provide a new and unique mountain biking experience to the St. Louis region and will establish the Missouri Department of Natural Resources as a leader in outdoor recreational opportunities. Other communities have embraced trails that are specifically built for mountain bikes with progressive features. Rollers, jumps, berms and grade reversals create a "rhythm" where mountain bikers can enjoy a flow and build their riding skills. The proposed gravity trails would include these features, yet be safe for all skill levels. (See the attached drawings, general trail planning and design guidelines and trail feature description document for more detailed information)

After approval, GORC's plan would be to construct these trails in a phased approach.

PHASE 1: Construction of a 2.41 mile two-way mountain bike and hiking trail.

- Features: Single-track, natural surface, rolling, maximum 5% grade average trail designed to provide access from Guy Park Drive to the trail hub located at the high point near the Alta Shelter.
- Labeled as Trail 1 on the proposed trail concept drawing.
- Ability Level: Beginner (Green), 3-4 feet wide, dual direction.
- Construction Timeline: 10-12 months.
- Cost: $127,248 In-kind donation by volunteers. (~$10/Linear Foot)

PHASE 2: Construction of a 2.28 mile one-way mountain bike only gravity trail.

- Features: Single-track, natural surface, rolling with TTF, maximum 5-7% grade average trail descending from the trail hub located near the Alta Shelter to Guy Park Drive.
- Labeled as Trail 2 on the proposed trail concept drawing.
- Ability Level: Beginner (Green)/Intermediate (Blue), 2-3 Feet wide, single direction.
- Construction Timeline: 10-12 months.
- Cost: $120,384 In-kind donation by volunteers. (~$10/Linear Foot)

PHASE 3: Construction of a 1.81 mile one-way mountain bike only gravity trail.

- Features: Single-track, natural surface with TTF, rolling, maximum 7-15% average grade trail descending from the trail hub located near the Alta Shelter to Guy Park Drive.
- Labeled as Trail 3 on the proposed trail concept drawing.
- Ability Level: Intermediate (Blue)/Advanced (Black), 2-3 Feet wide, single direction.
- Timeline: 6 months.
- Cost: $95,568 In-kind donation by volunteers (~$10/Linear Foot)

(Note: Trails are designed to "flow" through the woods using the natural features available. The trail will weave around existing trees causing minimal impact to the natural landscape. If live trees need to be removed, they are limited to those under 2"-4" in diameter.)

The density of the proposed trails is limited to 3.2 acres or 1% of the approximate 400 acres.

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PROJECT COST

Total project In-kind donation is nearly $350,000. Total cost to Missouri Department of Natural Resources is zero. GORC is committed to providing all volunteer labor to build these trails and seeking the donation of any materials required.

MAINTENANCE

Upon completion, at least one GORC Trail Steward would be assigned to Babler State Park. The Trail Stewards job is to schedule and organize maintenance. They would work directly with the Park staff to make sure the trails are being maintained properly by volunteers.

Typical maintenance could include:

- Tread Repair – repairing damage that may have occurred due to heavy rains, fallen trees and/or improper use during poor trail conditions.
- Deberming – as trails compact causing a trough, some deberming may be required to eliminate potential water erosion issues.
- Clearing Drainages – as leaves fall, they need to be removed from drainages to aid in water removal from the trail tread.
- Clearing Trail Corridor – lopping of trees and saplings is required to maintain the proper width of the trail corridor.
- Sawyer – downed trees must be removed from the trail surface to eliminate the possibility of ride arounds or dangerous conditions. GORC has trained USFS sawyers and are willing to remove downed trees only upon approval by park land managers.

These additional services would be provided at no cost to the Missouri Department of Natural Resources.

GENERAL TRAIL PLANNING AND DESIGN GUIDELINES

The following are guidelines for the construction and maintenance of future 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.

Stacked Loops

Stacked loops enable users to share many different levels of trail. In a stacked-loop system, the loops that are closest to the trailheads are more inviting to new users, beginners, or families. This allows users of all levels to enjoy the park and improve their fitness and skill while enjoying the natural world.

Bi-directional loops offer a trail experience that can be ridden in either direction, thereby essentially doubling the trail options and allowing users to complete a loop and avoid an “out and back.” These new loops will vastly increase the trail opportunities for beginner to expert mountain bikers, including families and groups.

Progressive Hubs and Clusters

All shared-use trails are to be created with skill level progression in mind. With progressive trail features, a mountain biker may become a better rider by gradually moving up in trail difficulty. It is proposed that this trail system offer features of varying skill levels so that riders may find a trail that meet their skills and progress accordingly.

Hubs and clusters give the users more trail options for varying skill levels at each hub, allowing for progressive skill level diversity. A trailhead or major trail intersection is usually a hub. A rider may start out on a beginner trail and then graduate on to a more difficult trail at the next hub. At many intersections, there is the option to change the trail difficulty, or continue on the same difficulty level trail.

This practice spreads out visitation and helps reduce trail user conflict. Signage includes difficulty scales at every hub, and wherever necessary in the trail system, to inform users of which type of trail to choose based on their skill levels and desired experience. A “cluster” is a concentration of trails with all levels of difficulty.

A design priority is to provide consistent climbs and extended descents. In most cases the trails contour gently up or down for consistent lengths to maximize climbs and descents, known as rolling contour design. All shared use trails should be of rolling contour design to minimize impact and sedimentation in the watershed.

The most challenging trail and terrain will be further away from the proposed parking hubs, rewarding those willing to travel longer distances. This is also a proven risk management tool. Putting the difficult segments further out of reach of beginners, and giving riders time and distance to warm up before reaching those technical segments, provides a level of safety in the system.

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. Mountain bikers prefer to exert themselves the fullest on the first half of an outing, and enjoy a descent back to their vehicle on the second half. Trailheads should offer information useful for the trail users, including trail maps, location information, emergency contact details, and volunteer information.

Develop Sustainable Trails

A sustainable trail balances many elements. It has little impact on the environment, resists erosion through proper design, construction, and maintenance, and blends with the surrounding area. A sustainable trail also appeals to and serves a variety of users, adding an important element of recreation to the community. It is designed to provide enjoyable and challenging experiences for visitors by managing their expectations and their use 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, bike, or equestrian trail.

Trail Design and Sustainability

The specific alignment of a trail tread should be built to accommodate mountain bicyclists, as this user group obtains speeds greater than a hiker or runner. Comprehensive trail design, construction guidance, and bike park planning can be found in Trail Solutions: IMBA's Guide to Building Sweet Singletrack, Managing Mountain Biking: IMBA's Guide to Providing Great Riding, and Bike Parks: IMBA's Guide to New School Trails, all published by IMBA. Another recently published resource is Guidelines for a Quality Trail Experience, jointly authored by IMBA and the Bureau of Land Management (BLM).

The following excerpts outline some basic trail design sustainability guidelines as described in the above-mentioned books.

A trail's location, alignment, grades, and soil texture are some of the most critical factors affecting design. One of the most sustainable trail designs is the "rolling contour trail," characterized by a sidehill location, a gentle trail grade (<10% average), grade reversals, and an outsloped tread. A sustainable trail sheds water off of the trail while keeping users on the trail. When applied collectively, the nine principles below create trails that are low maintenance, fun to use, while helping to manage risk, environmental impact, and user conflict.

- The best location for trails is on sidehills, as opposed to flatter terrain like ridge tops, meadows, or valley floors.
- Trails should gently traverse the slope, rather than traveling directly up or down it. Trails that directly ascend/descend the hillside are known as fall line trails.
- To ensure a stable alignment, a trail's grade should never exceed half the grade of the sidehill it is located on.
- The average slope of the trail should generally average no more than 10%.
- Typically, the maximum sustainable trail grade for short (<50 feet) distances is 15%. Grades can be as low as 3% or 4%, or as high as 25% depending on various factors.
- A grade reversal is a location at which a trail briefly changes elevation, dropping subtly before rising again. This change in grade encourages water to run off the trail at the low point of the grade reversal.
- The downhill or outer edge of the trail tread should be slightly lower than the inside edge. This is called outslope, and it encourages water to sheet across and off the trail in a gentle, non-erosive manner instead of funneling down the trail's center. Most trail should be built with a 5% outslope.
- Some soils are durable and drain well while others are fragile, and erode quickly. Trail design and maintenance should be adjusted to site specific soil types.
- Proper trail design with gentle grades and sidehill location can minimize soil displacement. In areas with loose soils or high traffic, consistent flow, insloped turns, and tread hardening are also frequently necessary.

Trail "Flow"
With good flow, the speed at which a rider travels on the trail should be fairly consistent, and the rider will not have to brake and accelerate frequently. Transitions between faster and slower speeds need to be gradual, with progressively increasing and decreasing turn radii and frequent uphill segments to reduce speed where needed. Steep downhill grades should not come right before tight turns. Adjusting the cross slope of the trail tread to match the flow also helps riders stay on the trail and allows higher speeds. Designing trails with flow in mind not only provides a high quality trail experience, it helps mitigate erosion issues from runoff and use.

Signage
The development of a mountain bike trail network requires 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, helps visitors navigate the trail network, and provides 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, balancing competing interests is key to developing a successful signage program.

A variety of signs can be created to help users identify trails and their location, select routes, remain confident in their trail choices, guide users to destinations and key points of interest, and provide information on regulations and allowed uses. Signage can also be interpretative; helping visitors learn about responsible recreation and trail etiquette, learn about resource protection, and reduce risk and hazards.

- Directional signs provide navigational information.
- Informational signs, usually positioned at the trailhead and major intersections, provide details such as trail length and difficulty. These include trailhead identification signs *(from a road)*, signs at a trailhead kiosk *(with a complete map and description of all the nearby trails and facilities, local regulations, emergency contact information, and educational messages)*, trail intersection signs, waymarks, difficulty rating signs, and trail length or elevation gain/loss signs.
- Regulatory signs delineate rules, such as prohibited activities, direction of travel, or other restrictions.
- Warning signs are used to caution trail users of upcoming hazards or risks. These include visitor rules and regulations signs, allowed activities, road/trail intersections, and emergency signs.
- Educational signs provide guidelines for responsible recreation and trail etiquette.
- Interpretive signs describe natural or cultural resources. These include education/responsible use signs, and interpretive signs.

Design Flagging
It is optimal to flag the corridors just before the permitting review team is available to physically tour the flag-line, so as not to lose flags from sunlight, wind, animal, human, and natural elements. Design and flagging costs will depend on conditions, accessibility, terrain, time of year, and other factors.

Construction
Creating the proposed trail network of traditional singletrack trails and mountain bike optimized trails, will guarantee a unique destination, drawing riders from afar while giving local families and residents an exhilarating outdoor activity close to home. Construction should be provided by a combination of skilled experience builders, especially for the mountain bike optimized trails, and a hybrid construction plan with volunteers providing much of the preparation and finishing work between machine operators. A phased plan of action will ensure continued

enthusiasm for the trails. Machines applicable to the landscape and style of trails include: mini-excavators, mini-skid steers, tracked haulers and plate compactors.

When constructing trails, follow these guidelines:

Do not exceed the Half Rule — A trail's grade shouldn't exceed half the grade of the hillside or sideslope that the trail traverses. If the grade does exceed half the sideslope, it is considered a fall-line trail. Water will flow down a fall-line trail rather than run across it. Measure the sideslope with a clinometer, then be sure to keep the tread grade below half of that figure in order to ensure good drainage. For example, if you're building across a hillside with a sideslope of 20 percent, the trail-tread grade should not exceed 10 percent. There is an upper limit to this half rule: You must also apply knowledge about maximum sustainable grades. Very steep trails will erode even if their grade meets the half rule. For example, a trail with a grade of 24 percent that traverses a steep, 50-percent sideslope will be unsustainable even though it complies with the half rule.

Follow the Ten Percent Average Guideline — Generally, an average trail grade of 10 percent or less is most sustainable, average trail grade is the slope of the trail from one end to the other. Many trails will have short sections steeper than 10 percent, and some unique situations will allow average trail grades of more than 10 percent. A trail's average grade is calculated by dividing total elevation gain by total length, multiplied by 100 to convert to percent.

Do not exceed the Maximum Sustainable Grade — Maximum sustainable trail grade is typically about 15 percent; it is site-specific and fluctuates slightly based on several factors. The variables to be considered when setting your target maximum trail grade include:

Half Rule - Soil Type – Rock - Annual Rainfall Amount - Grade Reversals - Type of Users - Number of Users – Difficulty Level

Construct Grade Reversals — A grade reversal is just what it sounds like—a spot at which a climbing trail levels out and then changes direction, dropping subtly for 3 to 15 linear meters before rising again. This change in grade forces water to exit the trail at the low point of the grade reversal, before it can gain more volume, momentum, and erosive power. Grade reversals are known by several different terms, including grade dip, grade brake, drainage dip, and rolling dip.

Construct trails that Outslope about 5% — As the trail contours across a hillside, the downhill or outer edge of the tread should tilt slightly down and away from the high side. This tilt is called outslope, and it encourages water to sheet across and off the trail instead of funneling down its center. Outslope is one reason why contour trails last for years and years. IMBA recommends that all trail treads be built with a 5-percent outslope.

Avoid The Fall Line — Fall-line trails usually follow the shortest route down a hill, the same path that water follows. The problem with fallline trails is that they focus water down their length. The accelerating water strips the trail of soil, exposing roots, creating gullies, and scarring the environment.

Avoid Flat Areas — Flat terrain lures many trail builders with the initial ease of trail construction. However, if a trail is not located on a slope, it will become a muddy wet basin full of water. The trail tread must always be slightly higher than the ground on at least one side of it so that water can drain off properly.

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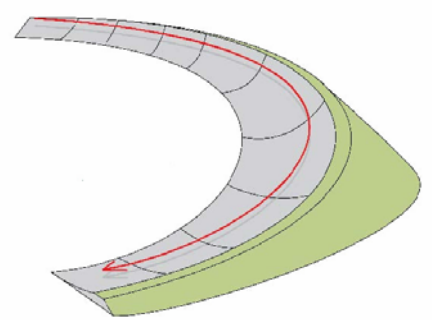
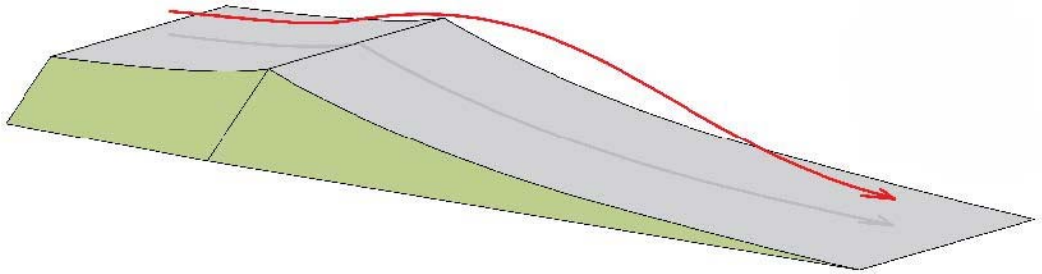
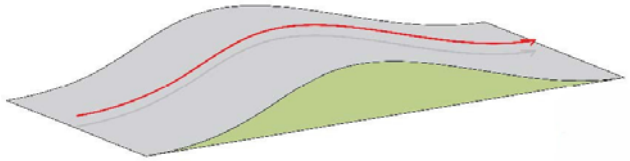
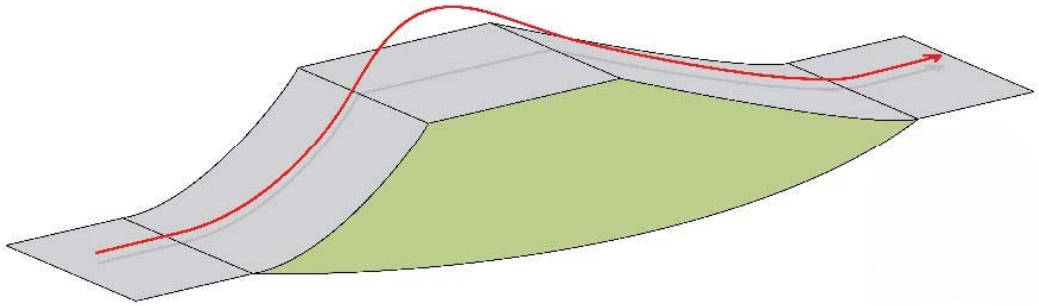
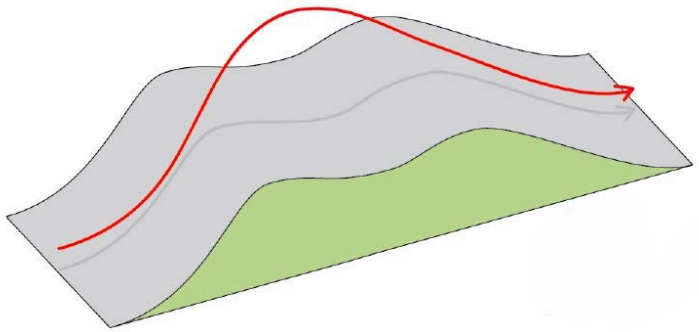




MOUNTAIN BIKE TRAIL FEATURES







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MOUNTAIN BIKE TRAIL FEATURE – Berms

DESCRIPTION

A berm is a banked and curved cornering feature on a trail that provides support for the rider when turning a corner allowing them to turn in a smooth manner. A berm allows the user to maintain speed while cornering. The features are usually located on flat or downhill section of trail. A beginner graded berm will be generally open and shallow with more difficult berms encompassing tighter angles, steeper surfaces and higher entrance speeds. The speed at which a berm is ridden increases with rider skill and experience. Berms may also be used as trail feature in themselves, with a series of berms on a descent being a typical feature of modern bike trails.

DESIGN COMMENTS

It is important to ensure that a berm is continued around a bend to a point where the rider is able to exit safely on the line of the trail. Riding the feature during construction will indicate the correct exit point much better than design sketches. The trail formation specification needs increasing for berms that are to be ridden at higher speeds or is on steep gradients.

CONTRUCTION METHODOLOGY

Berms are created by either constructing a bank from earth or stone or identifying an existing bank/gradient that has suitable properties for the trail. A basic 20-45° bank should be formed in a rough semicircle of 8-10' radius with an inverted dished face and suitable turning angle for the grade of trail. A trail compactor may be used to compact the earth or stone into the face of the berm, which should appear sealed when finished with no loose stone. An appropriate drainage area on the inside of the berm should be excavated to ensure water is shed successfully off the surface.

CONSTRUCTION MATERIALS

Local earth/soil
Local stone

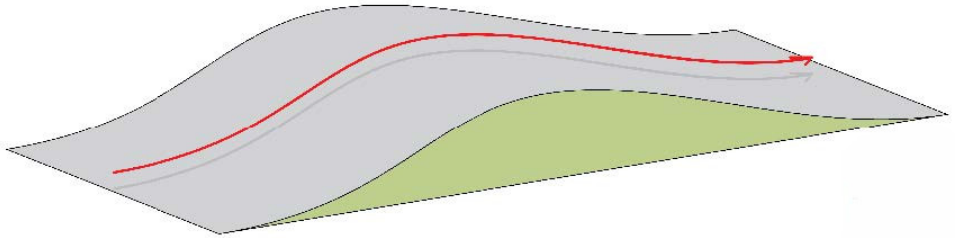
CONSTRUCTION MACHINERY

Hand Tools
Dumper
Mini-Skid Steer
Compactor

MOUNTAIN BIKE TRAIL FEATURE – Rollers

DESCRIPTION

A roller is a trail feature where the trail surface rises then falls smoothly, which should be ridable without pedaling. As the name suggests, rollers are designed to be rolled over. Skillful riders can use rollers to gain speed and control by 'pumping' them. Rollers can occur on the trail singularly, or in series, depending on the grade of the trail. On intermediate grade trails, rollers should generally be singular, although multiple rollers could be used if there is a minimum of a bike length (~6') gap between them. Advanced grade rollers can occur in succession and are steeper, taller and spaced closer than intermediate grade. Expert grade rollers should be technically challenging to ride, due their steepness and height. In some cases, riders can jump from one roller to another.



CONSTRUCTION METHODOLOGY

Rollers can be constructed from material on site or from imported material from local sources. Rollers can be built up on flat terrain, or use naturally occurring features. If built on flat terrain, a roller can be expected to use typically ½ ton of sub base. Machinery should be used to import and manipulate material into the appropriate spacing and heights. The shape of the rollers should then be refined using hand tools. The trail surface should be built according to specifications.

CONSTRUCTION MATERIALS

Local earth/soil
Local stone

CONSTRUCTION MACHINERY

Hand Tools
Dumper
Mini-Skid Steer
Compactor

MOUNTAIN BIKE TRAIL FEATURE – Jumps

DESCRIPTION

A jump is an exciting trail feature allowing riders to take off from the ground and land safely using their momentum. The larger the feature, the more severe the grade of jump. The entrance to and exit from a ramp is usually long which provides a safe environment within which to gain momentum, undertake the feature and land safely. Jumps may be constructed on all gradients, making them ideal trail features.

DESIGN COMMENTS

Poorly constructed jumps are dangerous. Focus should be on creating entrance and exit to the feature which will enable users to take the jump at different speeds requiring different skill levels.

CONSTRUCTION METHODOLOGY

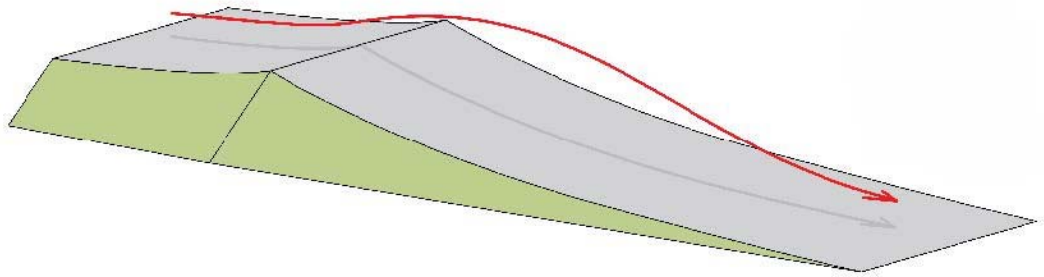
A machine should construct a solid ramp out of local or imported earth or stone. Dumpers may import material and ramps may be shaped roughly by the machine before being finished by hand and compacted. Rocks and boulders may be installed on the lip of the ramp to allow users to drop off or roll out of the jump if the feature is not to be 'jumped'. Slabs or extra stone may be laid on the feature landing to reduce erosion caused by landing bikes. The route corridor at the entrance and exit to the jump should have a good line of sight.

CONSTRUCTION MATERIALS

Local earth/soil
Local stone

CONSTRUCTION MACHINERY

Hand Tools
Dumper
Mini-Skid Steer
Compactor



MOUNTAIN BIKE TRAIL FEATURE – Tabletop

DESCRIPTION

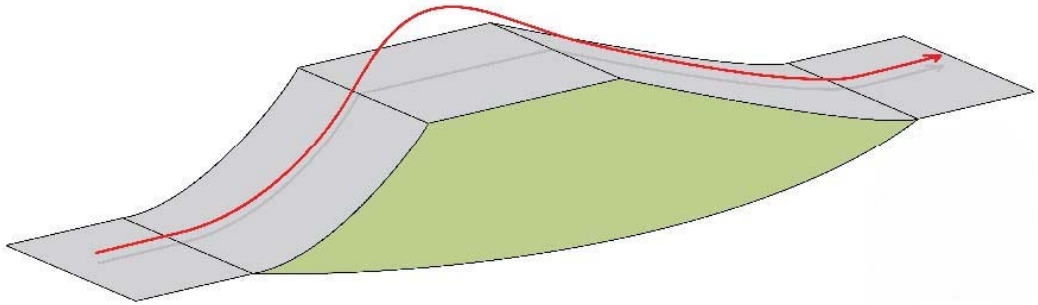
A tabletop is a jump feature allowing riders to experience jumps with a gap between the take-off and landing in a safe and controlled manner. The feature is fundamentally a take off ramp with a flat top and a downslope. The advantage of using this type of jump is that the gap is not mandatory allowing a rider to lump onto the flat top of the jump, working their way up to jumping to the downslope of the landing. The difference in tabletop design between moderate and severe grades of trail is focused on the gradient encountered on the up and down slopes, the height of the ramp to be navigated and the overall length. Tabletops can be constructed out of earth or stone material. It should be noted that whilst tabletops allow riders of all abilities to attempt the jump, the lip of the take-off is therefore more susceptible to erosion than jumps with mandatory gaps.

DESIGN COMMENTS

Dividing the entry route into two will provide opportunity to offer users different approach options to the same feature (e.g. steeper and cambered options for more difficult grades).

CONSTRUCTION METHODOLOGY

A tabletop feature is usually constructed from stone or earth that has been imported from appropriate local sources. A machine should be used to form material into a flat topped mound of



CONSTRUCTION MATERIALS

Local earth/soil
Local stone

CONSTRUCTION MACHINERY

Hand Tools
Dumper
Mini-Skid Steer
Compactor

MOUNTAIN BIKE TRAIL FEATURE – Roller Double

DESCRIPTION

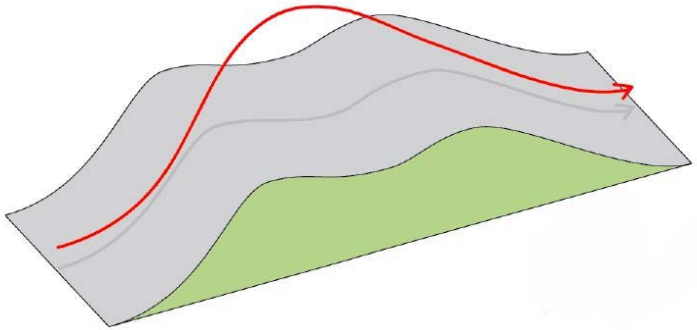
A roller double is a manmade jump feature with a smooth, shallow bowl between the take-off and landing slopes. This allows the feature to be rolled over providing an inclusive feature with no opt out route necessary. The difference between a moderate (intermediate) roller double jump and more severe grades (advanced) is the length, height and angle of transitions.

DESIGN COMMENTS

Roller double jumps are good for trails requiring features to be included for a variety of skilled users. Less able users will be able to simply roll over the feature whereas better riders can perform a large jump.

CONSTRUCTION METHODOLOGY

A roller double jump may be constructed from stone or earth found on site or which has been imported from appropriate sources. An mini-skid steer or excavator should be used to form local material into two ramps with a rollable center and side slope of no more than 45°. A compactor should be used to compact the material at regular intervals to a required height. A final stone or clay should be installed in a tray on the top of the ramps and compacted so that the surface appears sealed. The entry on the first ramp may be split into 2 to provide different angles of approach. The landing points on the downhill of the second ramp can be fortified with extra stone or clay and should be elongated to provide a safe landing strip.



CONSTRUCTION MATERIALS

Local earth/soil
Local stone

CONSTRUCTION MACHINERY

Hand Tools
Dumper
Mini-Skid Steer

MOUNTAIN BIKE TRAIL FEATURE – Grade Reversal

DESCRIPTION

Grade reversals are a feature that can be used when traversing a side slope where a full bench cut is required. The feature helps to maintain trail flow, add interest, control speed and shed water at strategic points across a traverse, by using the undulating trail gradient. The line of the trail can be descending, slightly ascending or flat. The gradient of grade reversals can vary hugely in length, height, and frequency. Riders can gain speed by pumping the down sides of the reversals and carry momentum up the next incline before repeating. Grade reversals are also very useful for managing runoff on the trail surface, as water can be shed quickly from the troughs of the grade reversals. This avoids high volumes of water flowing on the trail surface and therefore reduces erosion. Grade reversals on a true beginner trail are generally smooth and low with more technical grade reversals encompassing shorter wavelengths, higher amplitudes and faster entrance speeds. The speed at which grade reversals are ridden, increases with rider skill and experience. For best practice, the trail gradient should always be less than half that of the side slope.

DESIGN COMMENTS

Routing the trail above large boulders and trees helps to provide natural demarcation and avoids undermining root systems.

CONSTRUCTION METHODOLOGY

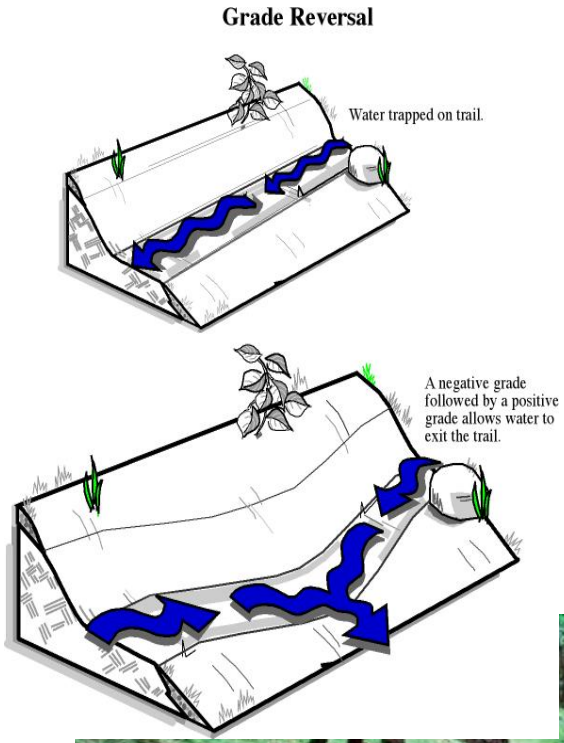
Create a full bench cut (either by creating a platform with hand tools or a mini-skid steer) and make sure the trail is constantly moving up or down. It is important to ensure that water can exit on the grade dips. A ditch and/or a culvert may be necessary. Once the shape is correct, a compactor should be used to compact the tread, which should appear sealed when finished with no loose stone.

CONSTRUCTION MATERIALS

Local earth/soil
Local stone

CONSTRUCTION MACHINERY

Hand Tools
Dumper
Mini-Skid Steer



GATEWAY OFF-ROAD CYCLISTS

5673 Wrenwyck Place, Weldon Spring, MO 63304

www.gorctrails.com

MOUNTAIN BIKE TRAIL FEATURE – Pump Track

DESCRIPTION

Pump tracks are an easy way to add challenge to an existing trail system. Pump tracks consist of bumps (called rollers) and earthen berms that vary in height and frequency. These land forms allow riders to navigate through the pump track course without pedaling by absorbing the front side of the rollers and compressing the back side. They are relatively small in overall size and can fit anywhere. For land managers, pump tracks provide a fresh, low-risk recreation option in a central, easily managed location. Pump tracks provide a fun place for kid's to play, experienced riders to learn new skills and friends/family a place to hang out.

DESIGN COMMENTS

The pump track will be designed with features that are suitable for riders of all abilities. It will be designed to allow riders to develop skills and experience needed for more advanced features. Minimum size should be 600 square feet and be built on a slight grade of 2-5 percent for drainage.

CONSTRUCTION METHODOLOGY

Existing dirt can be used, but it's best to import loam with fairly high clay content. Over time, the soil will compact, which will aid in drainage and sustainability. The use of materials other than compacted soil may be considered in the construction of pump tracks. These other materials will be selected based on durability and their need for on-going maintenance. Construction begins with the berms and then rollers are spaced evenly between.

CONSTRUCTION MATERIALS

Local earth/soil

CONSTRUCTION MACHINERY

Hand Tools
Dumper
Mini-Skid Steer
Compactor

5673 Wrenwyck Place, Weldon Spring, MO 63304
www.gorctrails.com

MOUNTAIN BIKE TRAIL FEATURE – Family Trail

Description

A family trail provides a safe introduction to the sport of mountain biking. This is classified as the easiest of all trails and should be able to be ridden by all users on any type of off-road bicycle. The trail is wide and free of major obstacles while maintaining a nearly flat grade. The ideal location is close to the trailhead/parking area.

Design Comments

The family trail will utilize many of the same concepts as pump tracks but arrange these features in a linear manner to create a trail. The trail will be 36” to 48” wide and free of major obstacles with possible advanced alternate lines provided to promote skill progression. Grades should be kept to less than 3-4% with no steep climbs.

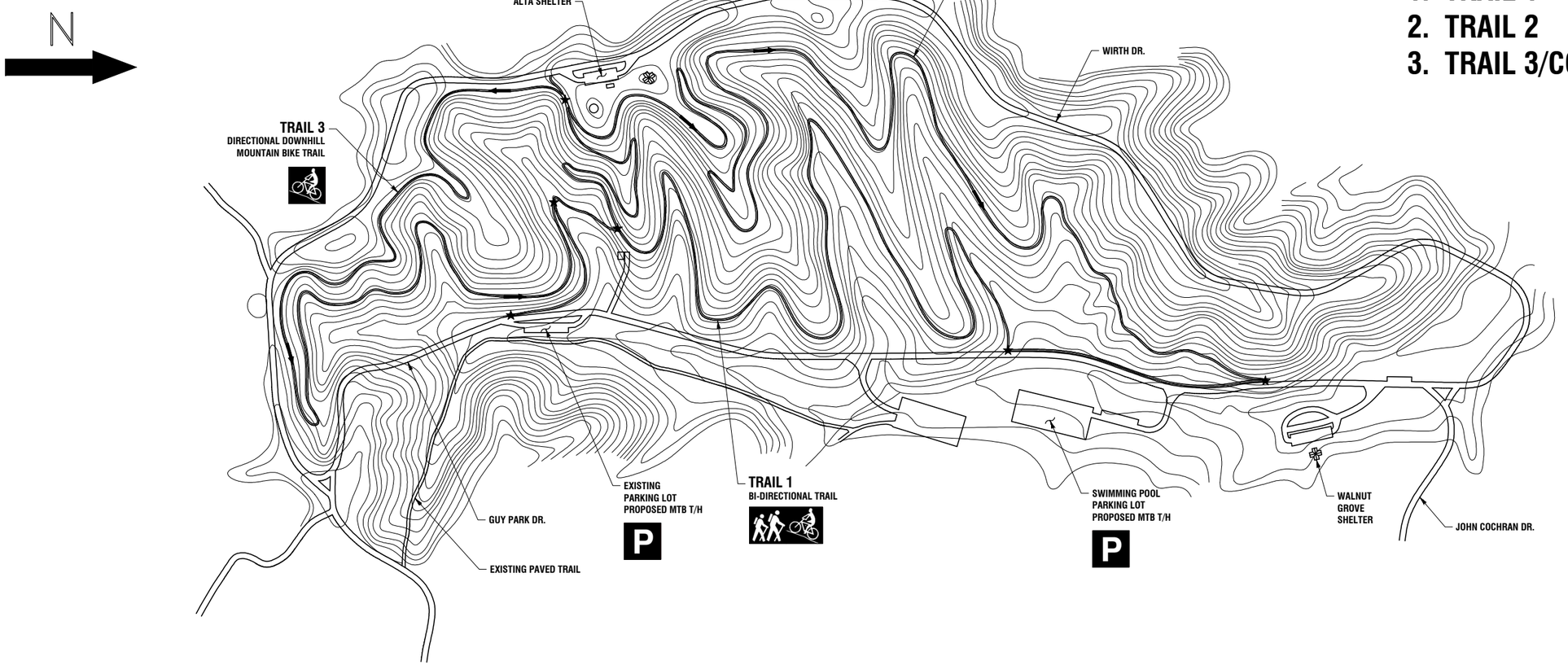
Construction Materials

Local earth/soil
Local stone

Construction Machinery

Hand Tools
Dumper
Mini-Skid Steer
Compactor

BABLER STATE PARK CONCEPTUAL PLAN



PROPOSED PHASES:

1. TRAIL 1
2. TRAIL 2
3. TRAIL 3/CONNECTOR

LEGEND

- PARKING
- HIKING
- MOUNTAIN BIKING
- TRAIL INTERSECTION

TRAIL 1

LENGTH: 12,713 FT. (2.41 MILES)
AVERAGE GRADE: 5%
TOTAL GAIN/LOSS: 234 FT.
MAXIMUM ELEVATION: 737 FT.
MINIMUM ELEVATION: 503 FT.

TRAIL 2

LENGTH: 12,010 FT. (2.28 MILES)
AVERAGE GRADE: 5-6%
TOTAL LOSS: 234 FT.
MAXIMUM ELEVATION: 755 FT.
MINIMUM ELEVATION: 521 FT.

TRAIL 3

LENGTH: 9,568 FT. (1.81 MILES)
AVERAGE GRADE: 7-8%
TOTAL LOSS: 125 FT.
MAXIMUM ELEVATION: 747 FT.
MINIMUM ELEVATION: 622 FT.

REV	DATE	DESCRIPTION	DISP	EWO	DFT	CK	APP
A	3-21-2019	FIRST ISSUE					

JOB/LOCATION: BABLER STATE PARK – PROPOSAL WILDWOOD, MO
CUSTOMER: MO DEPT. OF NATURAL RESOURCES MISSOURI
P.O. NO.: –
GORC ORDER NO.: –
THIS DRAWING CERTIFIED FOR CONSTRUCTION

UNLESS OTHERWISE NOTED:
DIMENSIONS ARE IN INCHES
INSIDE BEND RADII = 1 METAL THICKNESS
TOLERANCES ARE:
FRACTIONAL ± 1/8
2 PLACE DECIMAL ± .06
3 PLACE DECIMAL ± .030
ANGULAR ±

CROSS REF
NEXT ASSEMBLY
SCALE: NONE

MOUNTAIN BIKE TRAIL PROPOSAL
DIRECTIONAL FLOW TRAILS AND XC TRAIL
BABLER STATE PARK – WILDWOOD MO

GORC
Gateway Off-Road Cyclists

SHEET	SIZE	DRAWING NO.	REV
1	D	BSP-1	–