



Mountain Bike Facilities Master Plan

March 24th, 2023 - Draft Version



PURPOSE:

The following plan describes a road map to guide the development and management of mountain bike facilities in the City of Lincoln.

Mountain biking enthusiasm, both nationally and locally, has been building for the past couple of decades. The city has long maintained natural surface trails in Wilderness Park, but the flat nature, frequent flooding, and flood regulations of that park make the kind of features desired by mountain bikers difficult to construct and maintain. In 2017 a group of mountain biking enthusiasts approached the Lincoln Parks and Recreation Department with a plan to construct a single-track facility in an underutilized area of Van Dorn Park. Once plans and agreements were finalized, this track was constructed by volunteers with the support of the surrounding neighborhood associations. While the Lincoln Parks & Recreation Department (LPR) does not have the resources to track park usage, observations and testimony indicate the community interest and visits to this park dramatically increased, demonstrating a demand for mountain biking facilities in the Lincoln area.

As is often the case when a new facility type is added to the park system, LPR planners investigated mountain biking, conducted site visits, and received professional training on the proper construction and maintenance of mountain biking facilities. After several years of successful partnership with Trails Have Our Respect (THOR) at the Van Dorn single track and development of the 2022 Single Track Trails: Improvements and Features, 2022 Edition (See Appendix A), LPR began a master planning process to look at community level of service and potential sites for the expansion of public mountain biking facilities in Lincoln.

The Mountain Bike Facilities Master Plan Working Group began a series of four meetings in October of 2022. They reviewed a large amount of information, conducted site visits to various park properties and reviewed public comment gathered at two points in the process. The goals of this Working Group were as follows:

Working Committee Goals:

- A** Discuss range of mountain bike facilities in Lincoln and the Level of Service.
- B** Recommend priority locations for facilities to serve the community equitably.
- C** Discuss different frameworks for design and management of mountain bike facilities.
- D** Discuss timing for projects and different funding strategies.

The members of this working group represent cycling enthusiasts, community organizations, and industry professionals. **The Lincoln Parks and Recreation Department, and the City of Lincoln would like to thank these individuals for their dedicated service and the experience and insight they shared.**

Working Group Members:

Jason Brummels, Trails Have Our Respect
Nathan Lowry, Pedestrian Bicycle Advisory Committee
Jim Crook, Parks and Recreation Advisory Board
Dwight Brown, Great Plains Trails Network
Chris Spargen, Trails Have Our Respect
Audrey Krimm, Nebraska DEVO
Matt Avey, Lincoln Public Schools.
Kris Sonderup, Cycle Works
Jim Carveth, MTN Bike Community
Yun Saksena, NE Interscholastic Cycling League
Kyle Hansen, University of Nebraska-Lincoln
Isaac Remboldt, Lincoln Bike Kitchen
Tim Beckman, Star City BMX
Audrey Saksena, Youth Representative
Joselyn Poore, Youth Representative

PUBLIC INPUT

The first step in the process to develop a master plan was to reach out to the Lincoln Community for information about current usage and the desire for future mountain biking facilities. Information gathered through an online community survey included questions such as – What types of facilities should we plan for? What do we need in order to support those facilities? What skill levels should be planned for?

The survey was held open from September 22 to October 12, 2022. A press release, Twitter and Facebook messages were used to promote the survey. Members of the Working Group were also asked to spread the word to user groups and other contacts. Responses were received from 540 individuals who indicated they represented approximately 500 additional mountain bikers in their households. Approximately 73% of the respondents were male, 24% female, and 2% preferred not to say. Respondents fell into a wide variety of age groups with the largest group (29%) being 36-45 years old. About 2/3 indicated they were at least proficient in their mountain bike skills and rode at least weekly. While there was not a high preference for trails close to home, there was preference for commuter and recreational trail proximity to make mountain biking easier for young people to access.

There was support for a wide variety of mountain bike facilities (types discussed below) with pump tracks, single track and skills courses receiving the most support. Some recreational/support facilities that were desirable for nearby access were picnic areas, disk golf courses, playgrounds and skate parks. Respondents indicated that off-street parking, a water source, bathrooms, trash receptacles and picnic tables were supporting services most desired at mountain biking facilities. Some of these services could be shared with other park facilities and in some cases would represent new services that would need to be established. The full survey report is attached to this document as Appendix B.

A second opportunity for public input was provided as the Working Group reviewed various potential single track facility sites. A virtual open house was held from January 9th through 23rd, 2023. Participants were invited to watch a short presentation and then to visit an interactive map where they could view the 19 sites being considered and leave comments. Participants were also invited to enter comments through a web portal. These comments were considered by Working Group members as they deliberated priorities for future single-track sites.

The Draft Mountain Bike Facilities Master Plan was released for public review and comment from March 3 through April 13, 2023. All comments were gathered and shared with the Parks and Recreation Advisory Board. After discussion with the facilities subcommittee, the Parks and Recreation Advisory Board hosted a public meeting on May 11, 2023, where they received public comment and took action to endorse the Mountain Bike Facilities Master Plan.

MOUNTAIN BIKE FACILITIES

The origins of mountain biking can be traced back to every child that ever built a ramp out of a piece of plywood and a couple of cement blocks in their back yard. There is an adaptive and creative nature to the evolution from those ad hoc ramps to the complex and precisely engineered jumps of today's mountain biking facilities. As the sport has evolved, standards and common naming have developed that inform this plan as well as the Single-Track Trails: Improvements and Features document referenced earlier. Ideally, over time the Lincoln community would develop a range of facility types to provide a wide variety of experiences at different skill levels.

Natural Surface Bike Trail

This is the simplest type of mountain bike facility and is a non-technical, often multi-use and multi-directional facility. A plain bike trail does not have any integrated features and typically has a smooth, wide trail surface. These trails can serve as an entry level into mountain biking. In Lincoln, natural surface trails can be found in Wilderness Park.

Single Track

Single track is trail that is designed to travel in single file and is typically 18 to 24 inches wide. Because the trail does not have adequate width for passing, users travel in a single direction. Single track can be single use or multi-use; however, when pedestrians are included in the design it is recommended that the direction of travel be opposite cyclists in order to assist with visibility. Single track trail can be any length but longer lengths are considered more desirable. At the writing of this master plan, there is one single track trail facility in Lincoln located in Van Dorn Park.

Single track may have features appealing to a wide variety of skill requirements. Typically, signage will identify the level of experience suggested for a given track or feature. Features are often constructed with varying height or grade to allow users of various skill levels to experience them by slightly varying the course followed. Features are described in more detail in the Single Track Trails: Improvements and Features, 2022 Edition (See Appendix A).

Skills Course or Track

Skills courses are designed to allow riders to experience and develop skills on different features. They are usually shorter than a single-track course and the features are more closely spaced in relation to one another.

Pump Track

A pump track is carefully designed to allow a rider to use gravity to gain height and pick up speed on decent. When well-planned and constructed riders can complete a pump track loop with very little added pedaling simply by using the exchange of gravitational and kinetic energy. Pump tracks can be designed for various skill levels and/or may include feature options to allow riders of varying skill to enjoy the same track.

Dirt Jumps

Dirt jumps are specifically designed for the rider to be able to "catch air", often performing tricks while air born. Dirt jump tracks are typically flat overall and require the rider to attack the uphill in order to generate enough speed to leave the ground on the downhill side. Dirt jumps may be constructed as a looped trail.

Slalom Course

A slalom course involves two or more single tracks that are essentially identical and located side by side, usually on a downhill slope, to allow two riders to compete against one another.

LEVEL OF SERVICE

One of the first and most important steps in master planning is development of a desired Level of Service for the community. The Level of Service, or LOS, refers to both the number and geographic location of facilities needed to serve the full community. This information helps to set goals and prioritize investments. In some cases, national data from similar communities can provide insights into the appropriate LOS. In other cases, particularly with emerging recreational activities, there may not be enough information from similar communities to be able to answer these questions.

Organized, publicly supported mountain biking is a recreational activity that is new enough that level of service information is not readily available. While some communities such as Belville, Arkansas, and Boulder, Colorado, have extensive systems, most other communities either have none or are just beginning to develop mountain biking into their parks and recreation systems. LPR and the Working Group members collaborated to develop a LOS goal specific to the Lincoln community.

The LOS speaks to two specific goals for mountain biking in Lincoln. First, providing recreational opportunities located equitably across the community. Second, providing experiences for all levels of skill so that the beginner has space to learn safely and build confidence and experienced riders have facilities that provide challenge and enjoyment.





THREE TIER LEVEL OF SERVICE:

In order to provide a variety of mountain bike facilities equitably across the community, the following three tier approach to reach a Level Of Service over time is proposed:

Tier 1:

A major Bike Park with a wide variety of mountain bike facilities to serve as a major event site and potentially attract users to Lincoln from around the region. This Bike Park could include:

- Single track
- Dirt jumps
- Pump tracks
- Skills courses
- Slalom course

Supporting facilities such as off-street parking, restrooms, picnic areas, playgrounds and bike repair stations could also be included. The bike park should be located so there is (a) adequate access from major roadways and trails, and (b) nearby services such as restaurants and hotels in order to serve as a regional attractor.

Tier 2:

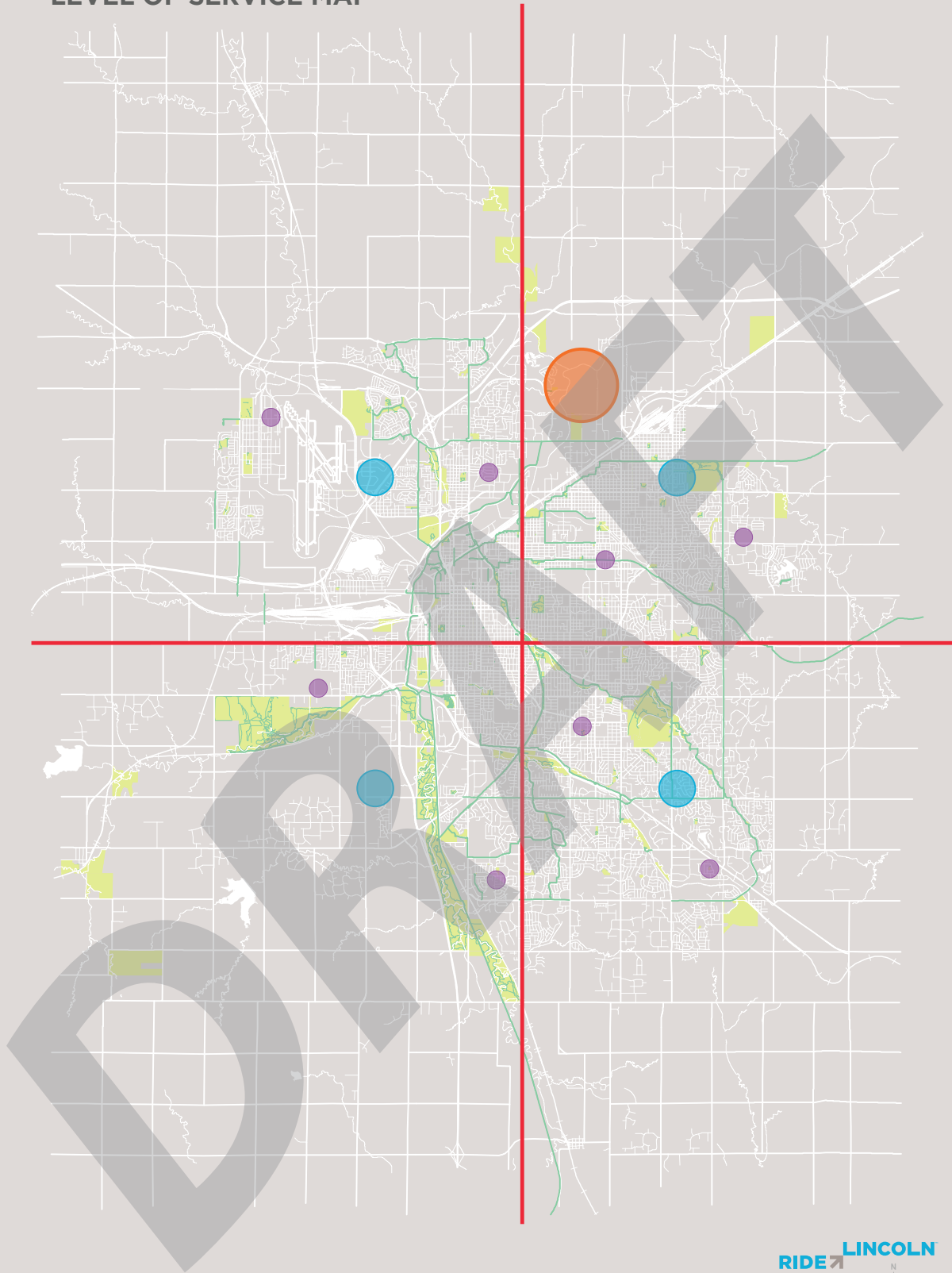
A single track facility in each of Lincoln's four quadrants (SE, SW, NE and NW). These facilities should have off street parking and access to nearby trails. Supporting features such as trash receptacles, water fountains, and picnic tables should be part of site development. Location near playgrounds, picnic shelters and other recreational activities such as skate parks and disk golf courses is desirable. Site selection and design should involve consideration of topography as well as soils.

Tier 3:

Neighborhood mountain biking facilities as opportunities arise. Smaller scale mountain bike features and facilities could be located along wide trail corridors or within parks. These may include pump tracks and skill courses, single skill features, single-track trail adjacent to commuter and recreational trails or other such features. The scale of these additions should be such that it does not act as an attractor for the wider community but rather serves the smaller neighborhood area, except in cases where off-street parking is available. The siting of these facilities will be primarily dependent on the interest of the surrounding neighborhood and the appropriate characteristics of the site.

CITY OF LINCOLN

MOUNTAIN BIKE FACILITY LEVEL OF SERVICE MAP



— City quadrants with center at about 27th and A Streets



Major Bike Park



Large Single Track



Neighborhood Scale Mountain Bike Facility

*This is a generalized map and not meant to show final location

RIDE LINCOLN

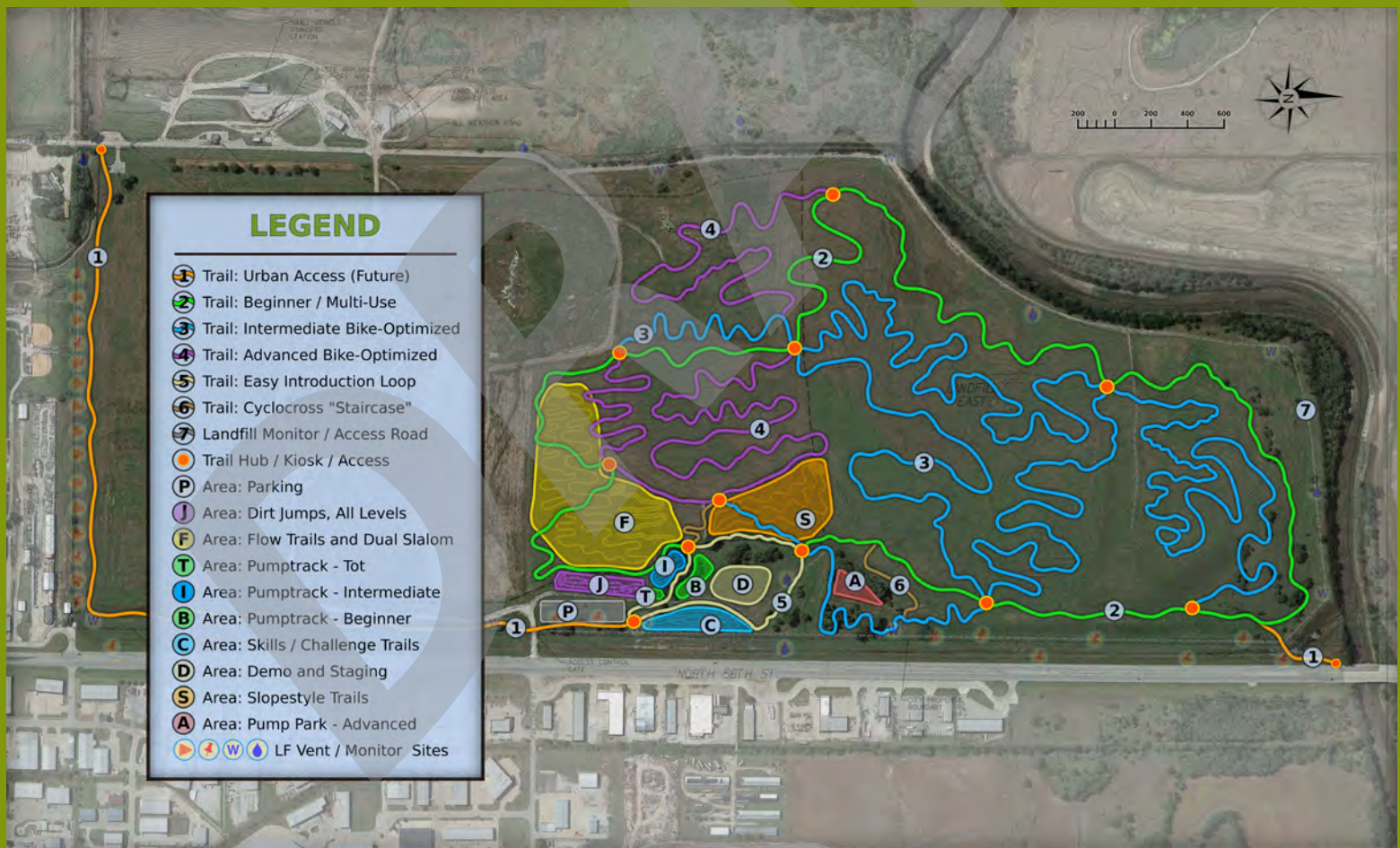


SITE SELECTION

Tier 1: Major Bike Park

For the past decade, LPR has been planning for a bike park facility as part of the end use plan for the Construction and Demolition Land Fill at N. 56th and Fletcher Road. The Working Group confirmed this location as the preferred site for the Tier 1 facility. The site offers excellent access to Interstate 80 and NE Highway 77 as well as many hotel and restaurant services nearby on N. 27th Street and in the Havelock neighborhood. Commuter and recreational trail access is available along Superior Street and is planned on N. 48th Street and along Alvo Road in the future.

In 2015, Trails Have Our Respect worked with the International Mountain Biking Association to evaluate the site and prepare a preliminary layout of features. This conceptual layout will serve as a template moving forward.



Lincoln NE - N. 48th Street Landfill Bicycle Facility

Conceptual
Site Plan
Winter 2015

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NEBRASKA



Lincoln Parks
& Recreation



SITE SELECTION

Tler 2: Quadrant Single Track

A majority of the Working Group's effort was toward selecting a site in each quadrant of the City where single track facilities might best be developed over time. This process started with an initial screening of all park properties three acres or larger in size. This set of properties was then reviewed to identify those sites that had an unprogrammed (no existing recreational uses) area of at least three acres. The resulting group was then screened to eliminate any areas that may already have been identified for other future recreational uses.

A list of 35 candidate sites was developed from this initial evaluation and presented to the Working Group. Each Working Group member selected one to three sites to visit in person and returned to the second meeting with their notes and observations from those site visits. During the meeting, each site was evaluated for general suitability for future development, facilities already in place and the characteristics of surrounding development that might support future single-track development. Each site was discussed and the various opportunities, as well as challenges, were reviewed. Working Group members then voted on whether to drop the site from consideration, gather additional information, or move forward with the site for additional analysis. A list of 19 potential sites emerged from this process.

Over the next two months, additional GIS analysis was performed on the 19 sites. Soils were evaluated for suitability and it was found that only a few isolated areas within some parks would be unsuitable, with all of those areas easily compensated for with proper design. Slopes were also analyzed and broken into three general groups: Flat (Red) being between 0% and 5%, Ideal (Green) being between 6% and 20%, and Steep (Yellow) being 21% or greater. A discussion of the selection of these categories is detailed in Slope Percentage Categories (Appendix C)

An interactive map was developed and both Working Group members and the general public were asked to share their comments on the suitability of each site. With the goal of selecting one primary priority site and one secondary priority site in each quadrant, Working Group members evaluated each site, discussed the relative benefits of each, reviewed comments that had been submitted by the public, and voted for priorities. The following sites were selected as the Primary and Secondary Priority in each quadrant of the City:

General note: Areas analyzed did not always include the full park site as many parks also include other activity areas. The area analyzed is preliminary and may need to be adjusted to accommodate more detailed design and access. While slope percentage is important when selecting a site, it is important to note that proper design can account for both Flat and Steep areas and the presence of these slopes, which are outside the Ideal range should not be reason alone for disqualifying a site. Primary sites refer to the highest priority area, secondary sites are considered slightly lower. Secondary sites could either serve as an alternative should the primary site be found to have challenges not yet realized, or they may serve as a future second single-track facility site if demand warrants.

SOUTHEAST QUADRANT

Generally bound by A Street on the north and S. 27th Street on the west

Primary Priority: Jensen Park

This community park located near S. 84th Street and Yankee Hill Road is in the early stages of development. Access from the Billy Wolff Trail and the Yankee Hill Trail is available. The Beal Slough Trail is planned for construction in 2024 and would provide a connection from the Boosalis Trail. In the future, the Wilderness Hills Trail is also planned to provide access and will include a grade separated crossing of S. 84th Street. Vehicular access to this location from S. 84th Street, Nebraska Parkway and the South Beltway is also good.

The park is approximately 190 acres in total and an area of about 29 acres, primarily along the wooded waterways, was the focus of this analysis. Approximately 42% of the area analyzed had slopes in the Ideal to Steep categories and the overall slope is 14.9%. Design will need to take into account waterway crossings and flood zones. A wide array of supporting services is planned for the park and a parking lot and ballfields are currently available in the northeast corner of the park. This park does have a master plan for future uses which should be reviewed and possibly amended to account for any single-track development.

Secondary Priority: Holmes Lake Park East

This area within Holmes Lake Park (regional park) is located north of the Rickman's Run dog facility parking lot. Access from the Billy Wolff and the S. 70th Street Trails is excellent. Vehicular access from S. 70th Street is good, although the current parking area would have to either be enlarged or a new parking area established south of Holmes Park Road.

The area analyzed is about 9 acres of wooded area with an average slope of 47.5%, and 32% of the area is in the Ideal or Steep range. The southwestern quadrant has floodplain which will need to be taken into consideration during design. There is currently a seasonal restroom available at the dog facility parking lot. All of the other facilities serving Holmes Lake Park are available to the west via a grade separated crossing underneath S. 70th Street.

SOUTHWEST QUADRANT

Generally bound by S. 27th Street on the east and A street on the north.

The Southwest Quadrant includes Van Dorn Park, site of the only existing single-track facility in a City park. This section identifies Van Dorn Park as the Primary Priority and Densmore Park as the Secondary Priority, although the priorities in this quadrant are more nuanced than others. Strictly considering the attributes and potential of these two parks, Densmore Park may have greater potential and offer more supporting services and better access. However, it is important that the existing single-track at Van Dorn Park be given due consideration in the development of future mountain biking facilities in the Southwest Quadrant.

Primary Priority: Van Dorn Park

This is the site of the only existing single-track facility currently located in Lincoln. It has been in operation through a cooperative agreement with Trails Have Our Respect (THOR) and appears to have grown in popularity over the past three years. Access is by the Bison Trail on the north, which is well connected to the Jamaica North Trail and the Salt Creek Levee Trail further to the west. A future connection, possibly by a combination of trail and on-street routes, is planned to link the Boosalis Trail to the east. Vehicular access is at High Street from Nebraska Parkway on the east and connection to the West Bypass of Highway 77 is nearby. There is an existing paved parking lot interior to the park.

Van Dorn Park is a community park totaling 28 acres with the area analyzed being approximately 16 acres. A well-established tree canopy provides shade and the site generally slopes downward to the west. Slopes in the Ideal range cover 76% of the area analyzed and the overall slope is 13.6%. There are restrooms located inside an enclosed rental shelter; however, they are not available unless the shelter is in use. A seasonal restroom, water fountain, playground and picnic facilities are all available within the park. A Master Plan is currently being developed to guide future improvements for this park and it has been identified as the potential location for a future botanical garden facility. Development of a botanical garden is the vision of a private interest group and at this time, no timeline has been established for its development nor has approval been granted by the City to proceed with any associated construction.

Secondary Priority: Densmore Park

This community park is located immediately west of S. 14th Street at Densmore Drive. Access from the Rock Island, Southpoint and Jamaica North Trails is excellent. The Rock Island Trail is planned to extend west, under Hwy. 77/2 to provide access to neighborhoods west of the West Bypass in the future. Vehicular access is from S. 14th Street with good connection to the South and West Bypasses of NE Hwy 2. There is a parking lot interior to the park; however, during use of the park's four softball/baseball fields, the park parking lot and roadway tend to become congested.

Although there may be further opportunities in other parts of the park, the area analyzed was approximately six acres located north of the playground and tennis courts. There are some existing concrete trails that would need to be considered for possible relocation during design. Additional consideration and coordination will be needed to address the existing residential sites that back onto the area. The tree cover in this area is sparse and some early planting of trees could be done to begin to establish a tree canopy. Slopes average 17.9% and about 72% of the area slopes are within the Ideal or Steep range. There are excellent supporting services in the park including restrooms, solar charging station, bike fixit station, picnic facilities and playground.

NORTHWEST QUADRANT

Generally bound by A Street on the south and 27th/48th Streets on the north.

Primary Priority: Arnold Heights Park

This neighborhood park located in the Air Park Neighborhood is situated near NW 54th Street and W. Superior Street. Access will eventually be available from trails that are currently in various stages of development. The NW 56th Street Trail is planned to pass through the park as it connects at its northerly end to Arnold Heights Elementary School. At its southerly end, the NW 56th Street Trail will connect to West O Street where a trail and on-street bike facility along West O/P Streets will provide connection to the Salt Creek Levee Trail. Trail is also being constructed along West A Street where it will link to the SW 40th Street viaduct in the future. Vehicular access from Hwy. 6, Hwy. 34, and Interstate 80 is good.

The majority of the 17.6 acre park could be available for development of a single track facility. There is currently off street parking at a former school site south of the park and coordination with Lincoln Public Schools might allow for some additional use space. Tree cover is sparse and tree planting could be initiated to begin to provide some canopy for the park. Over 92% of the park falls within the Ideal or Steep slope range with the overall slope percentage being 16.7%. Perhaps the best feature of this park is the steep hill known as Tanker Hill and often used for sledding by the neighborhood. This hill brings opportunities for slalom and downhill development. It should be noted that development of single track should be designed to minimize interfere with winter use as a sledding hill. There are scenic views of the downtown skyline from the park. Additional consideration and communication will be need with the residences that back onto the park.

Secondary Priority: Highlands South Greenway

This conservancy area is located in the center of the Highlands Neighborhood, near NW 1st Street and W. Fletcher Ave., and generally serves as a wide commuter and recreational trail corridor. Good site access is available from the Superior and First Street Trails. A future trail connection across Hwy. 34 is planned to link to the Fallbrook and Stonebridge Trails. Vehicular access from Hwy. 34 and I-180 is also available. There is no parking available interior to the park and development of additional of parking may be challenging.

The area analyzed was approximately half of the 33 acre greenway. There is designated floodplain located at the eastern end of the greenway with a stream and commuter trail that restrict the usable area. There is good tree canopy in about 25 percent of the park area and the average slope of the site is 21.6%, with about 53% of the slope within the Ideal or Steep range. There are no park services within the greenway; however, Highlands Park is located immediately north of the greenway and includes a water source, picnic area and playground. There are also commercial businesses along NW 1st Street with a wide array of services. Additional consideration and communication will be needed to address the existing residential sites that back onto the area.

NORTHEAST QUADRANT

Generally bound by N. 27th/40th Street on the west and A street on the south.

Primary Priority: Stevens Creek/Burns Park

This park property is located at N 98th and Adams Streets. Access by trail is not yet available; however, the Stevens Creek Trail is planned to follow the waterway from the Murdock Trail a half mile to the north and along Adams Street from the west. Vehicular access is via Adams or North 98th Streets. North 98th Street is currently a gravel county road but plans to upgrade to pavement are in process.

This community park is currently undeveloped and intended as a future community or regional park, depending upon future land acquisitions. It is about 80 acres in its entirety and an area of 14 acres was evaluated. Stevens Creek runs along the eastern border of the parkland. There is an existing small gravel parking lot off of N. 98th Street about 800 feet south of Adams Street. The Stevens Creek corridor is heavily wooded and has an overall slope percentage of 38.9% with 62% of the area slopes within the Ideal or Steep range. The northern end is primarily designated floodplain and floodway, with some additional floodway along the eastern side in the central portion of the property. Services are currently lacking and would need to be developed with a single-track facility.

Secondary Priority: Seacrest Park

This community park is located adjacent to Lincoln East High School on the corner of S. 70th and A Streets. Access by trail is from the MoPac and 84th Street Trails and then neighborhood streets. The 70th Street Trail currently ends about a half mile to the south but is planned for extension to the site in the future. Vehicular access would be from 70th or A Streets. There is a very large parking lot for East High School use and to provide sport event parking.

The park is integrated into Lincoln the East High School campus and campus related functions/uses will need to be considered during design. The adjacency to the school provides opportunities for youth organizations, as well as for integration with cross country trails. There is some tree cover, particularly west of the parking lot. The overall slope percentage of the area is 10% with about 57% of the slopes falling within the Ideal or Steep range. There may be some potential to connect the east and west sides of the park, although traffic along the internal parking lot drive would need to be carefully considered.

Primary Priority Parks



NORTHWEST: Arnold Heights Park



NORTHEAST: Stevens Creek / Burns Park

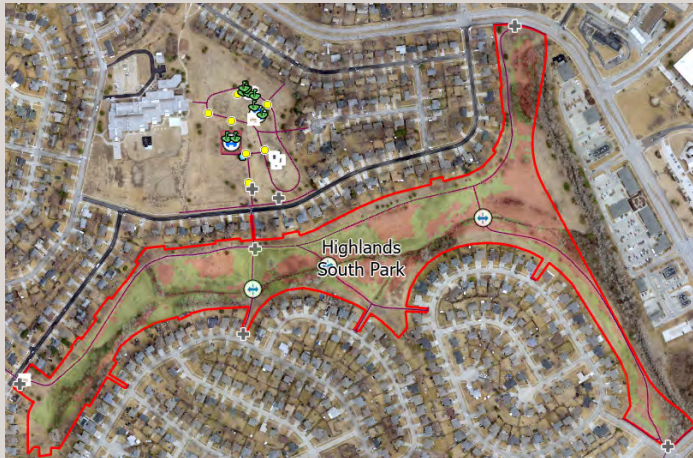


SOUTHWEST: Van Dorn Park



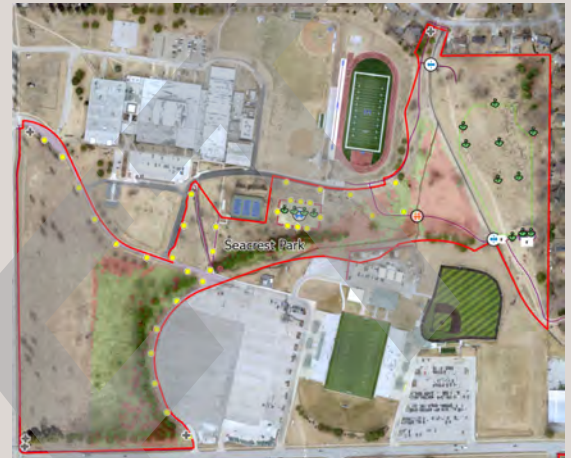
SOUTHEAST: Jensen Park

Secondary Priority Parks



NORTHWEST:

Highlands South Park



NORTHEAST:

Seacrest Park



SOUTHWEST:

Densmore Park



SOUTHEAST:

Holmes Lake Park

SITE SELECTION

Tier 3: Neighborhood Features and Facilities

Tier 3 of the proposed level of service envisions smaller scale facilities that would provide service more on a neighborhood level. These facilities should be designed at a size/scale that would not attract large numbers of users from outside the area unless sufficient off-street parking was available. Locations would be based on neighborhood interest and the commitment of a sponsoring organization to assist with construction and ongoing maintenance.

These facilities could include a pump track in a community park where parking is available, a single or couple of features such as a rock garden or skinny placed along the side of a concrete park pathway, or a single-track trail located adjacent to and within the corridor of a commuter trail. Design and feature type would be part of a conversation between the neighborhood, sponsoring organization, and LPR staff.

LPR may also include some of these features as new neighborhood parks are designed and developed. As the recreational interests of the community change over time, mountain biking activities, much like activities such as disk golf, skateboarding, and pickleball, are becoming more popular. LPR strives to monitor the popularity of these activities and to adapt park design to provide programming to meet the needs and desires of the community.



DESIGN AND CONSTRUCTION

Design and construction of mountain bike facilities requires a skill set that continues to evolve. While many early features were designed through trial and error and personal experience, engineers are now engaged in the design of these features. LPR staff includes trained professionals that are able to assess structures during and after construction for determination when the services of a professional engineer is needed.

After researching standards proposed by the International Mountain Biking Association, conducting site visits to existing facilities in both Nebraska and Arkansas, and attending multiple training sessions, LPR staff have developed guidelines for the design and construction of mountain bike features. The Single Track Trails: Improvements and Features, 2022 Edition, is attached to this document and has been posted to the Mountain Bike webpage. It describes feature types, the design, construction and inspection requirements as the scale of features increases, and the point at which the assistance of a professional engineer must be sought. This document shall serve as the basis for design and construction and will be attached to any agreements with sponsoring organizations moving forward.





MAINTENANCE AND PARTNERSHIPS

The maintenance of natural surface trails and features needs to be regularly conducted by someone trained for this work. In general, all natural surface trails and features should be inspected a minimum of every two weeks or after a rain event of 1 inch or more. Signs of erosion, movement or decay of underlying wood, stone or other materials, and interference of vegetation are some of the key items to inspect. The Single Track Trails: Improvements and Features, 2022 Edition, includes inspection guides as well as sheets that are used to log inspections.

Currently, mountain bike facilities are managed as a partnership between a sponsoring organization and LPR. A legal entity in the State of Nebraska must be identified to act as the sponsoring organization. In addition, a “trail boss” should be identified to act as the point of contact for that organization. The Trail Boss is responsible for making regular inspections and reporting their results to LPR. The Trail Boss is also responsible for organizing regular maintenance that is conducted on the facility or feature. LPR has trained staff that perform quarterly inspections and help to determine the extent of repairs needed. In cases where a feature must be constructed with guidance from a professional engineer, an engineer also may need to be engaged to recommend maintenance and assess potential repair needs.

In the future, as more mountain bike features and facilities are developed within the Lincoln Parks system, it may be necessary to increase the number of professionally trained staff members to conduct inspections and maintenance. Alternatively, the services of a adequately qualified contractor could also be engaged to perform this work.

A person wearing a black helmet, a dark jacket, and a bright orange backpack is riding a mountain bike through a field of tall, dry grass. The rider is seen from behind, moving away from the camera. The background features a line of trees under a clear blue sky. A large, faint, stylized 'X' watermark is visible across the center of the image.

APPENDIX A

The background of the entire page is a light gray silhouette of a person riding a bicycle. A decorative horizontal band, consisting of two parallel lines with a repeating geometric pattern, runs across the middle of the page. The title text is centered within this band.

SINGLE TRACK TRAILS IMPROVEMENTS + FEATURES

CITY OF LINCOLN, NE

First Edition: 2022

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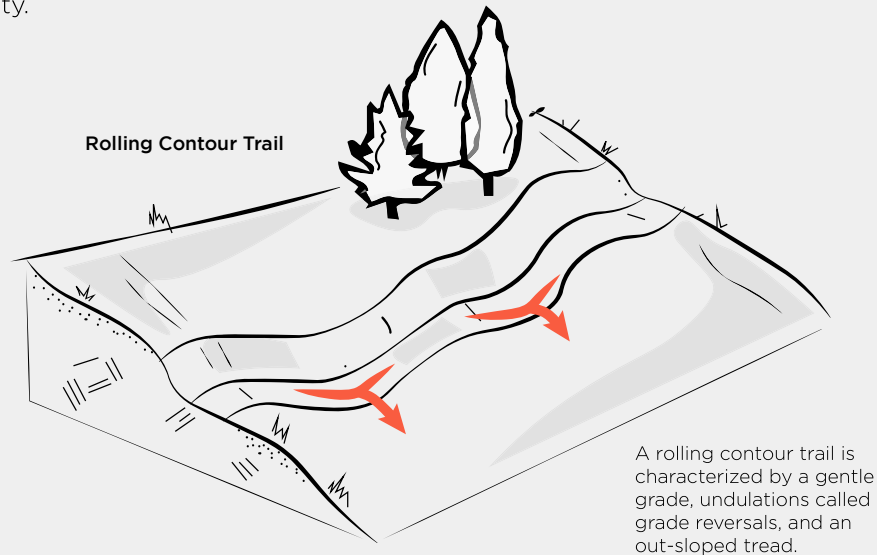
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Introduction

The following document is intended to provide guidance on the design, construction and maintenance of single track facilities. Single track development is a cooperative effort by the City of Lincoln and volunteer organizations. In this document, technical features are broken into 4 Groups with varying levels of design and construction requirements and levels of involvement of LPRD staff and other professionals. Each single track facility will have a Maintenance Agreement between the City and a recognized volunteer organization which describes the maintenance and inspection responsibilities of each, and references this document. Each single track facility will have a trail boss assigned from that volunteer organization who will be responsible for communication with LPRD and the regular inspection and maintenance of the trail and technical features. Staff from the Planning and Construction division of LPRD will act as the primary contact at the City.

Trails

Single track is trail that is designed to travel in single file and is typically 18 to 24 inches wide. Because the trail is not wide enough for passing, users travel in a single direction. Single track can be single use or multi-use, however, when pedestrians are included in the design, it is recommended that the direction of travel be opposite cyclists in order to assist with visibility.



Single track trails should be designed according to the recommendations of the International Mountain Biking Association, particularly the Five Essential Elements (The Half Rule, The Ten Percent Average Guideline, Maximum Sustainable Grade, Grade Reversals, and Outslope). Planning a trail should begin with creation of a map using GPS. Once the route has been reviewed by Staff it should be flagged and a walk-through of the route should be conducted with staff and volunteers. Slope and soils should be assessed for the potential of erosion. Soils in Lancaster County tend to be silt, clay and loam combinations, all of which have their own benefits and challenges. In general, Lancaster County soils are highly erodible, and the design should take that into account.



Where there is a potential for erosion, trails should be designed as rolling contour trails. The small grade changes along the length of these trails provide escape routes for water so that it does not run longitudinally along the trail and cause runneling. Where erosion does occur, grade reversals should be employed to force water to exit the trail. Trails that follow the fall line of a slope are highly discouraged.

Ideally, trails should be designed so that they do not cross over themselves, or over other pathways, trails or drives. If this is not possible, chokes may be employed to slow down trail users prior to encountering a crossing. Chokes may also be employed to slow trail users before blind turns or other places where a reduced speed is desirable. A choke may be rocks or timber laid on either side of the trail or may be vegetation planted there. The idea is to reduce the space and cause the rider to slow down in order to negotiate it.

Trees and rocks can also be used to anchor a point along the trail which may have the potential for cut through routes forming. It is good practice to anchor turns so that they don't widen over time and cause additional impacts to the surrounding vegetation.

Technical Features

Technical features have been divided into four categories based upon the construction methods employed and the relative level of risk to users. In cases where technical elements from groups 2-4 are employed, an alternative, lower risk route should be included for those who are not confident in their skills. Construction of technical elements should conform to the IMBA guidelines, or the specifications of the design engineer.

Group 1. Low Risk Landform Features

These are technical features that are created from soil only with no added rock or timber. Typical features would include grade switches, rolling dips or rolling grade switches, low berms, low tables, low doubles, switchbacks (without retaining walls), knicks, etc. These features are appropriate for all mountain bikers and would not require an alternative route.

Group 1 features may be constructed by volunteers. Park Staff should review plans for these features and inspect them once they are completed.

Group 1 technical features may not exceed 1 foot in elevation above the surrounding grade.

Group 2. Moderate Risk Features with Minor Construction

These technical features are similar to dirt features above but have added rock or timber in order to support additional height. The rock or timber is typically natural, although some concrete rubble or block may be used with written approval. Care must be taken in their construction so that soil is firmly tamped around the fill materials to avoid any voids which may collapse over time.

These would include tables and berms up to 24 inches, rock gardens, skinnies that are not elevated, rolldowns, berms or switchbacks with retaining walls, raised treads (causeways or turnpikes), armoring, rock or timber steps.

Group 2 features require written approval from Park staff and observation at major stages of construction.

Group 2 features are not to exceed 24 inches above surrounding grade with no slopes exceeding 1:1.

Group 3. Moderate to High Risk Features with Substantial Construction

These features require a frame to be constructed or feature to be secured to the ground in some way. Typically, constructed features are secured with some sort of fastener or driven into the ground to provide support.

These would include raised skinnies, drops, boardwalks, steps that require framing or retaining walls, doubles, multiple step ups, and armored crossings.

Group 3 features must include drawings with dimensions and materials listed and be reviewed by Park staff. Staff must inspect the construction and approve the final product.

Group 3 features are not to exceed 24 inches above grade and may have shear grade elevations.

Group 4. High Risk Features with Design and Construction

Engineered features are those that are deemed by the Parks and Recreation Department Planning and Construction Manager to require the services of a professional engineer. Typical features include small bridges and culverts, ladder bridges, constructed berms/walls, and jumps.

Inspections

Trail surfaces should be inspected for signs of erosion every two weeks or after a rain event of more than one inch. This inspection may be conducted by the trail boss assigned to the particular location.

Inspection of trail features will be completed by Park staff on a quarterly basis. Inspections will include trail surface, vegetation and technical features.

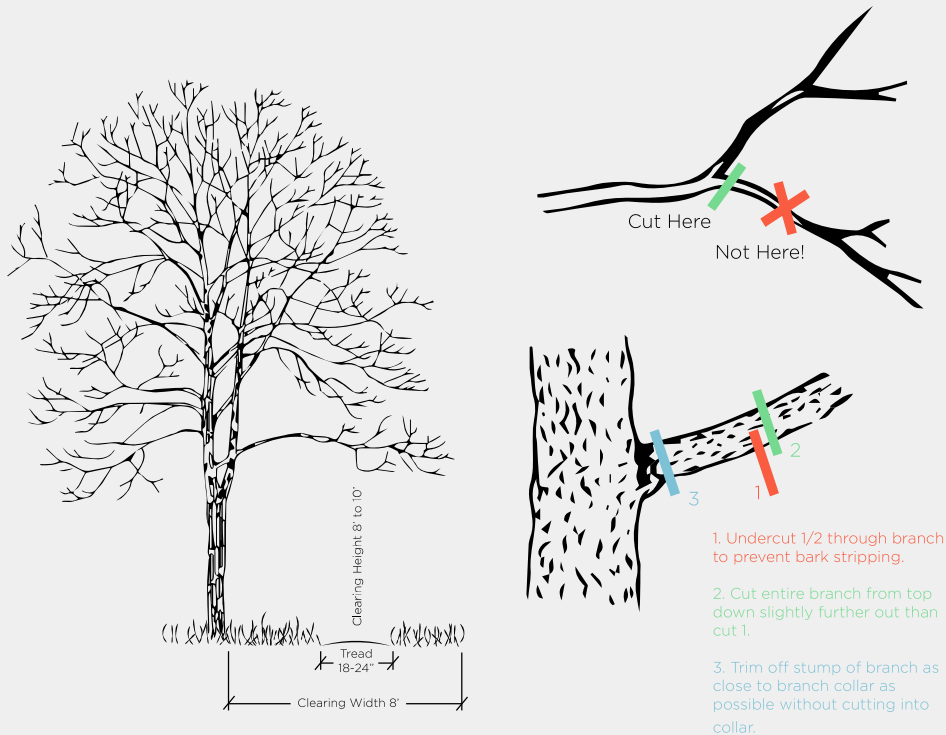
Inspections should recommend areas for drainage improvements. Inspection should also identify issues with features such as settling, shifting of rocks, decay of wood. Some features in Group 4 may need to be placed on the annual bridge inspection list to be inspected by a qualified engineer.

Maintenance

Patrolling of the trail for trash and stormfall should be completed on a regular basis. Any bulletin boards on trailhead kiosks should be reviewed regularly and notices and postings that are outdated or worn should be either removed or replaced.

Clearing of vegetation along the surface and edge of trails should be done on a continual basis. Vegetation within the trail tread should be removed (pulled) and the resulting hole filled and tamped level with the surrounding trail. A trail clearing width of 8 feet shall be maintained both horizontally and vertically adjacent to the trail. Branches and other vegetation should be trimmed back so that they don't extend into the trail clearing.

The area surrounding technical features should be kept clear of vegetation or other debris that may cause injury if a user falls from the feature. The area above the technical feature should be cleared taking into account the added height due to the feature, or the jump zone of the feature.



Maintenance of the trail edge is particularly important to avoid trail users diverting to avoid vegetation, resulting in widening of the trail tread. Branches should be trimmed using pruners or a hand saw and trimming the branch back to the point at which it breaks off from the trunk or major branch. Do not leave a “stub” sticking out that could pose a hazard. Each branch has at its base an area of thickened bark called the “collar”. This thickened bark represents the tree's natural defense against injury and should be protected during trimming. After the branch is cut, this collar will callus over like a bandage. Cuts should be made so that they are close to, but not within that thickened collar. Larger branches can fall as they are being cut, stripping bark and causing injury to the tree. Follow a three cut method to remove bulky branches as shown below.

If the vegetation surrounding the trail is primarily prairie, this should be cut back or burned at least every 3 years in order to keep the prairie healthy and prevent woody invasives.

Areas of trail surface erosion should be raked or scraped down to the depth of the cut, then soil re-spread evenly and tamped firmly to provide a smooth, even surface. Areas of persistent erosion should be evaluated for a potential treatment (knick or rolling grade reversal) or possible re-route.

Over time, a depression may be formed in the center of the tread. This can happen when the tread becomes compacted, or when water deposits silt along the outslope edge of the trail. This can trap water and should be scraped from the edge and the outslope re-established.

Technical features should be regularly inspected, and repairs made as soon as they show signs of wear or failure. This will include re-tamping soil on slopes or between rock or timber, replacing rotting timber, replacing boards that show signs of coming loose or decay, resetting stones that are showing signs of loosening, etc... These issues may be identified during the regular inspection performed by the trail boss, or during the quarterly staff inspections.

Before repairs are made to Group 2 or 3 elements, Parks staff should be consulted and make a visit to the site. Before repairs are made to Group 4 elements a qualified engineer may need to be consulted at the discretion of the Planning and Construction Manager.

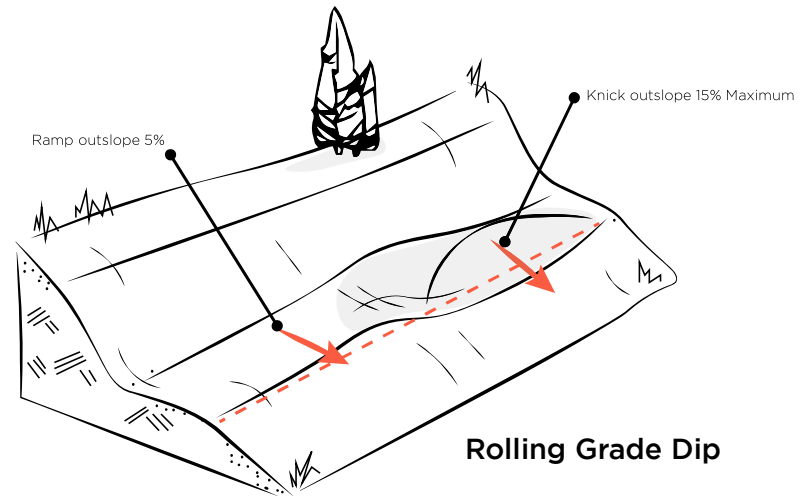
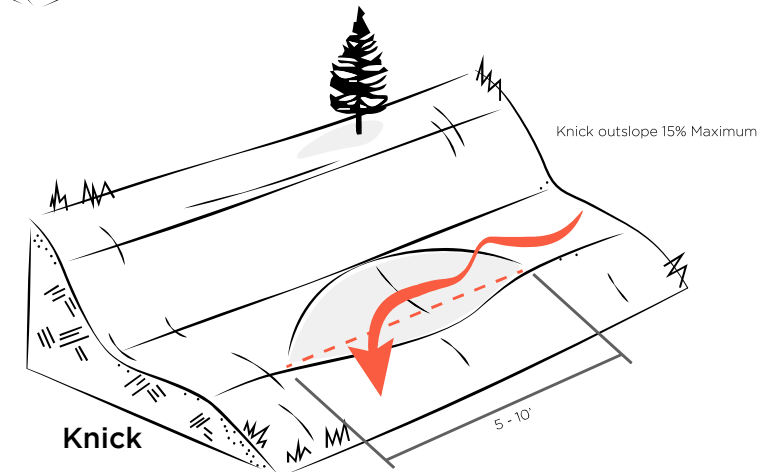
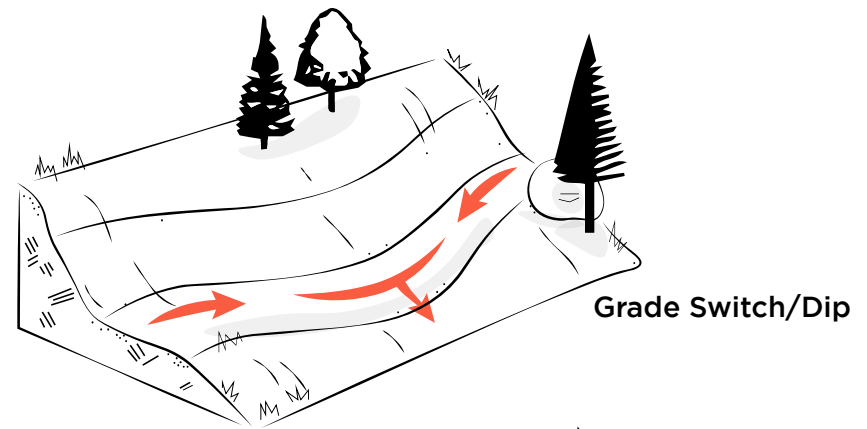
Features:

Grade Switch or Grade Dip – a grade switch or dip is simply a spot in the trail where it dips slightly down and then back up again. Because water always seeks the lowest point, this serves as a place to force water off the trail. Grade switches are best when using the existing topography to design them into the trail. Simply winding the trail slightly up and down the side slope can create grade switches and lead to a highly sustainable trail.

Knick – a knick is a semi-circular dip with the center being the lowest point and located at the edge of the downslope side of the trail. Knicks are useful when you have trouble with standing water and there is adjacent grade that is lower than the trail surface to which water can drain. Knicks are not as effective if the trail grade is over 5%. A knick should not have a maximum grade higher than 15%.

Rolling Grade Dip – a rolling grade dip is similar to a knick but includes a ramp built on the low end from soil excavated for the knick. Rolling grade dips should be used when more than a simple grade switch or knick is needed to divert water, typically when trail grade is over 5%. The length of trail covered by the rolling grade dip and the height of the downstream berm are reflective of the slope of the trail and the magnitude of the water problem.

A rolling grade dip is constructed by excavating a disk shaped knick and using the excavated soil to construct a ramp down the slope. The ramp should be constructed so the high ridge roughly follows the curve of the disk, sitting at an angle to the flow of traffic and guiding water to the focal point of the knick. Because that lowest point is where water will be leaving the trail at the highest volume and velocity, erosion control may be needed (rip rap or deadfall scree) and maintenance will have to be concentrated on that point. In general, the downslope of the downstream ramp should not be greater than twice the overall slope of the trail.

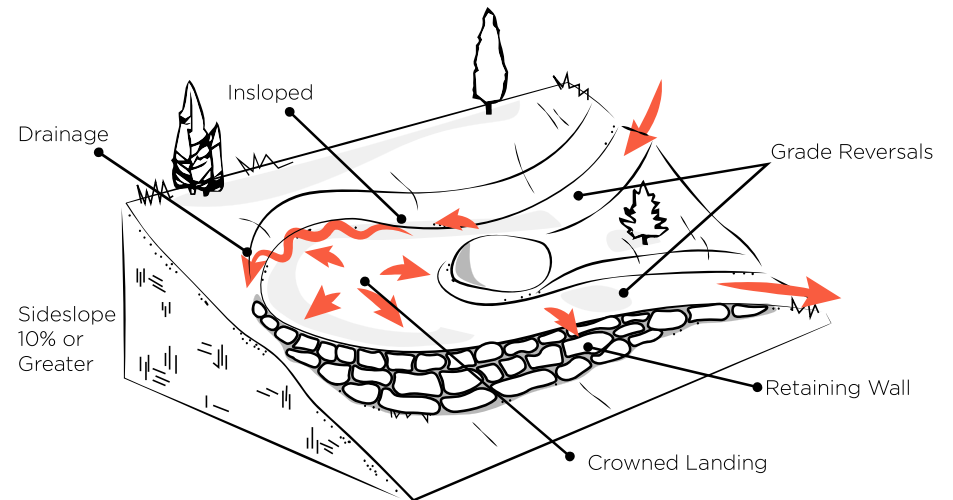
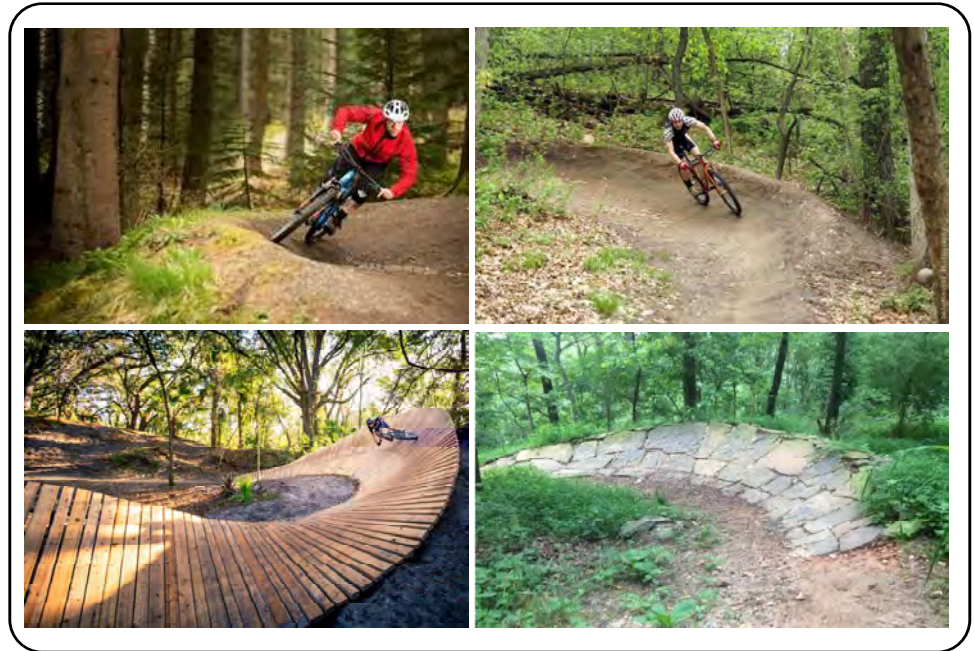


Features:

Berms – Berms are used to give a sloped surface to the trail on turns. This helps to keep the angle of force against the soil at 90 degrees reducing the risk of soil movement. Berms may be constructed of tamped soil (Group 1) or may have rock or timber with tamped soil covering (Group 2) or may even be constructed entirely of wood or other materials (Group 4). Soil needs to be placed in thin layers and compacted as the slope is constructed. Care must be taken to compact soil around any rock or timber as those pieces are laid to ensure no voids are left that may collapse over time.

The slope of the berm generally increases as it approaches the center of the turn. The back slope of the berm should be at least 3:1 for proper maintenance. The bulk behind the berm provides the counter point to the force applied by the rider. The level trail inside the berm should be maintained to allow for slower riders or pedestrians on multi-use trails. Because berms will naturally have an inslope, drainage can be a problem. This can be solved by installing a rolling grade switch up hill and the another after the turn, reestablishing the outslope of the trail.

Switchbacks – switchbacks are used to make tight turns going downslope. They differ from bermed turns in that instead of directing the rider to the outer edge at speed, they provide a platform on which the rider can turn. The platform is crowned so that there is 5% slope in all directions and drainage is in all directions from the platform. The uphill approach is insloped and water is directed tangentially out of the switchback as it approaches the curve. The downhill approach is out sloped. Because switchbacks are generally built to provide a flat platform for turning, they may require retaining walls on the downslope sides. General rule for height of the retaining wall is one foot for every 8-10% slope of the natural topography. Ex: A slope with a 26% slope should have a retaining wall about 3 feet high.



Features:

Tables – A table is a technical element which has an approach, an elevated platform, and a landing slope. Riders may jump and land on the slope, or they may stay in contact over the length of the feature. Low tables (Group 1) may be constructed entirely of tamped soil, tables may be built taller using rock or timber to support the structure (Group 2 and 3), or tables can be constructed of wood or other materials (Group 4). In the case of the first three groups, soil should be laid in thin layers and tamped as it is laid. If rock or timbers are used, soil must be tamped around those as they are put in place to ensure no voids are left. Care needs to be taken in keeping an appropriate clearing height maintained, as well as a fall zone around the feature.

Doubles – Doubles are similar to tables, but there is no platform connecting the ramp and landing slopes so the rider must jump to be able to clear the element. Construction guidance is similar to tables above. Care needs to be taken in keeping an appropriate clearing height maintained, as well as a fall zone around the feature.

Step Ups and Step Downs– Step ups and step downs are similar to tables and doubles, except the landing is either higher or lower than the takeoff, depending on if you are going up or down. Guidance is the same.

Rock Gardens – A rock garden in some areas may be natural, although that will likely not be the case in Lincoln. A rock garden is made of natural stone that is placed in the tread of the trail. Rock gardens typically have a variation in the height of the protruding rock, rather than being relatively level as in armoring or paving. Rock Gardens can be used as a technical descent or may be simply a challenge on flat terrain. Careful design can provide different levels of challenge in a single garden. Rock gardens need to be constructed so that the rocks are embedded at least 50-75% below grade and soil is firmly tamped around them to avoid shifting. Smaller wedges of stone can be used to fill spaces and reduce movement. Rock gardens are most stable when larger anchor rocks are placed to provide a framework for smaller rock. (Group 2)



Features:

Armoring or paving – Armoring or paving uses stone to provide a stable surface, commonly in areas where erosion has been an issue (Group 2), or in low water crossings (Group 3). Armoring typically requires heavy stone set at the beginning and end of the run, and at additional points for longer runs, to act as a sort of frame for smaller stone. Stones are usually set to provide a relative flat surface. Again, proper compaction of surrounding matrix is important.

Skinnies – a skinny is an element that provides a narrow pathway to be negotiated. They are typically made of logs or timber and may rest on grade (Group 2) or be elevated above grade (Groups 3&4). The most important criteria for a skinny is stability. If a log is placed on grade, this will mean rock, soil or other material must be used to wedge under the curve of the log and keep it secure. This needs to be inspected and maintained consistently. The upper surface of the skinny is typically flat but may be of variable width. Often a chainsaw or file is used to cut lines into the surface and give it some texture. Ramps or soil may be used to provide an approach, or the approach may require a step up. Care needs to be taken in keeping an appropriate clearing height maintained, as well as a fall zone around the feature.

Drops – A drop is a point on the trail where the elevation changes quickly. They are different from jumps because there is typically no take off ramp, the grade coming into a drop may be flat or may even be descending. A rolldown is a drop that has a bit of a landing ramp that can be used. Drops may be natural (Group 1), constructed with rock or timber (Group 2 and 3), or may be engineered (Group 4).

Steps – Steps may be single or in a series and are usually 10 inches or less in height. Steps may simply be rock or timber set into the soil and backfilled (Group 2), or they may be framed structures (Group 3 or 4). Steps can also be incorporated into other features, such as rock gardens, tables or drops in order to provide a different technical challenge or a route for hikers. Steps can also serve as grade checks in areas where erosion is an issue. As in all structures, rock and timber must be sufficiently buried to remain solidly in place under force, and backfilling should be done in thin layers with tamping in between.



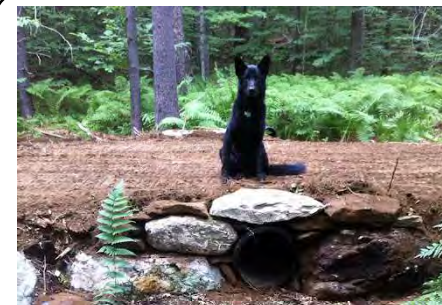
Features:

Causeways, turnpikes and boardwalks – These elements are generally constructed when the trail tread needs to be elevated because of conditions on the ground. In some cases, wet conditions can be addressed with a turnpike constructed with stone or timber edges and the space between filled with soil, rock or aggregate (Group 2). In other cases, delicate soils or wetlands must be protected by constructed a boardwalk that essentially acts as a bridge over the vulnerable area (Group 3 or 4). Because of the nature of the purpose of these elements, if timber is used rot resistant species should be selected and the element should be regularly maintained and inspected.

Ladder bridges – A ladder bridge is a simple bridge that is constructed much as a ladder with the tread being the “rungs”. These are generally constructed out of wood with treads being placed and inch or two apart to facilitate drainage and allow debris to fall through. Ladder bridges may span gaps or may be elevated and accessible by ramps. This construction technique may be used to build ramps. (Group 3 or 4).

Culverts – Culverts are typically metal or concrete tubes that are placed under trails where water must flow. Culverts need to be properly sized and placed if they are to function for the long term. Typically, a culvert will either have a flared end section, wing walls, or rock rip rap on the up and downstream sides to protect from erosion. (Group 4).

Small Bridges – It is best to avoid crossing water ways in order to avoid problems with stormwater, however, in some cases a small bridge may be appropriate and sustainable. The factor that determines whether or not the bridge requires a railing is the height above the grade below the bridges. Bridges with a height of 24 inches or less may be constructed without railings, any that exceed that height must have a railing. (Group 4)



Trail Name:				
Inspection Date:				
Name of Inspector:				
Short Summary (Weather? Riders Present? Muddy?):				
Inspection Item (General)	Condition (Good, Fair, Bad, Closed)	Comments (Rotting Logs? Loose Stones? Noxious Weeds? Erosion? Etc.)	Repairs Made? (Y/N)	Recommendations
Trail Tread				
Trail Corridor				
Trail Signage				
Trash/Vandalism				
Feature				
1				
2				
3				
4				
5				
6				
7				
8				
9				

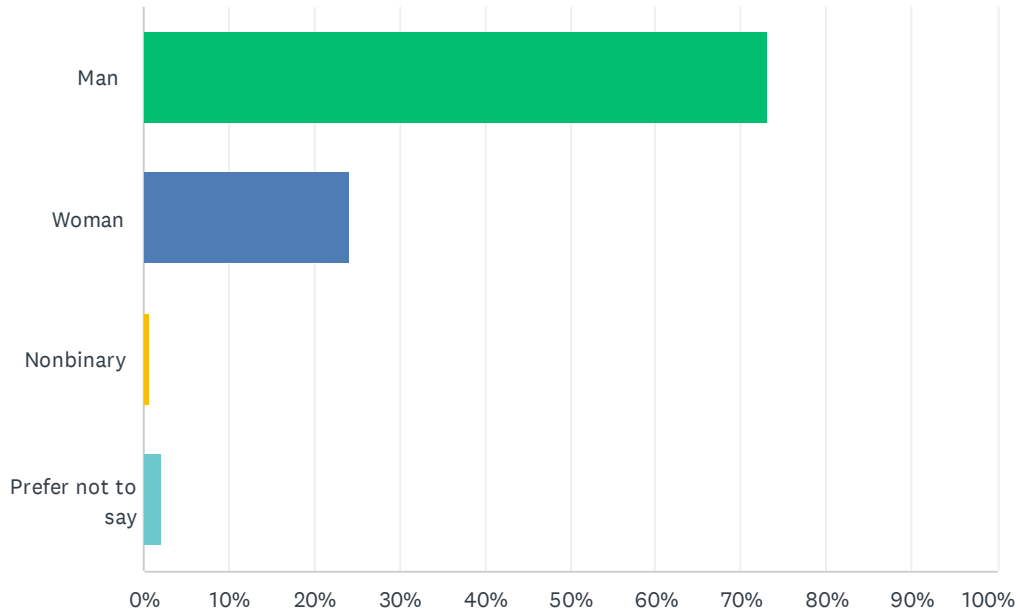




APPENDIX B

Q1 Gender (select one) of person filling out the survey

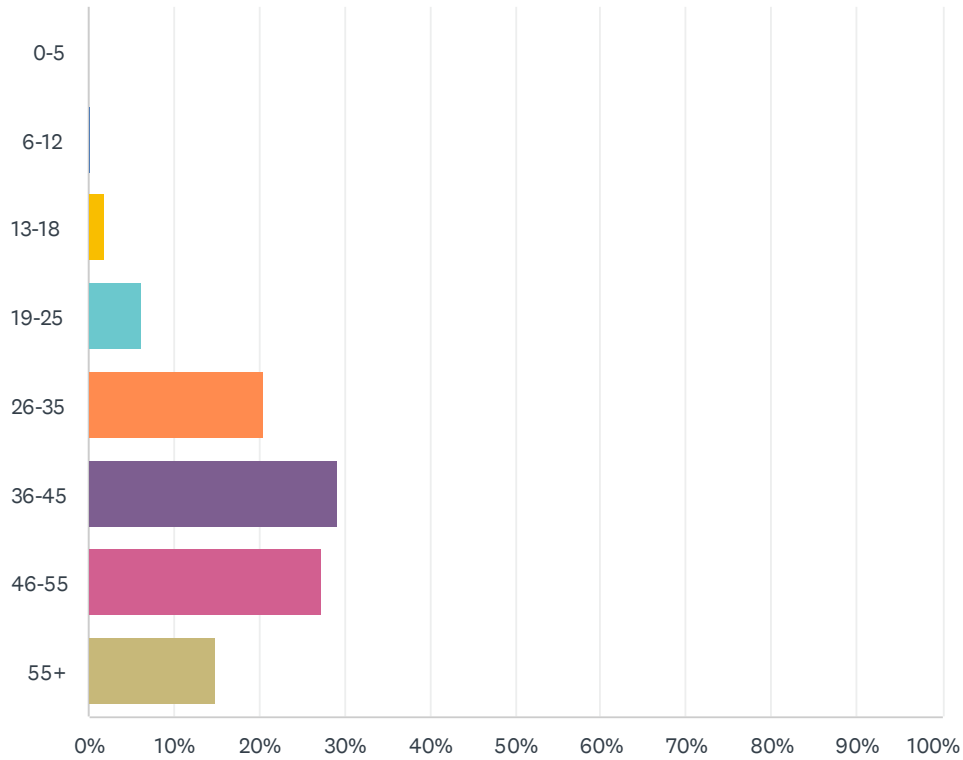
Answered: 537 Skipped: 3



ANSWER CHOICES	RESPONSES	
Man	73.18%	393
Woman	24.02%	129
Nonbinary	0.74%	4
Prefer not to say	2.05%	11
TOTAL		537

Q2 Age Group (select one) of person filling out survey

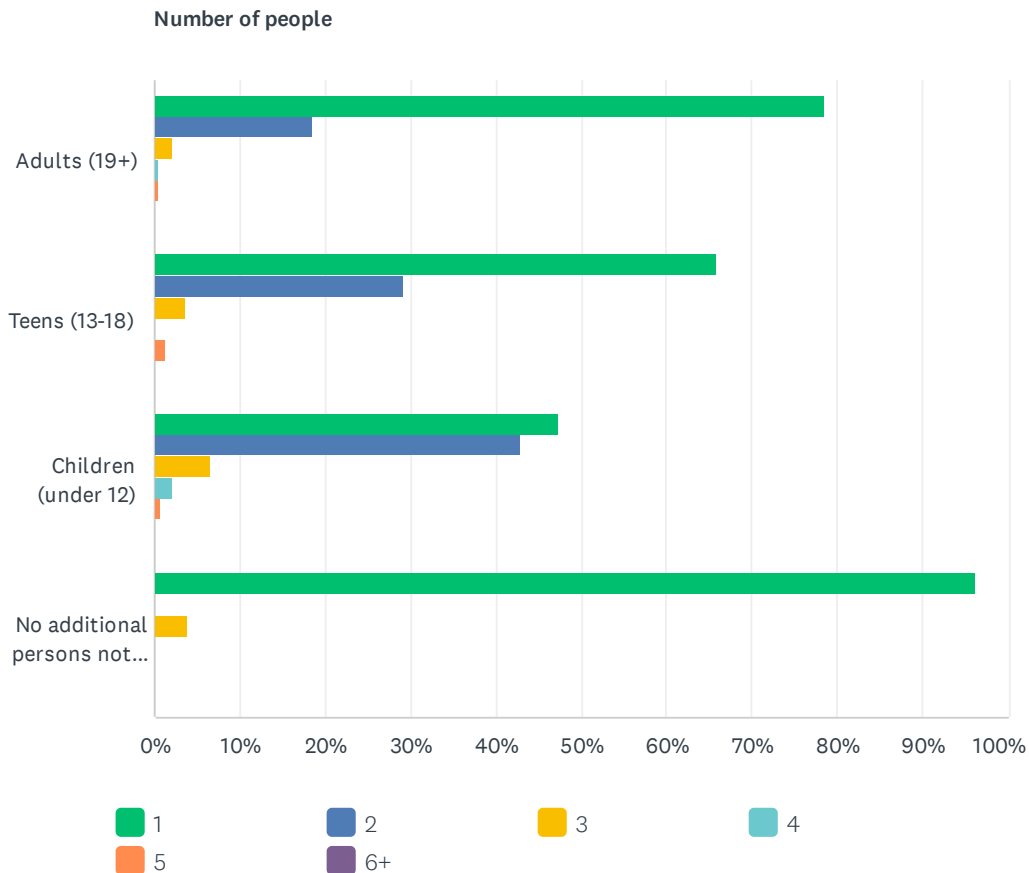
Answered: 540 Skipped: 0



ANSWER CHOICES	RESPONSES	
0-5	0.00%	0
6-12	0.19%	1
13-18	1.85%	10
19-25	6.11%	33
26-35	20.37%	110
36-45	29.26%	158
46-55	27.22%	147
55+	15.00%	81
TOTAL		540

Q3 Are there additional persons in your household that participate in mountain biking? If so, please indicate how many. Please do not include individuals who will be filling out their own survey.

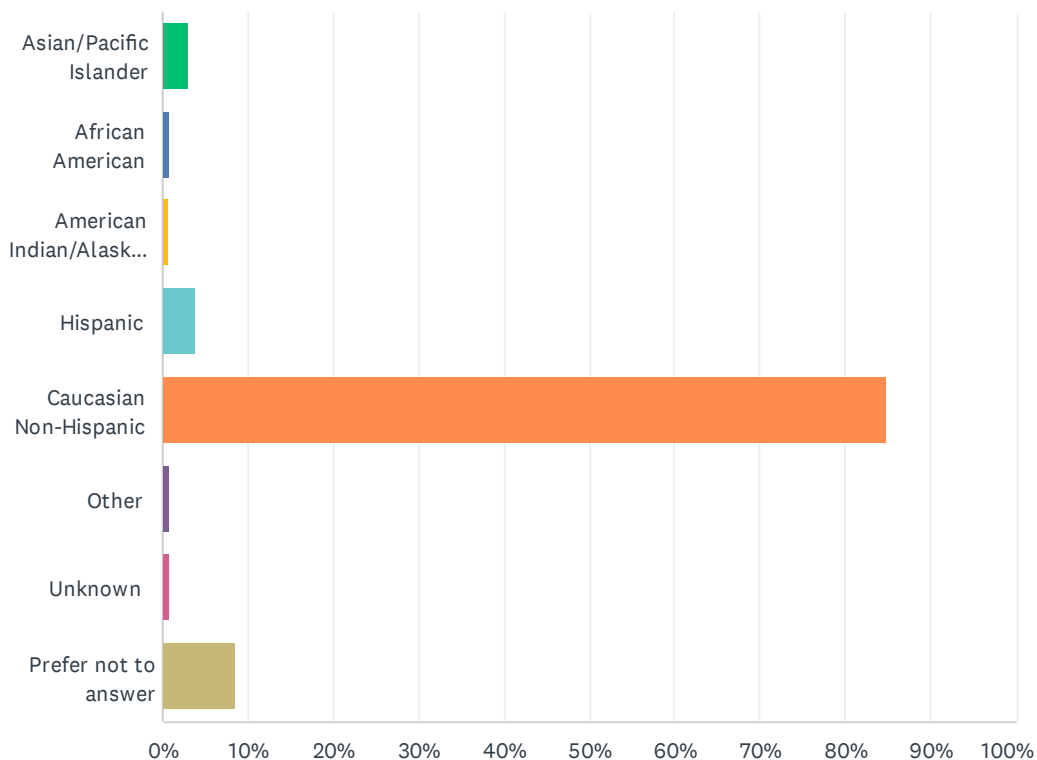
Answered: 361 Skipped: 179



Number of people							
	1	2	3	4	5	6+	TOTAL
Adults (19+)	78.57% 220	18.57% 52	2.14% 6	0.36% 1	0.36% 1	0.00% 0	280
Teens (13-18)	65.85% 54	29.27% 24	3.66% 3	0.00% 0	1.22% 1	0.00% 0	82
Children (under 12)	47.41% 64	42.96% 58	6.67% 9	2.22% 3	0.74% 1	0.00% 0	135
No additional persons not taking survey.	96.15% 25	0.00% 0	3.85% 1	0.00% 0	0.00% 0	0.00% 0	26

Q4 Ethnicity (select as many as apply)

Answered: 532 Skipped: 8



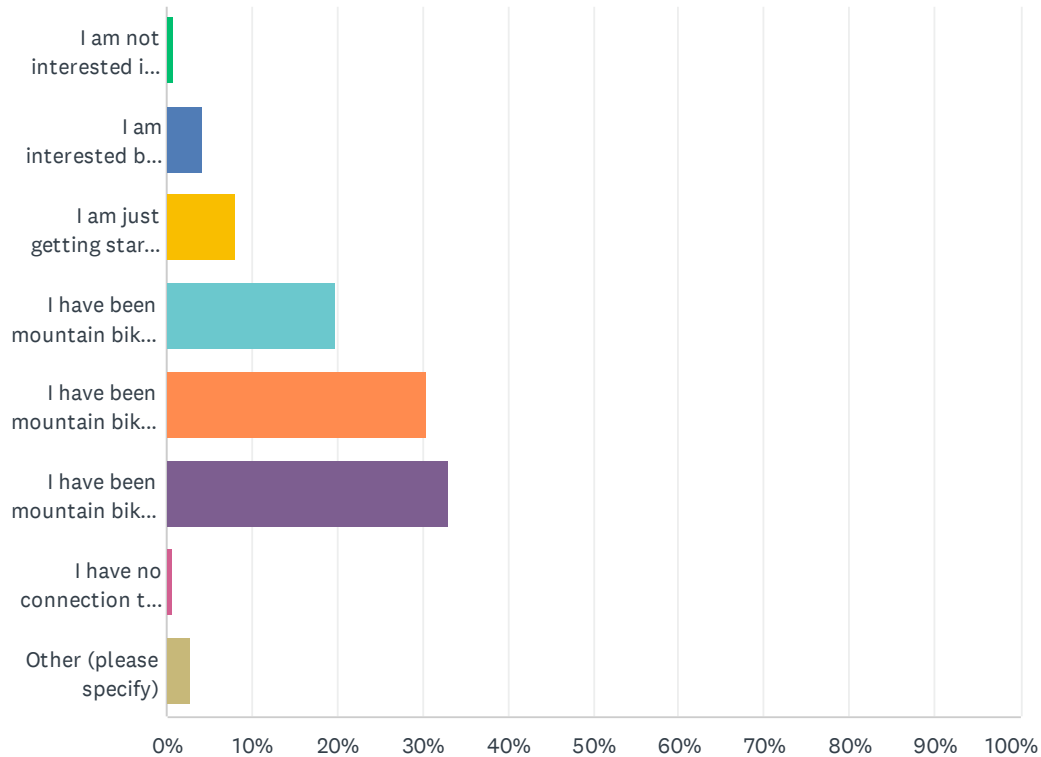
ANSWER CHOICES	RESPONSES	
Asian/Pacific Islander	3.01%	16
African American	0.94%	5
American Indian/Alaskan Native Aleutian	0.56%	3
Hispanic	3.76%	20
Caucasian Non-Hispanic	84.77%	451
Other	0.94%	5
Unknown	0.94%	5
Prefer not to answer	8.46%	45
Total Respondents: 532		

Q5 Zip Code of your primary residence (enter 5 digit code)

Answered: 539 Skipped: 1

Q6 About how long have you been participating in mountain biking? (select one)

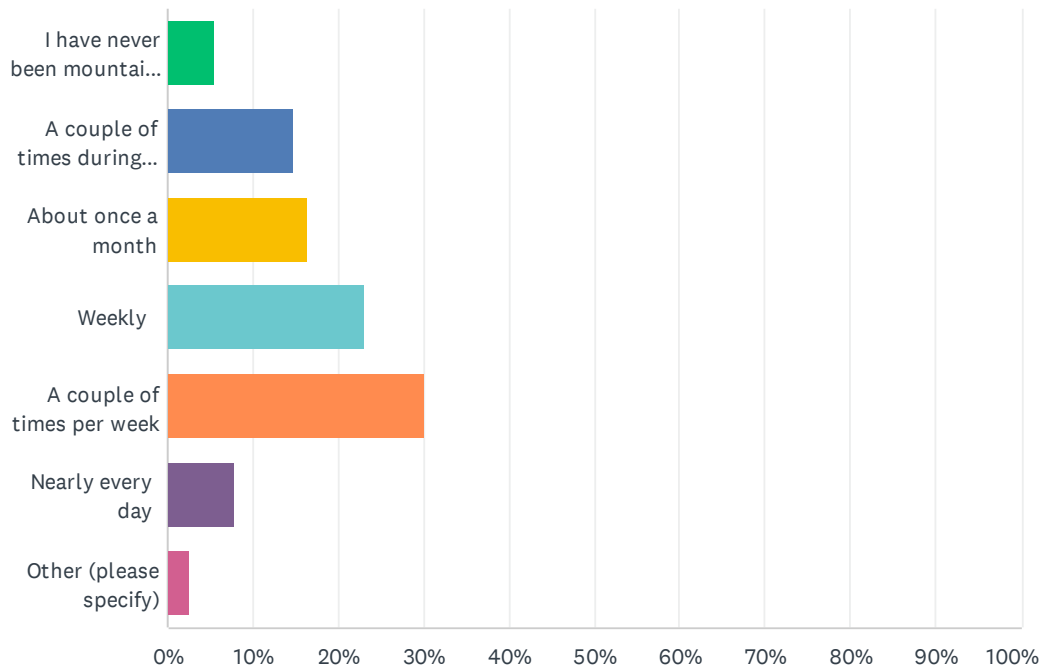
Answered: 484 Skipped: 56



ANSWER CHOICES	RESPONSES	
I am not interested in mountain biking but know others or have others in my family that are.	0.83%	4
I am interested but have never been on mountain bike trails.	4.34%	21
I am just getting started in mountain biking.	8.06%	39
I have been mountain biking for a couple of years but am still pretty new.	19.83%	96
I have been mountain biking for several years and am pretty confident in my skills.	30.58%	148
I have been mountain biking for many years and am highly confident in my skills.	33.06%	160
I have no connection to, or interest in, mountain biking	0.62%	3
Other (please specify)	2.69%	13
TOTAL		484

Q7 During the period from April to November, about how often do you go mountain biking? (select one)

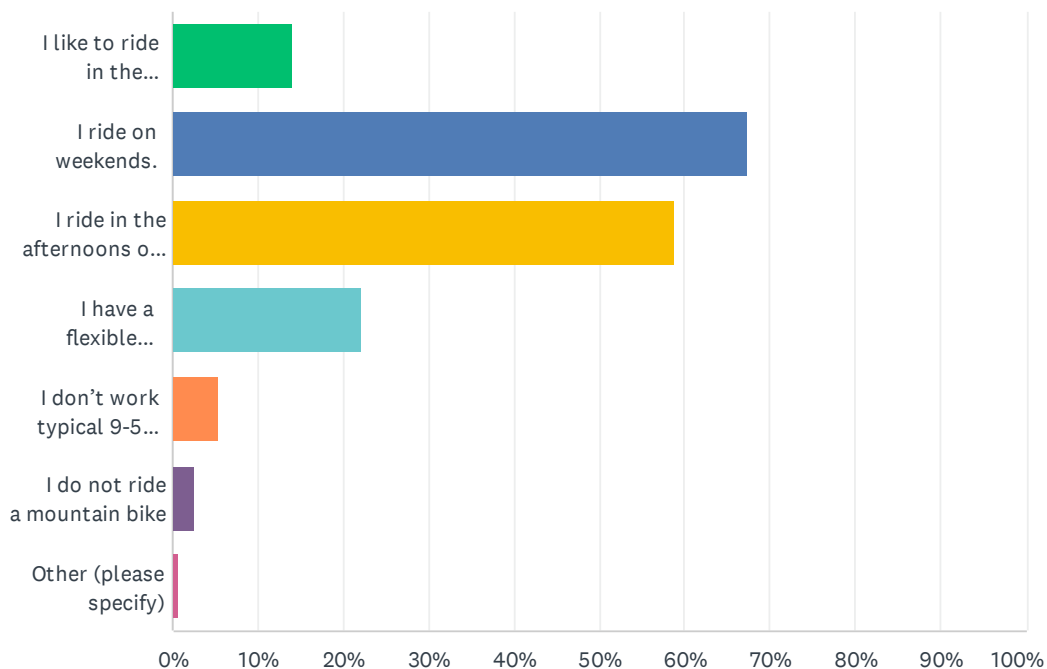
Answered: 484 Skipped: 56



ANSWER CHOICES	RESPONSES	
I have never been mountain biking	5.58%	27
A couple of times during that period.	14.67%	71
About once a month	16.32%	79
Weekly	22.93%	111
A couple of times per week	30.17%	146
Nearly every day	7.85%	38
Other (please specify)	2.48%	12
TOTAL		484

Q8 When do you usually ride? (select as many as apply)

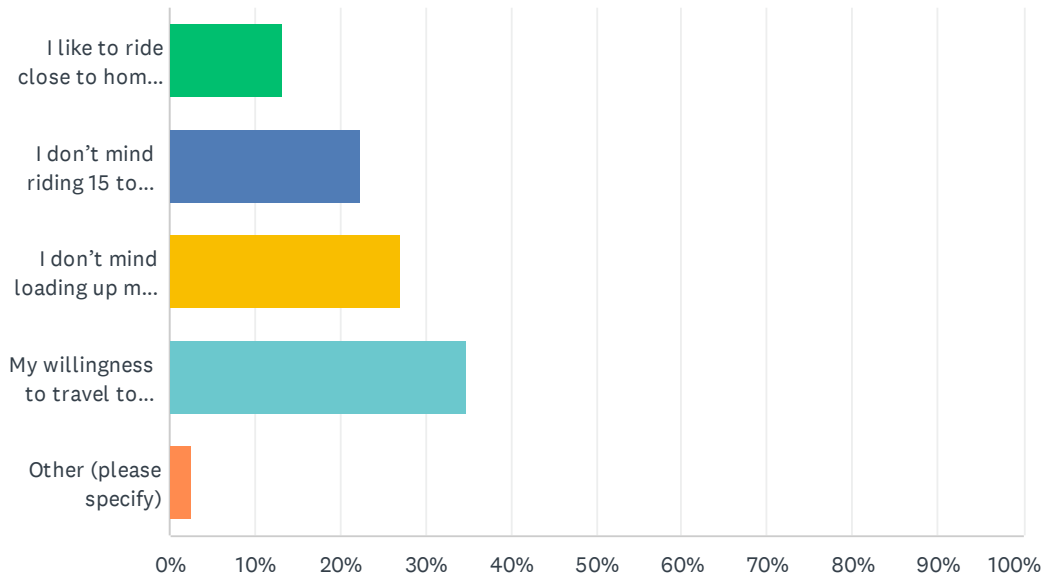
Answered: 484 Skipped: 56



ANSWER CHOICES	RESPONSES	
I like to ride in the mornings/before work or school.	14.05%	68
I ride on weekends.	67.36%	326
I ride in the afternoons or evenings/after work or school.	58.88%	285
I have a flexible schedule and ride at all times of the day.	22.11%	107
I don't work typical 9-5 hours and ride when most others are working or in class.	5.37%	26
I do not ride a mountain bike	2.48%	12
Other (please specify)	0.62%	3
Total Respondents: 484		

Q9 Assuming proposed mountain biking facilities would be located within the City of Lincoln, select the statement about proximity of the facility to your home that best applies. (select one)

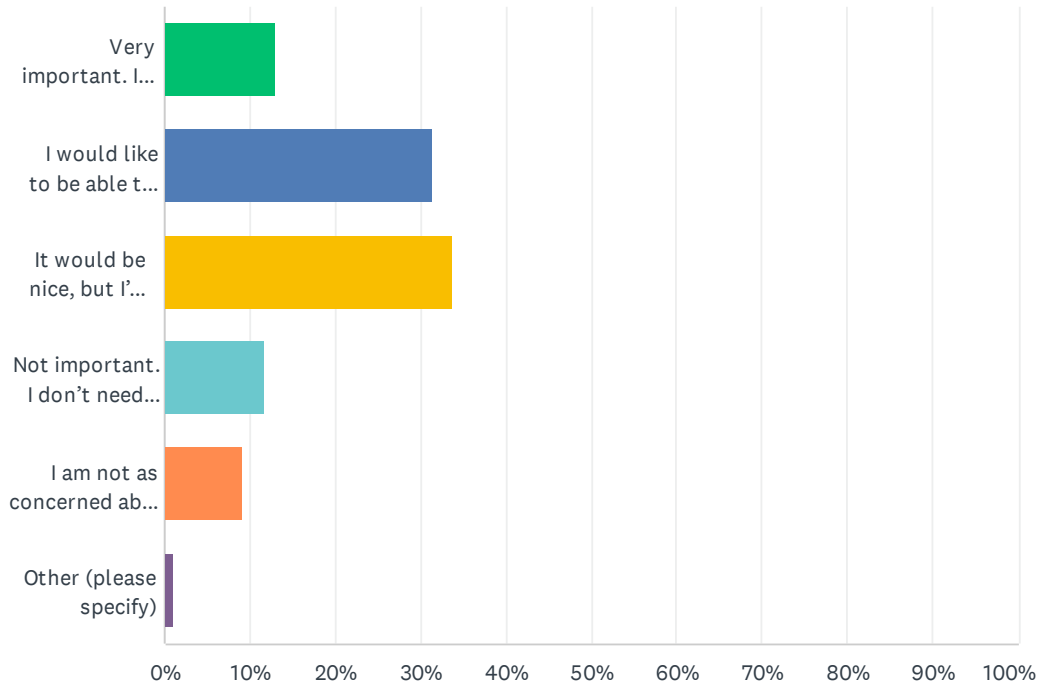
Answered: 483 Skipped: 57



ANSWER CHOICES	RESPONSES	
I like to ride close to home, within walking or short biking distance. If the facility is further away, I would not go as often.	13.25%	64
I don't mind riding 15 to 20 minutes away to get to a facility. It probably wouldn't impact how often I participated.	22.36%	108
I don't mind loading up my bike and driving across town to get to a facility.	27.12%	131
My willingness to travel to a mountain bike facility is going to depend on the quality of the facility.	34.78%	168
Other (please specify)	2.48%	12
TOTAL		483

Q10 How important is it that a mountain bike facility be accessible by trail? (select one)

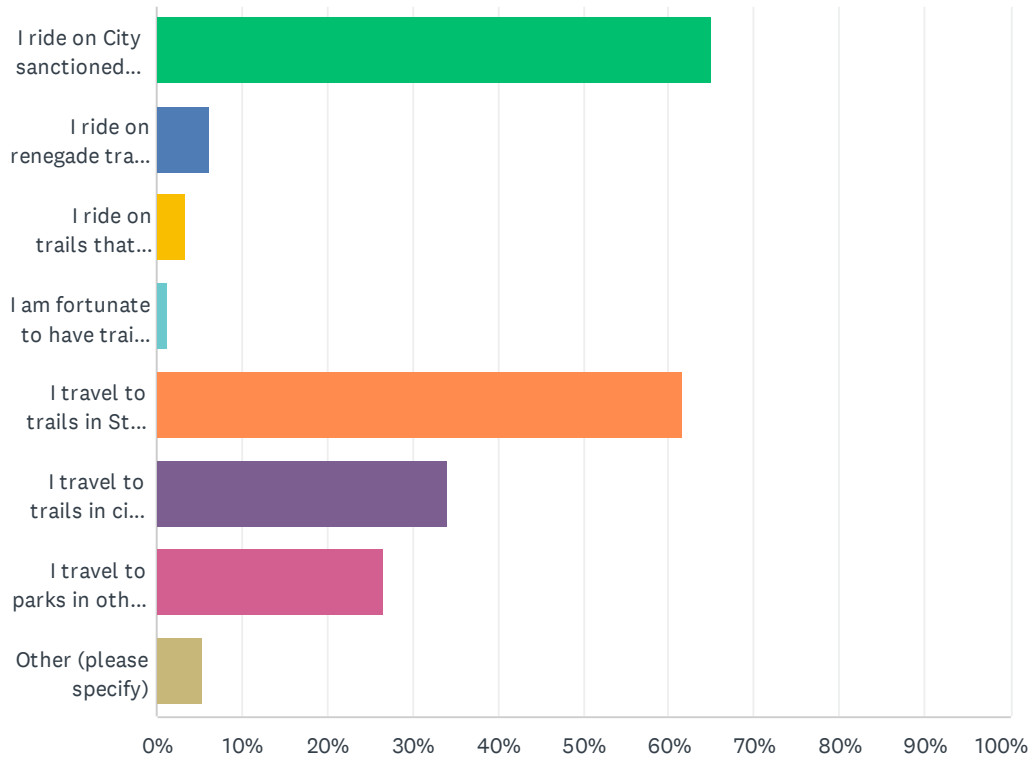
Answered: 483 Skipped: 57



ANSWER CHOICES	RESPONSES	
Very important. I would not want to go to a facility if I couldn't ride there on the trail.	13.04%	63
I would like to be able to ride trail to get there, but if I can get close on trail, I'll find a way to make it the rest of the way.	31.26%	151
It would be nice, but I'm OK riding on the street or loading up my bike and driving there.	33.75%	163
Not important. I don't need trail to get there and often use different bikes for trail and mountain biking anyway.	11.80%	57
I am not as concerned about myself, but I would want safe trail access for younger riders.	9.11%	44
Other (please specify)	1.04%	5
TOTAL		483

Q11 When you ride on single-track trails, where do you usually ride? (select up to 3)

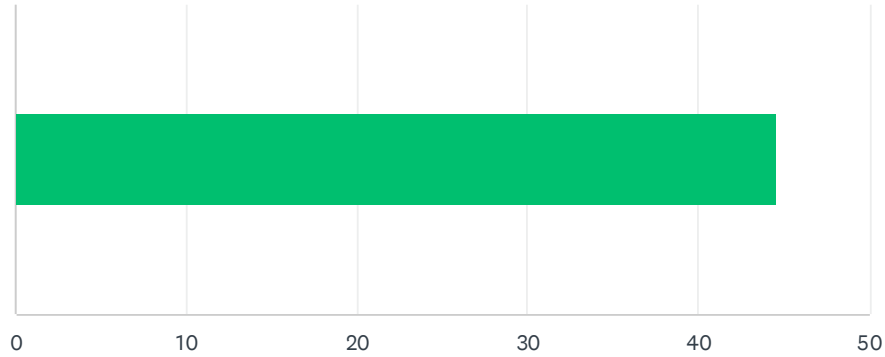
Answered: 484 Skipped: 56



ANSWER CHOICES	RESPONSES	
I ride on City sanctioned trails in Wilderness or Van Dorn Park most often (these are the only two official natural surface trails in Lincoln parks).	65.08%	315
I ride on renegade trails (not City sanctioned) in other Lincoln parks.	6.20%	30
I ride on trails that have been constructed on private property.	3.51%	17
I am fortunate to have trails on my own property.	1.24%	6
I travel to trails in State parks in the surrounding area.	61.57%	298
I travel to trails in city parks in surrounding communities.	34.09%	165
I travel to parks in other states.	26.65%	129
Other (please specify)	5.37%	26
Total Respondents: 484		

Q12 Using the color/shape model, place the marker at the level that best describes your skills.If you are not a current trails user, please continue to next question.

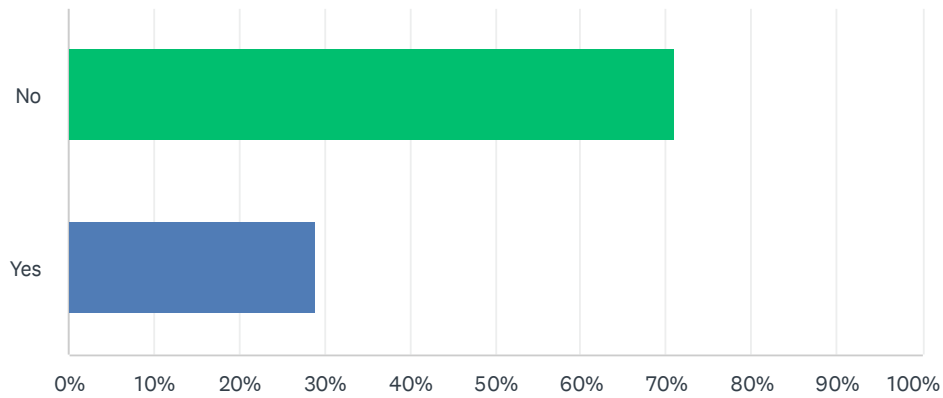
Answered: 461 Skipped: 79



ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	45	20,520	461
Total Respondents: 461			

Q13 Are you currently a member of an organized mountain biking group?

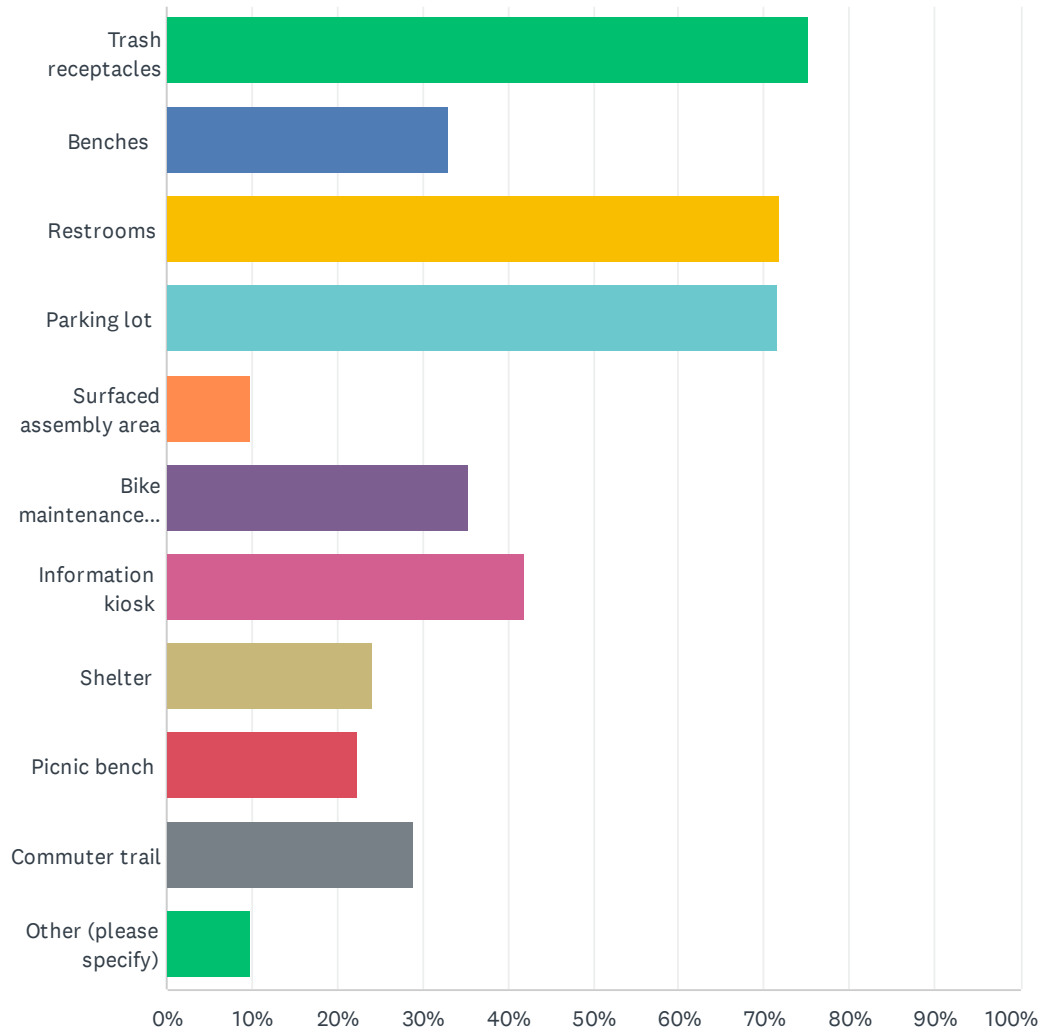
Answered: 484 Skipped: 56



ANSWER CHOICES	RESPONSES	
No	71.07%	344
Yes	28.93%	140
TOTAL		484

Q14 What basic park services do you feel are necessary to have nearby? (Select all that apply)

Answered: 471 Skipped: 69

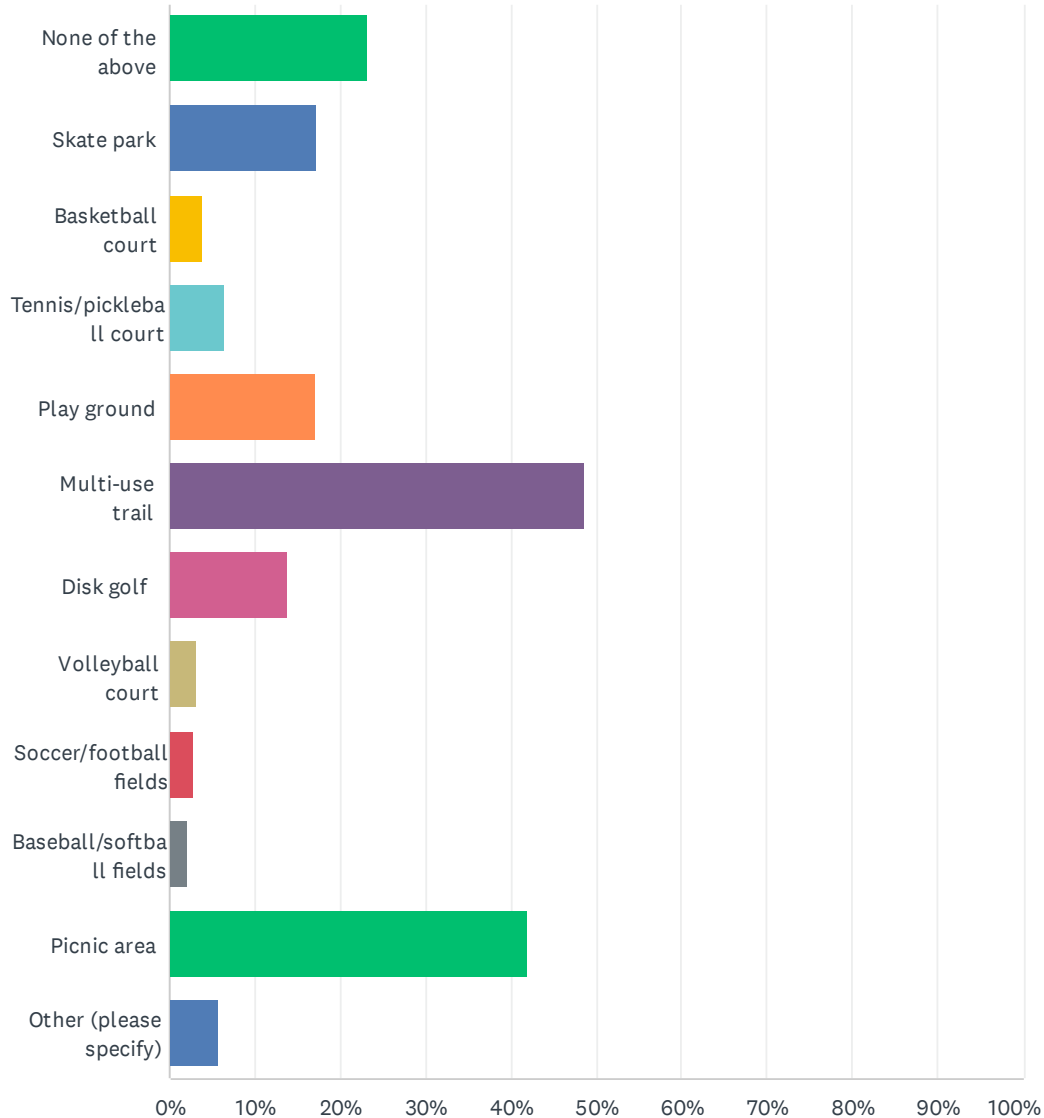


Mountain Bike Facility Survey

ANSWER CHOICES	RESPONSES	
Trash receptacles	75.37%	355
Benches	33.12%	156
Restrooms	71.76%	338
Parking lot	71.55%	337
Surfaced assembly area	9.77%	46
Bike maintenance rack/tools/air pump	35.46%	167
Information kiosk	42.04%	198
Shelter	23.99%	113
Picnic bench	22.29%	105
Commuter trail	29.09%	137
Other (please specify)	9.77%	46
Total Respondents: 471		

Q15 What other park amenities would you like to have near a mountain biking facility? (Select all that apply)

Answered: 439 Skipped: 101

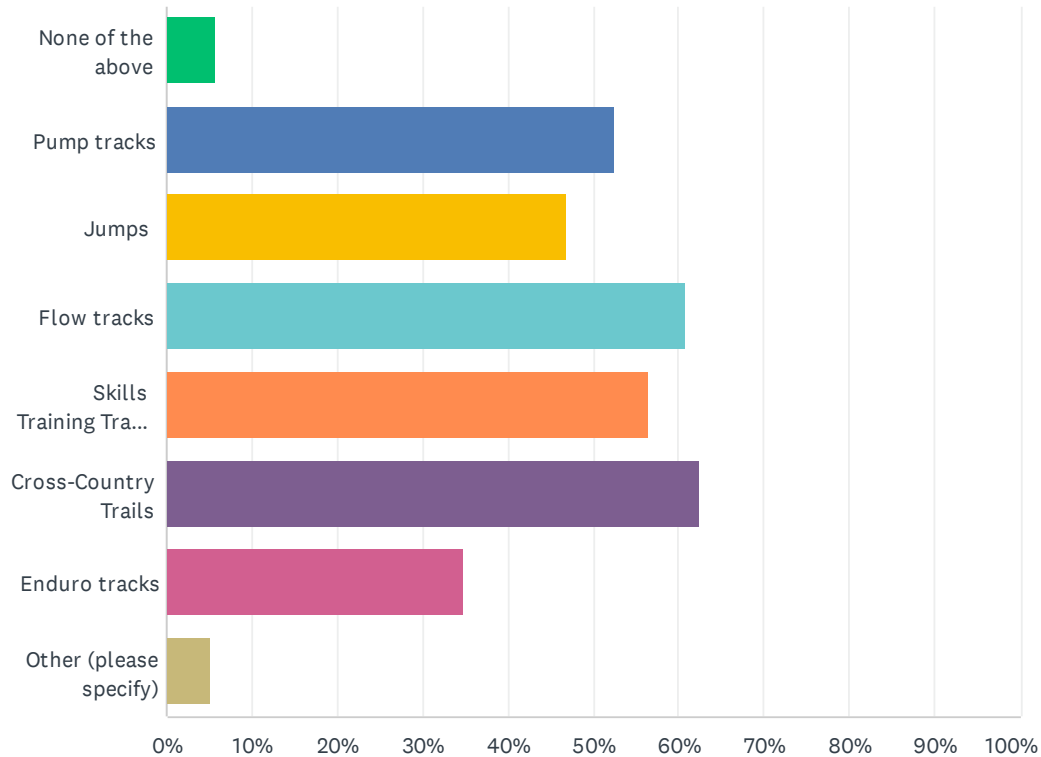


Mountain Bike Facility Survey

ANSWER CHOICES	RESPONSES	
None of the above	23.23%	102
Skate park	17.31%	76
Basketball court	3.87%	17
Tennis/pickleball court	6.38%	28
Play ground	17.08%	75
Multi-use trail	48.52%	213
Disk golf	13.90%	61
Volleyball court	3.19%	14
Soccer/football fields	2.73%	12
Baseball/softball fields	2.05%	9
Picnic area	41.91%	184
Other (please specify)	5.69%	25
Total Respondents: 439		

Q16 Besides single track, what other mountain bike amenities would you like to see in Lincoln? (select all that apply)

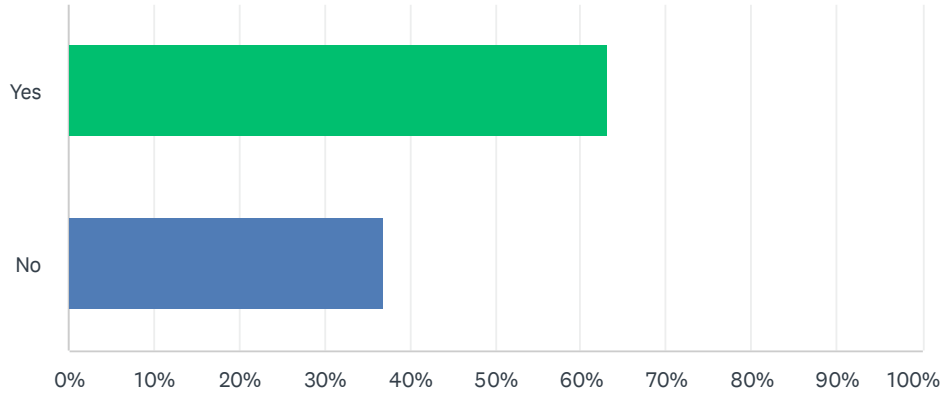
Answered: 459 Skipped: 81



ANSWER CHOICES	RESPONSES	
None of the above	5.66%	26
Pump tracks	52.51%	241
Jumps	46.84%	215
Flow tracks	60.78%	279
Skills Training Tracks	56.43%	259
Cross-Country Trails	62.53%	287
Enduro tracks	34.86%	160
Other (please specify)	5.01%	23
Total Respondents: 459		

Q17 Have you ever taken a trip specifically to enjoy mountain biking facilities that are more than 100 miles from home?

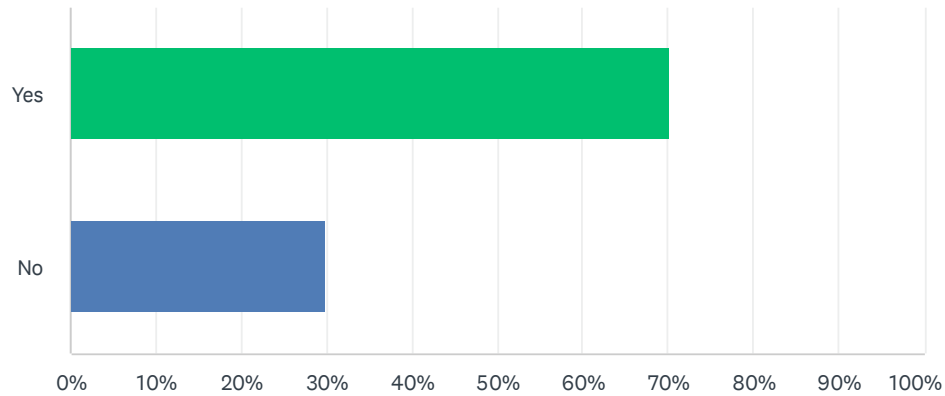
Answered: 471 Skipped: 69



ANSWER CHOICES	RESPONSES	
Yes	63.06%	297
No	36.94%	174
TOTAL		471

Q18 Have you ever taken a trip more than 100 miles from home that was not specifically for mountain biking but did include planned mountain biking?

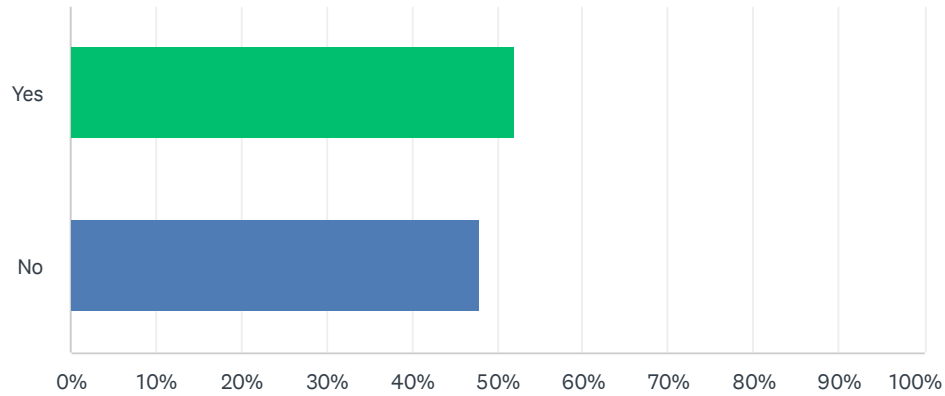
Answered: 469 Skipped: 71



ANSWER CHOICES	RESPONSES	
Yes	70.15%	329
No	29.85%	140
TOTAL		469

Q19 Have you ever taken a trip more than 100 miles from home that included a spontaneous mountain bike activity?

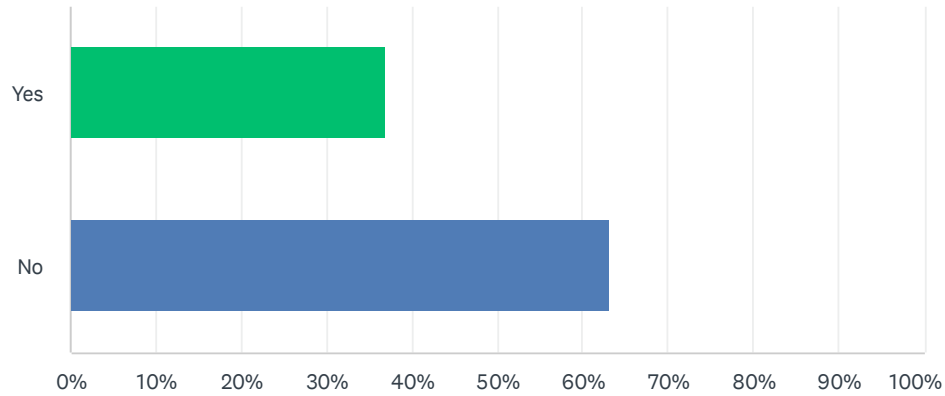
Answered: 468 Skipped: 72



ANSWER CHOICES	RESPONSES	
Yes	51.92%	243
No	48.08%	225
TOTAL		468

Q20 Have you ever travelled more than 100 miles in order to participate in a mountain biking event or competition?

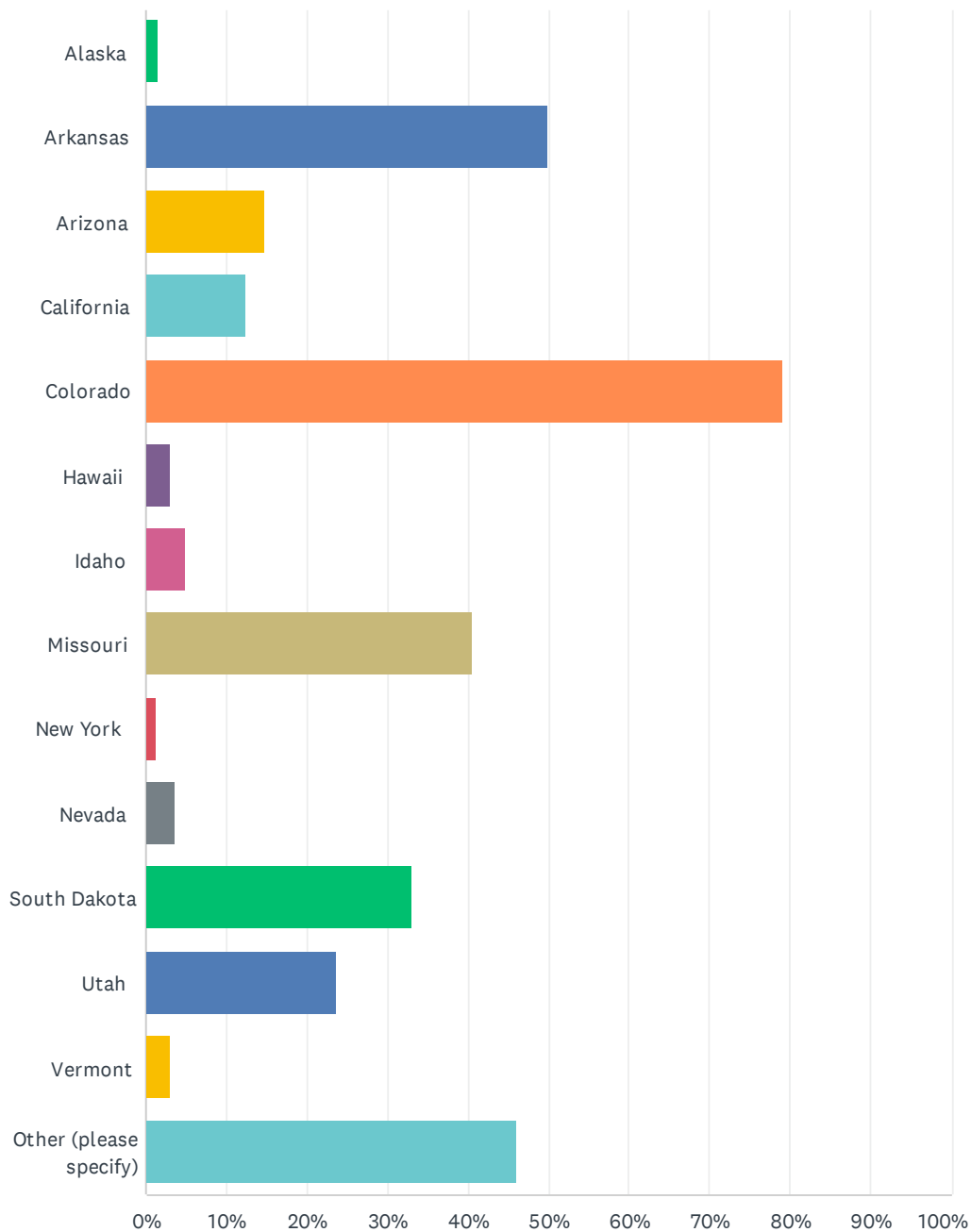
Answered: 469 Skipped: 71



ANSWER CHOICES	RESPONSES	
Yes	36.89%	173
No	63.11%	296
TOTAL		469

Q21 If yes, please indicate which states you have visited where you participated in mountain biking (select all that apply):

Answered: 341 Skipped: 199

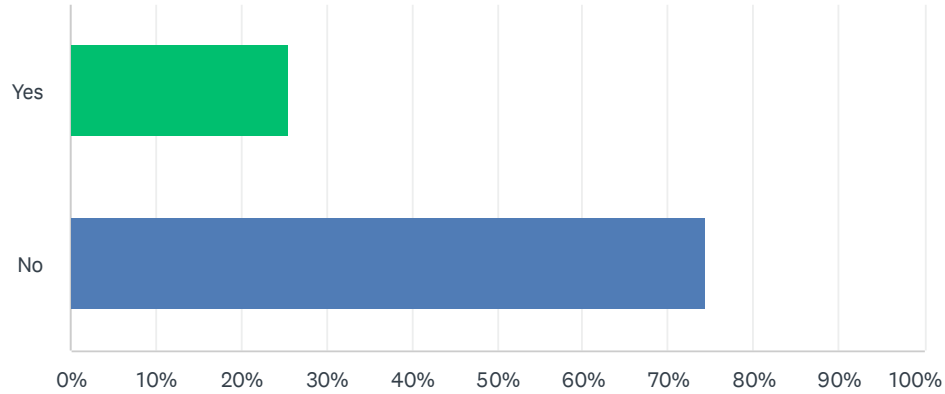


Mountain Bike Facility Survey

ANSWER CHOICES	RESPONSES	
Alaska	1.47%	5
Arkansas	49.85%	170
Arizona	14.66%	50
California	12.32%	42
Colorado	79.18%	270
Hawaii	2.93%	10
Idaho	4.99%	17
Missouri	40.47%	138
New York	1.17%	4
Nevada	3.52%	12
South Dakota	33.14%	113
Utah	23.75%	81
Vermont	2.93%	10
Other (please specify)	46.04%	157
Total Respondents: 341		

Q22 Have you ever paid a membership or daily/weekly/monthly fee to use a mountain biking facility?

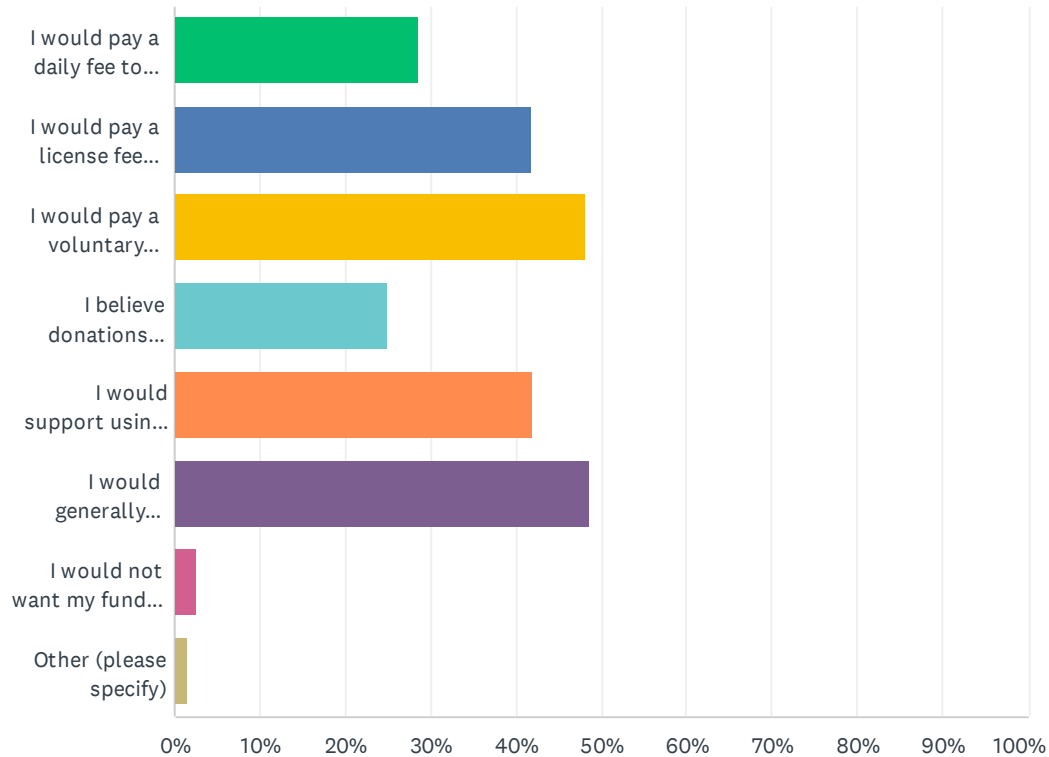
Answered: 460 Skipped: 80



ANSWER CHOICES	RESPONSES	
Yes	25.65%	118
No	74.35%	342
TOTAL		460

Q23 How inclined would you be to direct some of your funds to support a mountain bike facility? (select up to 3)

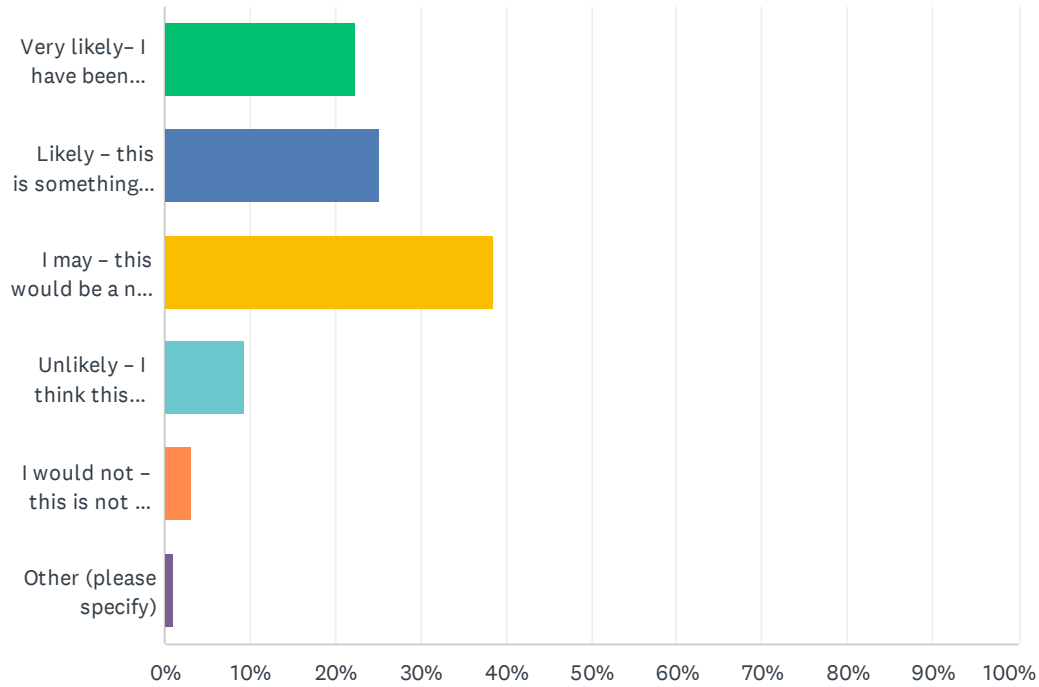
Answered: 462 Skipped: 78



ANSWER CHOICES	RESPONSES	
I would pay a daily fee to gain access to a private mountain biking facility.	28.57%	132
I would pay a license fee that allows access to public mountain biking facilities.	41.77%	193
I would pay a voluntary contribution to support public mountain biking facilities.	48.27%	223
I believe donations should be used to support public mountain biking facilities.	24.89%	115
I would support using property taxes or sales taxes for mountain biking facilities if the public has voted for such use as part of a Quality of Life bond Issue.	41.99%	194
I would generally support a portion my city taxes being used to support mountain biking facilities.	48.70%	225
I would not want my funds to be used for mountain bike facilities.	2.60%	12
Other (please specify)	1.52%	7
Total Respondents: 462		

Q24 How inclined would you be to volunteer, donate or raise funds for mountain biking facilities in Lincoln? (select one)

Answered: 456 Skipped: 84

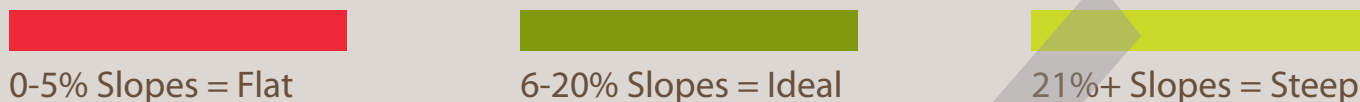


ANSWER CHOICES	RESPONSES	
Very likely– I have been waiting for an opportunity to contribute	22.37%	102
Likely – this is something I am interested in or that my workplace would like to support	25.22%	115
I may – this would be a nice addition to Lincoln parks	38.60%	176
Unlikely – I think this would be nice, but only if it falls within current budgets	9.43%	43
I would not – this is not a use that should become part of Lincoln parks	3.29%	15
Other (please specify)	1.10%	5
TOTAL		456



APPENDIX C

Slope Percentage Categories



Logic behind the percentage categories:

1. 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's considered a fall-line trail. Water will flow down a fall-line trail rather than run across it.
- The half rule is especially important in gently sloping areas. A common mistake occurs when trails are routed down gradual slopes, based on the assumption that erosion won't be a concern in nearly flat areas. Yet, water will funnel down trails and ruin them even on gentle slopes.
- Example: Building a trail across a hillside with a sideslope of 20%, the trail-tread grade should not exceed 10% - in order to escape the fall line.

2. The Ten Percent Average Guideline:

- Generally, an average trail grade of 10% or less is most sustainable.
- 10% or less average trail grade aides trail planning, works with most soil types, minimizes user-caused erosion, allows for flexibility in design, and accommodates undulations.

3. Maximum Sustainable Grade:

- Generally, the maximum sustainable grade is typically 15-20%.

The "Half Rule", "Ten Percent Average Guideline", and "Maximum Sustainable Grade" are the three most essential elements to consider for sustainable trail design. **The three essential elements were used to identify the three slope categories of Red/Flat, Green/Ideal, and Yellow/Steep.**

For parks that primarily fall within the Red/Flat category with slopes ranging from 0-5% that would mean a sustainable trail grade following the Half Rule would require the trail grade be a maximum of 2.5%, essentially flat which presents drainage concerns.

For parks that primarily fall within the Green/Ideal category with slopes ranging from 6-20% that would mean a sustainable trail grade following the Half Rule would require the trail grade be a maximum of 10%, **which is also the average trail grade for the most sustainable trails.** This is the ideal category of slopes because it conforms with the three most essential elements of sustainable trail design.

For parks that primarily fall within the Yellow/Steep category with slopes at or above 21% it means the trail designer must be careful not to exceed the maximum sustainable grade of 15-20%. If the slopes are 40% that would mean a sustainable trail grade following the Half Rule would require the trail grade not to exceed 20% which is at the high end of the Maximum Sustainable Grade and could exceed the 10% average guideline if that grade is sustained for most of the trail.



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