

Powder Mountain Trails Master Plan



Mary's Bowl, Powder Mountain Resort

SUBMITTED BY



PREPARED FOR



POWDER MOUNTAIN

TRAILS MASTER PLAN

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Note: Map titled “Powder Mountain Trails Master Plan,” dated 11/21/12 is intended to accompany this report

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 Purpose of Powder Mountain Trails Master Plan

Powder Mountain resort opened in 1972 and has operated primarily as a ski resort with lift and snowcat served skiing over thousands of acres of private land. There are natural surface and gravel roads throughout the resort that are used to access the lifts, other resort facilities and the few residential homes and lodges presently existing within Powder Mountain. Minimal biking and hiking trails exist within the resort, but they are not part of an official trail system.

Summit LLC is in the process of acquiring the majority of the private land in the Powder Mountain resort area, with intentions of expanding development within the resort area. They are preparing development plans and desire to establish an extensive trail system, incorporating both public and private trails, into this development. The Powder Mountain Trails Master Plan map referenced throughout this document is to be used as a guide for future trail design and is not intended to define the exact route of every pathway.



View from south end of the proposed trail network

1.2 Planning Goals and Objectives

Summit desires to develop an extensive network of new trails, and enhance some of the existing trails and access roads, as part of the proposed expansion of the Powder Mountain resort. These trails would primarily consist of non-motorized, multi-use natural surface trails that would be used for hiking, running, mountain biking, cross country skiing, snowshoeing and equestrian recreation activities.

One objective is to develop lift served biking and hiking for the public which would include the construction of a network of new hiking, mountain biking, slopestyle and downhill biking trails for public use. Most of these public trails would be located in Cache County; in addition the trails proposed around the Sundown lift would be public trails. A pump track and skills park would also be provided for public use.

A second objective is to develop a network of new biking, hiking, equestrian, and cross country skiing trails within the private Summit development, which will be located primarily within Weber County. This will allow a variety of non-motorized outdoor recreational

opportunities for residents and guests of Powder Mountain. The proposed trail system would be designed to provide walking and biking access to as many residents, employees and guests as possible, and minimize the need to drive to trail access points. Some of the mountain biking trails would also be designed to allow the use of cyclo-cross bikes. Other recreational facilities being consider are the incorporation of a Par Course, obstacle course and/or disc golf which would be accessible from the trail network.

CHAPTER 2: PLANNING PROCESS

2.1 General

Consultants from NV5, Inc. and Singletrack Engineering LLC worked with representatives of Powder Mountain and Summit in preparing the Powder Mountain Trails Master Plan. Planning meetings were held with the ownership group and mountain operations staff to identify existing trails, access roads, facilities, site constraints, future development goals, intended trail users, trail destinations, and to develop the overall concept.

2.2 Documentation of Existing Conditions

Aerial photographs, topographic surface information, lift locations, and property ownership information was combined from historical files made available by Summit LLC. Trails built on slopes that exceed 30% are more difficult to build and maintain, and often identify rock outcrop areas, so NV5 prepared a slope-analysis to identify areas where slopes exceed 30% and shaded these areas on the base map. Two site visits were made by Singletrack Engineering personnel to familiarize them with some of the existing facilities and trails within the property and general area. GPS data was collected for a majority of the existing trails within Powder Mountain.



View looking Northeast from Raintree Ridge

After the base map was prepared, NV5 and Singletrack Engineering completed a site reconnaissance visit and explored the entire resort boundary courtesy of Powder Mountain's mountain operations staff and off-road vehicles. During the site reconnaissance, existing conditions were documented for trail considerations including but not limited to: heavily vegetated areas, rocky and barren areas, natural surface and gravel access roads, parking areas, chair lift specifics, spectacular views, places of interest, and site nomenclature.

2.3 Summary of Conditions affecting Trails Development

Site conditions and key findings of this study related to trail development are as follows:

- The vast majority of land in the Powder Mountain resort area is private. The land is located in both Cache and Weber Counties.
- There is an existing extensive network of natural surface and gravel roads within the resort to provide access to ski facilities.
- A few unofficial trails already exist within the resort area.
- Elevations at Powder Mountain range from approximately 7,200 feet to over 9,000 feet. Slopes are steep and precipitous in many places, exceeding 30 percent and including some areas with slope stability hazards. North and east facing slopes are generally covered with snow for much longer than south facing slopes, reducing their value as wildlife habitat and limiting their utility for warm-season recreation. South and west facing slopes are generally more attractive for wildlife and human use, including trails.
- Vegetation varies depending on slope orientation, elevation and availability of water. Tree covered slopes cover some of the area with aspen and firs prevalent, with most of these areas assumed to have a significant soil cover. Areas not covered by trees, either consist of rock outcrop areas where limited vegetation is able to grow, or brush, grass and shrub covered areas. Trails should be designed to minimize the damage or removal of existing trees, where possible.
- Resort facilities which presently exist include ski lifts, lift ticket and restaurant buildings, maintenance and operation buildings, and residential and lodge buildings.
- There are numerous streams and drainages with the area. The trails should be designed to minimize the impact on drainages, wetlands and ponds.
- Much of the area where ski lifts are presently located is being considered for trail development for and use by the public.
- There are numerous scenic points of interest and views that were considered when designing the trail alignments.
- Existing and future development plans were acknowledged.
- Wildlife occurs throughout the resort area and trails should be located away from areas wildlife frequent, if possible. Our experience has been that the wildlife tends to “adopt” some of the trails for their use in getting from one area to another, once new trails are built.
- Slope stability
- This area has unique visual qualities and future trail alignments and construction techniques should be adequately considered to minimize visual impacts.

CHAPTER 3: PROPOSED TRAIL SYSTEM

3.1 General

The proposed trail system has been developed to provide a large network of trails and access roads to the public as part of lift served recreational opportunities. In addition, the trail system will enhance the private development planned for the Weber County portion of the Powder Mountain resort by providing biking, hiking, running, cross country skiing, and equestrian trails for use by residents and guests. The proposed trail system was developed from (1) input from Gregg Greer and Roger Arave with Powder Mountain, (2) input from Summit representatives including Greg Mauro, Natalie Spilger, Avi Spielman, Thayer Walker, and Ryan Bradley, (3) review of available Powder Mountain information and preliminary Summit conceptual plans, (4) site visits which included the collection of GPS data, photographs and other site information, and (5) input from meetings held on September 14 and October 23, 2012.

The trail network will link Summit residential and commercial development pods, access roads and parking lots, lifts and other Powder Mountain facilities where possible. The network will also incorporate and improve existing trails and encourage the closure of underutilized, controversial and poorly integrated existing trails. The trail system will probably be implemented in several phases, with the public trails and some of the private trails being constructed during the development of the Village Center and lots adjacent to Powder Ridge Road.



Trail system will be incorporated with development

3.2 Description of Trails, Trailheads and Access Points

3.2.1 Trails and Trail Types

The majority of the trails will be designed and constructed as natural surface, multi-use trails which can be used by hikers, bikers and runners in both directions. In addition, some of the trails will be wide gravel or paved trails that will allow a variety of walkers, hikers and bikers to access the Village Center and other private facilities. A few of the trails will be one-way downhill and slopestyle (lift served) mountain biking trails that will be open to the public. Equestrian specific trails are also proposed to be constructed within the Summit development. The trail loop in Gertsen Meadow will be groomed for cross country skiing in the winter, and some of the trails

may be used for snowshoeing, where conflicts with alpine skiers and snowboarders will not occur. Details of the proposed trails are provided in the following paragraphs.

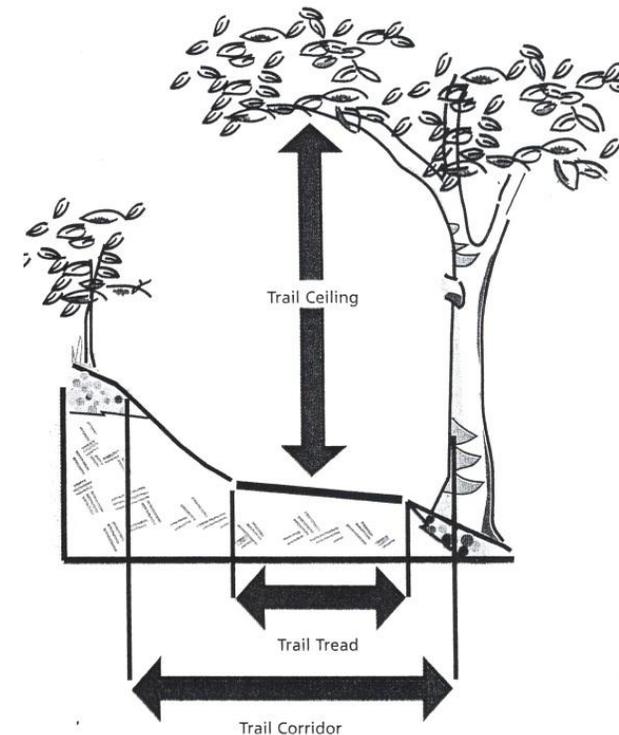
Hiking & Biking Trails

Easy walking, hiking and biking trails are proposed to be constructed adjacent to Powder Ridge Road and extend south of the Village Center to the Gertsen Meadow Loop (solid green on the Trails Master Plan Map). These trails will be 3 to 8 feet wide, exhibit gentle grades and consist of paved, gravel or smooth natural surfaces. If paved, the trail could be used by a variety of cyclists using road bikes, cyclo-cross bikes, hybrid bikes and mountain bikes. These trails could be used for snowshoeing in the winter, and cross country (XC) skiing if the trail is at least 8 feet wide.

Cyclo-cross, Mountain Biking and Hiking Trails and Loops

Easy to intermediate cyclo-cross, mountain biking, hiking and running multi-use trails are proposed to be constructed primarily in the Gertsen Meadow and Raintree Ridge areas of the Summit Development (dual dark green and light green on the Trails Master Plan Map). These trails will generally be 3 feet wide with gentle to moderate grades and will consist of primarily smooth natural surfaces with gravel added where the soils are rocky. Much of the proposed trail alignment is in a meadow or on a ridge with no or sparse tree coverage, so little tree removal or trimming will be required. Where tree trimming is required, the trail corridor should be cleared to a width of 6 feet and the trail ceiling should be at least 8 feet high. Trails that will be used in the winter for snowshoeing or XC skiing will require a trail ceiling of 12 to 16 feet to accommodate the snow cover.

The relatively smooth trail surface will allow the use of cyclo-cross bikes with two primary loops which allow a variety of recreation routes. This trail surface will also appeal to hikers, trail runners and beginner and intermediate mountain bikers. As shown on the Trails Master Plan Map, a 2-mile loop and 5-kilometer loop have been designed in Gertsen Meadow to allow short hikes or runs.



Cross Country (XC) Skiing Loop

A XC skiing loop is proposed to be groomed in the winter in Gertsen Meadow over the cyclo-cross trail (solid white on the Trails Master Plan Map) to be used by classic XC skiers, skate skiers and possibly those using snowshoes. The XC skiing loop should have a trail corridor width of at least 8 feet, and up to 18 feet wide, if the wider snow grooming equipment will be used to prepare the XC skiing surface.



Cross Country Skiing

Mountain Biking and Hiking Trails

Intermediate mountain biking and hiking trails are proposed to be constructed throughout the Powder Mountain resort and the Summit LLC development (solid blue on the Trails Master Plan Map) to provide extensive recreation experiences within the property. The majority of these trails would consist of two-way intermediate cross country mountain biking trails with average grades of less than 10%, trail widths between 2 and 3 feet and natural surfaces with some rocky irregularities. The trail corridor should be cleared to a width of 6 feet and the trail ceiling should be at least 8 feet high. The trails should provide excellent hiking, and trail running opportunities, for most hikers. Most of these trails will be located in areas used for alpine skiing in the winter, so snowshoeing will likely be limited or not allowed on these trails.



Mountain Biking and Hiking Trail Example

Slopestyle Biking Trails

Slopestyle biking trails are proposed in the lift served areas including the Sundown lift and the Hidden Lakes Express lift (solid black on the Trails Master Plan Map). These are proposed to be one-way trails from the top of the lifts with average grades of approximately 7%, and numerous technical trail features (TTFs) consisting of optional lines, enhanced natural features and wooden ramps and bridges. The slopestyle trails will generally be very difficult and should be used by expert mountain bikers using longer travel full suspension bikes. All TTFs will be located to minimize the risk to winter recreational users, probably by placing them in the trees and roping them off in the winter.

There are some unofficial slopestyle (dashed black) and downhill (dashed red) trails in the Powder Mountain Resort area that may be accessible for a while, but future development will probably eliminate them or require them to be re-aligned.

Downhill Biking Trails

Downhill mountain biking trails are proposed for the same two lift served areas: the Sundown lift and the Hidden Lake Express lift (solid red on the Trails Master Plan Map). These will also be one-way trails from the top of the lifts with average grades of 15% to 20%, and numerous TTFs. The downhill trails will be extremely difficult and should be used by expert riders using long travel full suspension bikes.

Equestrian Trails

Equestrians are the heaviest, widest and tallest non-motorized users. These trails require a 6 foot wide corridor and a 10 foot trail ceiling. Contour trails with a durable tread and frequent grade reversals are the most suitable for equestrians. We have proposed equestrian trails in the southeast area of the property which also includes a possible equestrian center and parking lot.

Hiking Trails

Dirt access roads and steep trails will provide hikers with more strenuous experiences than the multi-user trails. These steep roads and trails will generally be too steep for use by mountain bikers, and this will allow some trails where hikers have the trails to themselves. These trails will generally include steep grades and difficult terrain.

Pump Track and Skills Park

A pump track and skills park are proposed to be located at the bottom of the Sundown lift which will be open to the public.

3.2.2 Trailheads and Access Points

Four potential trailhead parking areas have been identified on the Powder Mountain Master Plan map. Powder Mountain resort has three winter parking areas that are proposed to be part of the trailhead parking lots during the summer months when lift served biking and hiking will be offered to the public and as an amenity for the residents and their guests. One of the trailhead parking lots would be located near the bottom of the Sundown lift. This would allow hikers and bikers who want to ride the Sundown lift to park near the lift and associated trails. Hikers and mountain bikers who want to access the proposed trails without using the lift could also park in this trailhead parking lot.

The second trailhead parking lot would be located at the top of the paved road (U-158). Hikers and bikers that want to access the existing access roads in this area could park in this lot.

The third trailhead parking lot exists at the top of the Hidden Lake Express lift. It is uncertain whether this parking lot will be open to the public; it may just provide parking for residents and their guests. This parking lot and a fourth trailhead parking lot which is proposed at the top of the Timberline lift would allow hikers and bikers access to the Hidden Lake Express lift area trails.

The trails proposed adjacent to and in the area of the Powder Ridge Road will provide multiple access points for residents, employees and guests to the Summit project. Utilizing the existing access roads, new trails and roads will provide numerous locations and ways for trail users to access the trail system.

CHAPTER 4: IMPLEMENTATION

4.1 Permitting

Powder Mountain resort and the proposed trail system are located in both Cache County and Weber County. Both counties have been contacted to verify any permitting requirements associated with building trails. There are no permits with the respective Planning departments associated with building a trail. However, the trail designer or contractor should consult with the respective County Engineering Department regarding any stream/drainage crossings, excavation requirements, storm water pollution prevention plan requirements, wetland issues, etc.

4.2 Determination of Final Trail Alignments

The preliminary trail alignments shown on the Powder Mountain Trails Master Plan Map are conceptual in nature, based in large part on general site information and assessments and preliminary expansion plans for Powder Mountain. These trail alignments are expected to be adjusted as the development expansion plans are further refined. Prior to implementation, the identified routes should be verified in the field and adjusted to reflect specific site conditions. Detailed design studies will need to be carried out to ensure the trails are sustainable and safe; these design studies can be performed by an experienced trail building contractor or specialized trail design firm.

4.3 Preliminary Opinion of Probable Costs

Approximate lengths of the proposed trail types were determined from the Powder Mountain Trails Master Plan map, and they are summarized in the following table:

	Existing		Proposed	
	<i>Feet</i>	<i>Miles</i>	<i>Feet</i>	<i>Miles</i>
Biking, Hiking (Easy)			10,470	2.0
Cyclo-cross, Mountain Biking, Hiking (Easy to Intermediate)			47,160	8.9
Cross Country (XC) Skiing Loop			26,830	5.1
Mountain Biking, Hiking (Intermediate)	4,260	0.8	150,210	28.4
Slope Style Biking (Very Difficult, One-Way)	9,800	1.9	21,860	4.1
Downhill Biking (Extremely Difficult, One-Way)	7,960	1.5	17,990	3.4
Equestrian Trail			24,990	4.7
Hiking Only			2,770	0.5
Gravel Road	67,380	12.8		
Total	89,400	16.9	302,280	57.3

There are approximately 17 miles of existing hiking and biking trails within the Powder Mountain resort area at the present time, and the majority of these “trails” are access roads within the resort. This Trails Master Plan proposes approximately 52 miles of additional biking, hiking and equestrian trails, and one of the 5.1 mile trail loops is also proposed to be used as a cross country skiing course in the winter.

Probable costs were estimated based on similar projects and conceptual trail lengths as summarized in the trail system table. All costs are in 2012 dollar amounts and do not include prices for trail easements and/or acquiring any land to build the trail system.

- Easy biking and hiking trails are assumed to cost approximately \$50,000 to \$80,000 per lineal mile based on a 8 foot wide trail with 6-inches of untreated base course surface material and a limited amount of site grading. It is likely that the trail will be constructed as part of the proposed Powder Ridge Road, which would reduce the costs significantly. Based on 2 miles, we estimate approximately \$100,000.

- Cyclo-cross, mountain biking and hiking trails are assumed to cost approximately \$24,000 per lineal mile based on a three foot width with some crusher fines to smooth the trail for cycle-cross usage. Based on 8.9 miles, we estimate approximately \$215,000.
- The cross country skiing loop costs are assumed be on the order of \$10,000 to grade out the large boulders in the trail footprint, and for the placement of course marking poles to facilitate grooming operations.
- The costs to design and construct the intermediate mountain biking and hiking trails is estimated to cost approximately \$15,000 per lineal mile based on natural surface trails in mostly moderate sloped and vegetated areas. Based on 28.4 miles, we estimate approximately \$426,000 for this type of trail.
- The costs to design and build slopestyle trails at the Sundown lift and Hidden Lake Express lift are estimated to be approximately \$26,400 per lineal mile plus approximately \$2,000 per Technical Trail Feature (TTF). We have estimated approximately 8 TTFs at the Sundown lift area and 22 TTFs at the Hidden Lake Express lift area. Based on 4.1 miles and 30 TTFs, we estimate approximately \$170,000 for the proposed slopestyle trails.
- The costs to design and build downhill trails are estimated to be approximately \$37,000 per lineal mile plus approximately \$2,500 per TTF. Based on 3.4 miles and 30 TTFs, we estimate approximately \$200,000.
- The equestrian trails are estimated to cost approximately \$5,500 per lineal mile, so we estimate approximately \$26,000 based on 4.7 miles of equestrian trails. Costs are not included at this time for the suggested Equestrian Center and parking lot.
- Additional costs associated with the trail network implementation will probably include another \$30,000 for Powder Mountain to modify the Sundown lift and Hidden Lake Express lift to carry bikes during the summer to access the new slopestyle and downhill trails. There will probably be some additional costs associated with upgrading the trailhead parking lots for summer operations; this is estimated to be on the order of \$75,000.

Total probable implementation costs are estimated to be on the order of \$1,250,000 based on the conceptual trail system that has been developed.

4.4 Trail Development and Management Standards

The guidelines and standards which follow are intended to direct the detailed design and construction of the trail system. The International Mountain Biking Association (IMBA) has developed an extensive set of documents that address the design, construction and maintenance of natural surface trails. These include Trail Solutions: IMBA's Guide to Building Sweet Singletrack IMBA, 2004; Building Better Trails: Designing, Constructing and Maintaining Outstanding Trails IMBA, 2001; and Managing Mountain Biking IMBA.

IMBA outlines the five essential elements of sustainable trails in their 2004 Trails Solutions book: (1) The Half Rule is that the trail's grade should not exceed half the grade of the side slope that the trail traverses. There is an upper limit to the half rule; very steep slopes may erode even though the trail satisfies the half rule. (2) In general, an average trail grade of 10% or less is sustainable for two-way biking and hiking trails. Short sections steeper than 10% may be acceptable, especially in stable soils or rock outcrop areas. (3) Grade reversals are critical elements of sustainable trails. Most trails will benefit from grade reversals every 20 to 50 feet, depending on soil type and precipitation. Grade reversals also make a trail more enjoyable. (4) Where a trail contours across a hillside, the downhill or outer edge of the trail should tilt slightly down and away from the high side. This tilt is called outslope, and IMBA recommends that all trail treads be built with a 5 percent outslope. (5) Maximum sustainable trail grades are based on local conditions such as topography, soil types and climatic conditions, types and number of users and frequently of grade reversals. Maximum trail grades are typically 15% to 20%, which should allow the one-way downhill trails to be on the order of 15%, however, this is to be determined during the design and construction phase of the steeper trail segments.

Trails installed near streams or natural drainages shall be constructed so as not to adversely affect the water quality or riparian vegetation of the stream or to impair the natural processes of the stream, such as spring flooding.

It is recommended that trail signage be designed and installed to designate the types of trail users allowed on the trails, warn trail users of intersections with roadways and other trails, and provide trail names, trail difficulty rating and other relevant information.

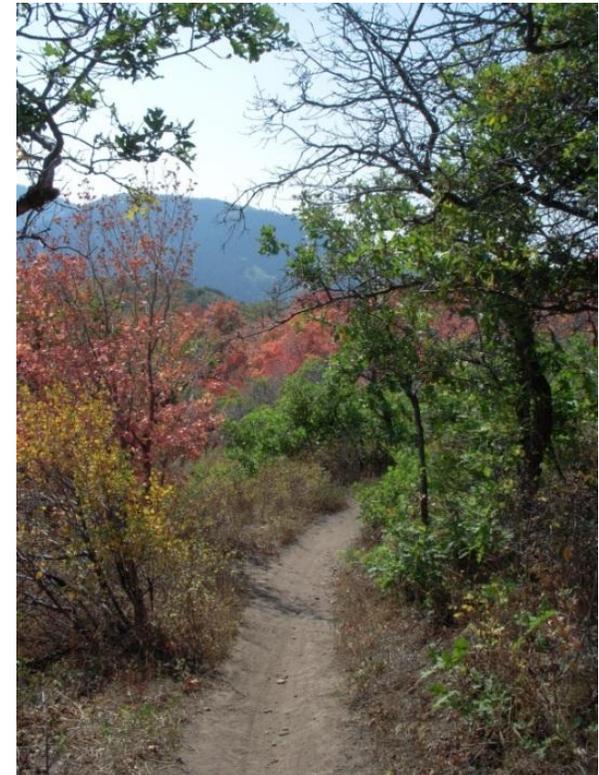
4.5 Trail Maintenance and Management Guidelines

Adequate maintenance is essential to ensure that the trails are safe and passable. If trails are designed and constructed to be sustainable, the required maintenance and associated costs are minimized. The success of the trail system is dependent on an integrated and well-programmed system of maintenance. Maintenance requirements include the removal of tree downfall, weeding and the trimming back of tree branches and vegetation, erosion control, litter and animal waste collection and disposal, trailhead and parking lot cleaning, and the repair of the trail tread, slopes and other surfaces.

4.6 Trail Etiquette and Safety

Trail etiquette is an essential component of a successful trail system, particularly for the multi-use both direction trails that are proposed for most of the trail network. Trail users should understand and utilize "rules of the trail" that address who has the right-of-way, and what is expected of them. A proactive approach for educating the public about trail etiquette is suggested. Information regarding the trail and trail use should be provided to trail users through pamphlets, maps, trail and trailhead information boards, trail signs, and by word-of-mouth.

The trail system has been designed to separate the equestrian users from hikers and bikers since there is a likelihood of conflict and safety issues when equestrians share trails with other users.



Maintenance: Trimming Vegetation

