Feasibility Study

Biathlon and Nordic Skiing Facility
Mammoth Lakes, CA

December 15, 2011

Prepared by

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In Cooperation With

Mammoth Lakes CALIFORNIA

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

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CONTENTS

EXECUTIVE SUMMARY 5
1.0 INTRODUCTION 7
1.1 Plan Objectives 8
1.2 Activities Conducted 10
1.3 Overall Structure of Report 11
2.0 BACKGROUND 13
2.1 Mammoth Area and Geographic Scope of Analysis 13
2.2 Economic Structure of Mammoth Lakes Region 14
2.3 Climate/Snow Characteristics 14
2.4 Topography and Elevation 15
2.5 Land Ownership and Management 15
2.6 Mammoth Region Trails 17
2.7 Biathlon and Nordic Skiing in Mammoth Lakes Region 18
2.8 Regional Location 19
3.0 CONSIDERATIONS FOR BIATHLON AND NORDIC FACILITIES 20
3.1 Competition and Recreation 20
3.2 Biathlon 20
3.2.1 Biathlon Requirements 21
3.3 Nordic Skiing 25
3.3.1 Overall Trail Planning and Design Considerations 25
3.3.2 FIS and USSA Homologation 26
3.4 Four-Season and Other Trail Uses 30
4.0 POTENTIAL SITE LOCATIONS 32
4.1 Criteria Developed for Evaluation of Sites 32
4.2 Review of Three Sites Presented for Evaluation 34
4.3 Shady Rest Area and Campground 35
4.3.1 Site Overview 35
4.3.2 Shady Rest – Considerations for Future Trail and Venue Planning 37

4.4 Panorama Dome 38
4.4.1 Site Overview 38
4.4.2 Panorama Dome – Proposed Venue Plan 40
4.4.3 Next Steps for Panorama Dome Venue Development 41
4.5 Inyo Craters 43
4.5.1 Site Overview 43
4.5.2 Inyo Craters – Proposed Venue Plan 45
4.5.3 Next Steps for Inyo Craters Venue Development 46
5.0 ECONOMIC IMPACTS 48
5.1 Mammoth's Economy – An Overview 48
5.2 Demographic and Tourism Trends 51
5.3 Economic Impact Analysis 52
5.3.1 Other Impacts 56
5.3.2 Economic Impact Evaluation of Different Sites 57
6.0 Financial Feasibility 59
6.1 Capital Costs 59
6.1.1 Operation and Maintenance Costs 65
6.2 Summary of Economic Impacts and Financial Feasibility 66
7.0 ORGANIZATIONAL MANAGEMENT 68
7.1 For-Profit Corporation or Related Entity 68
7.2 Public Agency or Entity 69
7.3 Non-Profit or Quasi-Public Entity 70
8.0 DEVELOPING A BROADER NORDIC TRAIL NETWORK CONCEPT 77
8.1 Concept for a Multi-Node Nordic Skiing Trail Network 78
8.2 Other Trail System Considerations 83
8.2.1 Mammoth Lakes Schools 83
8.3 Point-to-Point Trails and Events 83
8.3.1 Hut System 83
9.0 SUMMARY AND MAJOR RECOMMENDATIONS 85
APPENDIX A– CRITERIA MATRIX FOR INITIAL SITE SELECTION 87
APPENDIX B– MAMMOTH BIATHLON ADVISORY COMMITEE MINUTES 92

Table of Accompanying Tables, Maps, Figures, and Boxes

Table 2.1– Climate and Snowfall Data – Mammoth Lakes Ranger Station 15

Table 5.1 - List of Selected Major Employers in Mammoth Lakes (15 or more employees) 48

Table 5.2 – 2011 Establishment and Employment by Industry – Mammoth Lakes 50

Table 5.3 –Impacts From a Biathlon/Nordic Trail Venue and Expanded Trails 54

Table 6.1 - Two Scenarios of Implementation for a Biathlon/Nordic Competition and Training Facility 60

Table 6.2 – Estimated Annual Operation and Maintenance Costs for Proposed Biathlon and Nordic Event Facility 65

Table 7.1 - Examples of Prominent Nordic-Based Non-Profit Organizations 71

Map 2.1 – Mammoth Lakes and Mono County 13

Map 2.2 – Mammoth Lakes Area Land Ownership and Management 16

Map 4.1 - Three Sites Evaluated for Feasibility of a Biathlon/Nordic Facility 34

Map 4.2 – Shady Rest Area 35

Map 4.3 – Panorama Dome Biathlon/Nordic Venue Plan 40

Map 4.4 - Inyo Craters Biathlon/Nordic Venue Plan 45

Map 8.1 – Conceptual Multi-Nodal Network of Nordic Skiing in Mammoth Region 79

Figure 3.1 - Illustrative "Stadium" or Start/Finish Area Layout for a Nordic Skiing Competition Venue 29

Figure 5.1 – Economic Impacts of a Biathlon/Nordic Facility 53

Figure 5.2 – Impacts of Nordic Trail Proximity on Residential Real Estate 57

Figure 7.1- % of Homeowners Citing Various Amenities as Important or Very Important.. 69

Box 1- Case Example – Maine Winter Sports Center 73

Box 2- Methow Valley Sports Trail Association (MVSTA), Washington State 80

EXECUTIVE SUMMARY

This report provides an evaluation of developing a Biathlon and Nordic Ski Competition Facility in Mammoth Lakes, California at the request of the Mammoth Biathlon Advisory Committee (MBAC) and the Town of Mammoth Lakes. This effort has been the result of a variety of initiatives including the growth and increased interest in the annual Mammoth Biathlon event, implementation of the Town of Mammoth Lakes Trail System Master Plan, interest in a high level competition venue for Nordic skiing and biathlon that would also serve four-season recreational and trail-based competition uses, and enhancement and diversification of the Town's and region's economic base.

In a collaborative process with multiple stakeholders including the US Forest Service (Inyo National Forest), Town of Mammoth Lakes, Mammoth Mountain Ski Area (MMSA), Mammoth Biathlon, Mammoth Lakes Trails and Public Access Foundation (MLTPA), and other private, non-profit, and public groups and individuals, three sites for a potential Nordic/Biathlon Venue were identified for the feasibility analysis in this report:

- Shady Rest Area and Campground, near the business district of the Town of Mammoth Lakes;
- Panorama Dome, in the vicinity of Tamarack Lodge off of Lake Mary Road; and
- Inyo Craters, off of the Mammoth Scenic Loop Road.

Through both off-site work and field investigations conducted by Morton Trails during August of 2011, the major findings and recommendations of this study including the following:

- **Panorama Dome and Inyo Craters offer the most potential for a world-class biathlon and Nordic competition and training venue** – both of these sites have favorable topography and terrain, reliable snow, outstanding views, minimized potential for conflicts of uses, and sufficient area to support trails, supporting facilities, and parking that would meet international standards for biathlon and Nordic ski events;
- **Initial capital costs for a facility range from $0.3M to$2.3M** – the lowest amount ("Basic Level") of estimated investment is based on development of the trails and basic facilities at the Panorama Dome site ($0.3M for Panorama Dome and $0.4M for Inyo Craters), and the highest amount ("Premium Level") assumes a higher level of supporting facilities (such as a day lodge) at the Inyo Craters site ($2.3M at Inyo Craters and $1.6M at Panorama Dome). The major differences in costs between the two sites are associated with the relative remoteness and undeveloped character of the Inyo Craters location compared to the proximity of the Panorama Dome location to the existing Tamarack Lodge cross country facilities and operations. These estimates are preliminary and not based on any detailed engineering analyses.

- **A Biathlon/Nordic facility has the potential to generate significant economic impacts to the Mammoth Lakes and Mono County region** – depending on the level of investment and extent, between 13 and 66 new jobs (full-time equivalents) and between $0.6M to $3.3M in economic output (annually) would be directly associated with the facilities. Other less quantifiable impacts would also accrue to the region including potential increases in real estate values (particularly near the trail systems), attraction of new residents to the area as a direct result of the enhanced trails, human and social capital benefits, and increased health, educational, and employee productivity benefits. Compared to the costs of development there is a 6 month to 4 year payback between capital investment and direct economic benefits.
- **There is significant potential for Mammoth Lakes to develop a connected multiple node Nordic trail system, making it possibly one of the premier cross country skiing destinations in the US and North America** – While the focus of this analysis was primarily to evaluate a specific venue for higher level biathlon and cross country skiing training and competition, it is evident that Mammoth's existing trails and other infrastructure, ski tradition, land ownership and management, and physical characteristics offer the potential to develop multiple four-season trail systems, which would include the three locations evaluated in this study as well as other possible locations. Such a system could rival or surpass such cross country destinations as Royal Gorge and the Lake Tahoe region, the Methow Valley in Washington State, Trapp Family Lodge in Vermont, and West Yellowstone in Montana.
- **Establish an entity to oversee the development and long-term management of the biathlon/Nordic facility and related activities** - There are multiple options for such an entity, two of which the most preferred include: 1) A non-profit 501(c)3 or related organization, which could be or a subsidiary of the MLTPA, 2) An expansion of the Town of Mammoth Lakes Recreation Department. Option 1 would likely be the most feasible.
- **Development of a biathlon and Nordic trail system and/or facility should be coordinated with Mammoth's growing reputation as a year-round, world-class, high altitude training location** – The reputation of Mammoth as a location for high-end long-distance running training and camps and world-class mountain biking events can incorporate development of a biathlon/Nordic facility and use of that facility for multiple activities including other trail-based events, concerts, and other community gatherings and events.
- **Consider a broader point-to-point network across Mono County incorporating development of this facility(ies)** – There is high feasibility for an extended hut-to-hut or longer distance trail system connecting areas outside of Mammoth Lakes, with Mammoth acting as a central node.
- **Use this analysis to make informed decisions on next steps** – These next steps include the close involvement of the Inyo National Forest as well as the other regulatory and important stakeholders to conduct the appropriate environmental, archaeological, fiscal, and other analyses. This document should provide the basis for enacting these next phases towards implementation of the projects discussed in detail in the remainder of this document.

1.0 INTRODUCTION

This report provides an evaluation of developing a Biathlon and Nordic Skiing Competition Facility in the Mammoth Lakes region of California. This study is at the request of the Mammoth Biathlon Advisory Committee (MBAC) and the Town of Mammoth Lakes, but also includes the close involvement and cooperation of: the US Forest Service, Inyo District; the Mammoth Lakes Trails and Public Access Foundation (MLTPA); as well as monies and support via the "Measure R" initiative within the Town of Mammoth Lakes, dedicated to the creation and/or expansion of recreational opportunities for residents and visitors of Mammoth.

As described later in this report, a primary impetus for this study is the increased interest in developing the winter sports of Biathlon (cross country skiing and rifle marksmanship, adopted as an official Winter Olympic sport in 1960) and Nordic skiing (which encompasses cross country skiing, ski jumping, and Nordic combined – jumping and cross country skiing -- all of which are long-established Winter Olympic sports). Although Mammoth Lakes has had a long history of Nordic skiing, there have been recent training, competitive events, and expanded recreational interests in these activities. All of these events are held on existing Nordic skiing trails, some of which are suitable for competition, but none that meet most of the modern requirements of biathlon or Nordic skiing in terms of course profile, supporting infrastructure, spectator facilities, and other characteristics, which we describe in detail within this report.[1]

Another important development within the community of Mammoth Lakes which has precipitated this study is the Town's (as well as Mono County's and the Inyo Forest Service District's) development and implementation of a region-wide master trail plan. This plan, adopted in September 2011, provides a comprehensive evaluation of the Town and region's needs for trails and recommendations for implementing a well-planned program. Many of these trail-based initiatives are in progress, including an extensive bike path project from the Town to the Lake Mary area, a system of soft-surface hiking and mountain biking trails (incorporating many which have existed for decades), motorized uses, and dedicated trail plans in the Sherwin Area Recreation Area (SHARP). Additionally, the US Forest Service has been implementing plans and proposed infrastructure for motorized and non-motorized trail uses throughout the area (the USFS, Inyo District, is the major manager of land in the Mammoth Lakes region).

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[1] A note on terminology: Nordic skiing encompasses the sport of biathlon as well, but we use the terms separately in this report as needed. Additionally, the terms "Nordic" and "Alpine" are capitalized in the text as their historical roots stem from a specific geographic region (Nordic being the Scandinavian countries, and Alpine from the "Alps" in Europe). Biathlon is a sport, like biking, and is capitalized only when referring to a specific event (i.e., the Biathlon World Championships), governing body or regulation (i.e., International Biathlon Union), or the specific project that is the subject of this report (i.e., Biathlon and Nordic Skiing Competition Facility).

Finally, Mammoth Lakes has both a long-established history of summer and winter outdoor recreation (with the dominance of Mammoth Mountain Ski Area (MMSA) since its official beginning of operations in the mid-1950s) and recent influx of new activities. Mammoth Lakes has become a home base for some of the world's premier long-distance runners, which, in turn has stimulated numerous - high school, collegiate and club-based training camps for runners throughout the non-winter months. Additionally, Mammoth Mountain Ski Area was one of the first Alpine ski areas to develop dedicated mountain bike facilities, and the region has hosted numerous mountain bike events at the national and international level.

This brief background provides the context for the current project. As we describe in the next section, there are multiple objectives for this evaluation, many of which are specific to biathlon and Nordic ski competition and training, while others are complementary to the broader initiatives associated with trail-based and outdoor activities in the Mammoth Lakes region.

1.1 Plan Objectives

The key objectives of this project include:

- **Evaluate the needs of existing, and potential future users as well as stakeholders** in Mammoth Lakes, which would include organizations, agencies/government entities, and individuals within and outside the Mammoth area;
- **Establish criteria for the selection of a location for a proposed Biathlon/Nordic skiing venue**, including such factors as topography, elevation, snow cover, management, access, and suitability for high-level competition.
- **Identify potential locations for a venue** based on the criteria mentioned above, and conduct an on-site review of each location to evaluate each site's merits and challenges.
- **Develop a consensus on a preferred location(s) and prepare a preliminary conceptual design of a Biathlon and Nordic facility at this/these location(s)** meeting the primary criteria for a world-class venue as established by the International Biathlon Union (IBU), United States Biathlon Association (USBA), International Ski Federation (FIS) and United States Ski and Snowboard Association (USSA). These criteria would include standards for trail design, shooting range layout, spectator facilities, and other required amenities such as parking and additional space for event staging.
- **Design a venue to meet multiple, four-season objectives for both recreation and competition**. Well-designed biathlon and Nordic facilities are often entirely appropriate for other trail and non-trail activities such as running, hiking, mountain biking, cyclocross, and special events to include concerts and other community gatherings.

- **Propose other complementary trail systems or infrastructure to enhance Mammoth's role as a destination for Nordic-based activities**. While the emphasis of this study has been on a world-class competitive and training venue, there are possibilities for creating multiple nodes of connected trail systems, enhancing the potential of Mammoth as a Nordic-based destination for recreational and competitive residents and visitors.
- **Conduct an economic impact analysis of the proposed facility(ies)**. Trails have become one of the most highly valued amenities for individuals and communities, and there is a growing body of research demonstrating the potentially substantive economic impacts a trail system (particularly Nordic and/or biathlon) can have on a community. Some of these impacts are quantifiable and others are more qualitative – this study addresses both in the context of the Mammoth region's existing economic structure.
- **Highlight case examples of communities that have successfully implemented a Nordic skiing trail system and program**, specifically in rural areas similar in size and economic characteristics to Mammoth Lakes.
- **Provide an estimate of financial feasibility** for developing various components of a Biathlon and Nordic venue plan, including direct and indirect financial and economic benefits and revenues as well as the capital and operating expenses.
- **Recommend options for a permanent organizational structure** for developing, operating, and maintaining a Biathlon and Nordic events venue, including private, public, non-profit and quasi public/private entities, or working within existing structures such as the MLTPA.
- **Coordinate a recommended plan with various trail user groups, land owners, and other entities as well as making a plan consistent with the objectives and activities of the Town of Mammoth Lakes Trail System Master Plan**. We will identify the list of various stakeholders below, but this report takes particular consideration of shared, versus single-use trail systems, the cooperation and periodic conflicts between trail user groups, and the management objectives of important entities such as the US Forest Service, Town of Mammoth Lakes, and Mono County government agencies.
- **Provide a phased, implementable plan** . We understand the challenges of creating a successful competition and events venue as well as a comprehensive trail system, particularly where there are many variables -- technical, political, financial, and otherwise – and our recommendations provide, in our view, a workable set of phased actions, some of which can be implemented immediately upon the review and acceptance of this report.

1.2 Activities Conducted

To prepare this report, we conducted the following activities:

- Reviewed relevant plans, reports, maps, and other documents including:
    - *Town of Mammoth Lakes Trail System Master Plan*, Mammoth Lakes Trails and Public Access Foundation (MLTPA) and various partners and parties, Final Draft, February 2009.
    - *Visitor Use Report, Inyo*, USDA Forest Service, Region 5, "National Visitor Use Monitoring," 2/14/2001 based on data collected FY 2006.
    - *The Economic and Fiscal Impacts and Visitor Profile of Mono County Tourism in 2008*, Mono County Department of Economic Development and Special Projects, prepared by Lauren Schlau Consulting, January 2009.
    - Various meeting notes of the Mammoth Biathlon Advisory Committee (MBAC), 2011
    - Multiple maps and drawings provided by the MLTPA and US Forest Service (Mammoth Ranger District Office), including the Mammoth Lakes region, and detailed topographic and aerial photographs of the three priority sites evaluated in this analysis (Shady Rest, Panorama Dome, and Inyo Craters).
    - International Ski Federation (FIS) Homologation Manual, 5th Edition, May 2009
    - International Biathlon Union (IBU), *Event and Competition Rules* (and related documents associated with facility design and layout), 2010.
    - US Census, various documents.
    - *InfoUSA*, employment and establishment level data for Mammoth Lakes, zipcode 93546, accessed October 3, 2011.
    - Various documents and maps associated with the Mammoth Lakes region
- Prepared "Site Evaluation Matrix" for review of potential locations in Mammoth region for a Biathlon and Nordic Competition Venue, as shown in Appendix A; matrix was evaluated and modified slightly by the MBAC.
- John Morton visited Mammoth Lakes for several days in June 2010 with Tracv Lamb of the United States Olympic Committee (USOC) to meet with Dr. Mike Karch and others regarding possible locations for a biathlon competition venue.
- John Morton returned to Mammoth for several days in March 2011 to observe and assist with Mammoth's highly successful, annual biathlon event.
- Conducted on-site visit to Mammoth Lakes from August 22 to 29, 2011, which included the following activities:
    - One-day, on-site visit to the three sites prioritized by the MBAC (narrowed down from 12 by the MBAC – see Appendix B f or the minutes of the MBAC meeting where these sites were evaluated).
    - Meeting with MBAC members, after a one-day on-site assessment of the three sites prioritized for Morton Trails' review.
    - Initial on-site concept for biathlon and Nordic skiing venue design by Morton Trails at Panorama Dome and Inyo Craters (described in detail in Chapter 4

of this report), including preparation of maps with assistance from Chuck Megivern of the MLTPA.
    - On-site review of design by members of the MBAC for the Panorama Dome and Inyo Craters sites, and final debriefing.
- Reviewed and evaluated other Nordic and trail-based communities and studies; analysis of academic and trade literature on economic impact of trails and recreational amenities.
- Delivery of a draft of this document in mid-November to the MBAC, including staff of the Inyo National Forest, MMSA, and Town of Mammoth Lakes. Comments were incorporated into this final draft. It should be noted that this report is intended as a detailed evaluation for discussion and decision making, but it is not a document binding any of these or other parties to the recommendations and conclusions made in the report.

1.3 Overall Structure of Report

In general, this report has two main components: first, an evaluation of the physical (e.g., topographical, climatic, location) and land use/management components to determine the potential for a Nordic-based system trails, events and training center, and associated facilities; and second, an assessment of the economic impacts of a Nordic-based strategy, the financial feasibility of a strategy, and recommendations for plan implementation. Specifically, the remainder of this report is organized as follows:

- **Background** – Identifying the geographic scope, general physical characteristics of the Mammoth Lakes area, land ownership patterns and management, other trails planning and development in the region, and a history of biathlon and Nordic skiing in the Mammoth area;

- **Considerations for Biathlon and Nordic Facilities** – Including a review of key components and distinctions of recreational and competition facilities, a summary of the requirements for biathlon training and event venues, Nordic skiing design as well as national and international requirements for trails and venues, and use of facilities for four-season trail activities such as running and mountain biking.

- **Potential Site Locations** – Identifying the initial criteria matrix developed for evaluating sites by the MBAC, a discussion of the Shady Rest Area and Campground location, and a detailed discussion and presentation of the concept designed for Panorama Dome and Inyo Craters locations (including benefits and challenges of each location).

- **Economic Impacts and Financial Feasibility** – Including an overview of the Mammoth region's economic structure and demographic characteristics, an economic impact analysis of various scenarios of biathlon and Nordic ski venue development as presented in the earlier evaluation of sites, a presentation of the costs of

venue development for different levels of investment, including capital and operating costs, and an overall assessment of the financial feasibility.

- **Organizational Management**– Identifying options for how to implement recommended alternatives, including for-profit, public, and non-profit structures based on other comparable trail and Nordic communities and Mammoth Lakes existing trail-based organizations.

- **Developing a Broader Nordic Trail Network Concept** – Presenting a framework for creating a more comprehensive vision of Nordic skiing in the Mammoth Lakes region, case examples of other model Nordic skiing rural communities, programmatic and event oriented Nordic trail-based activities, and concepts of "nodes," connectors, and point-to-point trail networks.

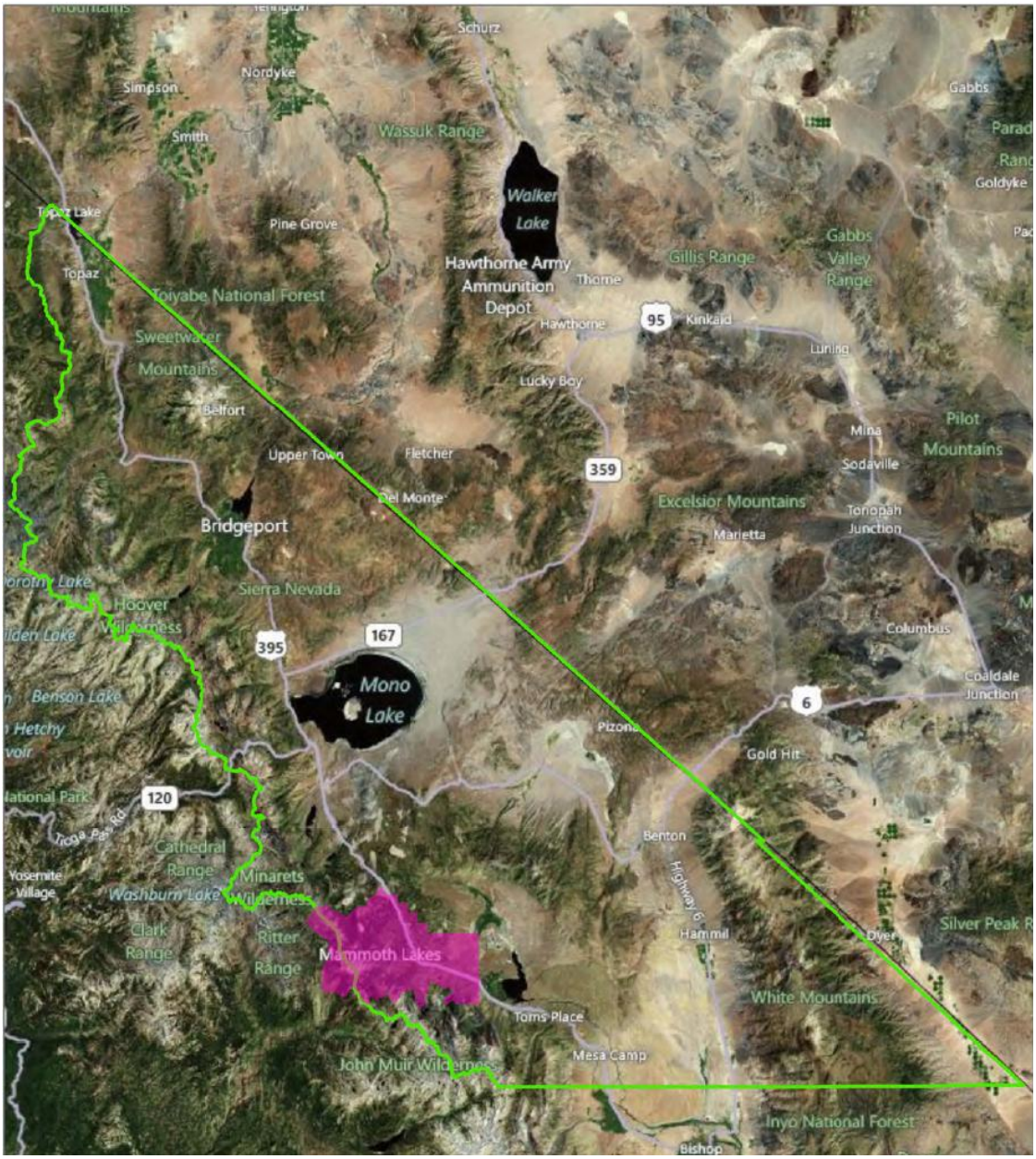
- **Summary of Recommendations** – Highlighting prioritized recommendations and phasing of a plan for implementation.

2.0 BACKGROUND

2.1 Mammoth Area and Geographic Scope of Analysis

The study area for this project primarily encompasses the community of Mammoth Lakes in Mono County, California. The geographic area we evaluate includes both the formal municipality of the Town of Mammoth Lakes, as well areas in the immediate vicinity within the Mammoth Lakes Region of the Inyo National Forest. Mammoth Lakes is on the eastern

Map 2.1 – Mammoth Lakes and Mono County



Source: MLTPA, Chuck Megivern

side of the Sierra Range, with road access via State Route 203, approximately 3.5 miles from the north-south artery of US 395. Mammoth Mountain Ski Area, developed over fifty years ago by ski pioneer Dave McCoy, is a dominant destination and employer in the region. The area is bounded by the high Sierra to the west and southwest, which includes the Sherwin Range to the south. To the north and east is the Long Valley Caldera, a volcanic depression which includes notable geologic features such as Inyo Craters and nearby Devils Postpile National Monument. The area remains geologically active, with a 6.1 magnitude earthquake in 1980 and continued thermal activity throughout and in the immediate vicinity of the Long Valley Caldera.

The Town of Mammoth Lakes, which comprises most of the study area's residents, had a 2010 population of 8,234 (3,229 households), growing 16% from its population of 7,093 (2,814 households) in 2000.

2.2 Economic Structure of Mammoth Lakes Region

As described in greater detail in Section 6.1 of this report, Mammoth Lakes is dominated, first, by the commercial resort of MMSA (which employs approximately 2,500), as well as the tourism-oriented business and services stimulated by skiing and the four-season attractions of the Mountain. Secondarily, the US Forest Service controls most of the land outside the Town of Mammoth Lakes. While only directly employing 75 positions, the USFS Mammoth Lakes Ranger District provides a variety of logging, tourism, and recreational activities.

Other government activities – including state, local, and other federal activities – as well as a medical center are also important employment sectors of the local economy. Additionally, real estate, for both 2nd homes and permanent residents, has been an important driver, having a direct impact on construction, landscaping, and related economic activities.

2.3 Climate/Snow Characteristics

Mammoth Mountain Ski Area and the Mammoth Lakes region is blessed with some of the longest ski seasons in the country, often stretching from early November to late spring. There is wide variation in this snowfall, depending on altitude. Table 1 below provides climate and snowfall data for the Mammoth Lakes Ranger Station, which is located near the business district of the Town of Mammoth Lakes (approximately 7,800 feet).

Mammoth Mountain Ski Area, with a 500 to 3,000 foot elevation difference from the station represented in Table 2-1, receives a considerably greater amount of snow (as well as a longer season where snow is on the ground). Between 1969 and 2008, average annual snowfall was 339 inches, with January and February averaging approximately 70 inches in each month (patrol.mammothmountain.com/MMSA-SnowSummary69-09.htm).

Table 2.1– Climate and Snowfall Data – Mammoth Lakes Ranger Station

	Nov	Dec	Jan	Feb	Mar	Apr
Temperature						
Avg. High	48˚F	41˚F	40˚F	39˚F	45˚F	49˚F
Avg. Low	22˚F	16˚F	16˚F	16˚F	20˚F	25˚F
Avg. Snow Depth	2”	12”	22”	29”	25”	9”

Source: Mammoth Lakes Ranger Station, Western Regional Climate Center (www.wrcc.dri.edu)

Temperatures are generally moderate compared to other notable ski resort areas, which does provide an advantage for attracting Nordic and biathlon enthusiasts. The notorious Sierra snowstorms, as well as high winds in certain areas of the Mammoth Lakes region, can create significant difficulties for transportation, grooming, and hosting of events.

2.4 Topography and Elevation

Like many areas of the US West, the topography of the Mammoth Lakes area includes significant features with a high degree of vertical elevation change. This can be a challenge for Nordic ski trail design, as many trail systems are frequently located on large sidehills. Although the vast amount of logging and mining roads in the area to traverse this terrain are often used for skiing and trail-based activities, these are often less than desirable alternatives to the rolling nature distinguishing the history of the sport in Scandinavia. However, the Mammoth Lakes region does include, areas with terrain that is more varied in nature – particularly near the USFS ranger station, in the Inyo Craters area, and in the cirque and lake basins of Lake Mary and nearby areas.

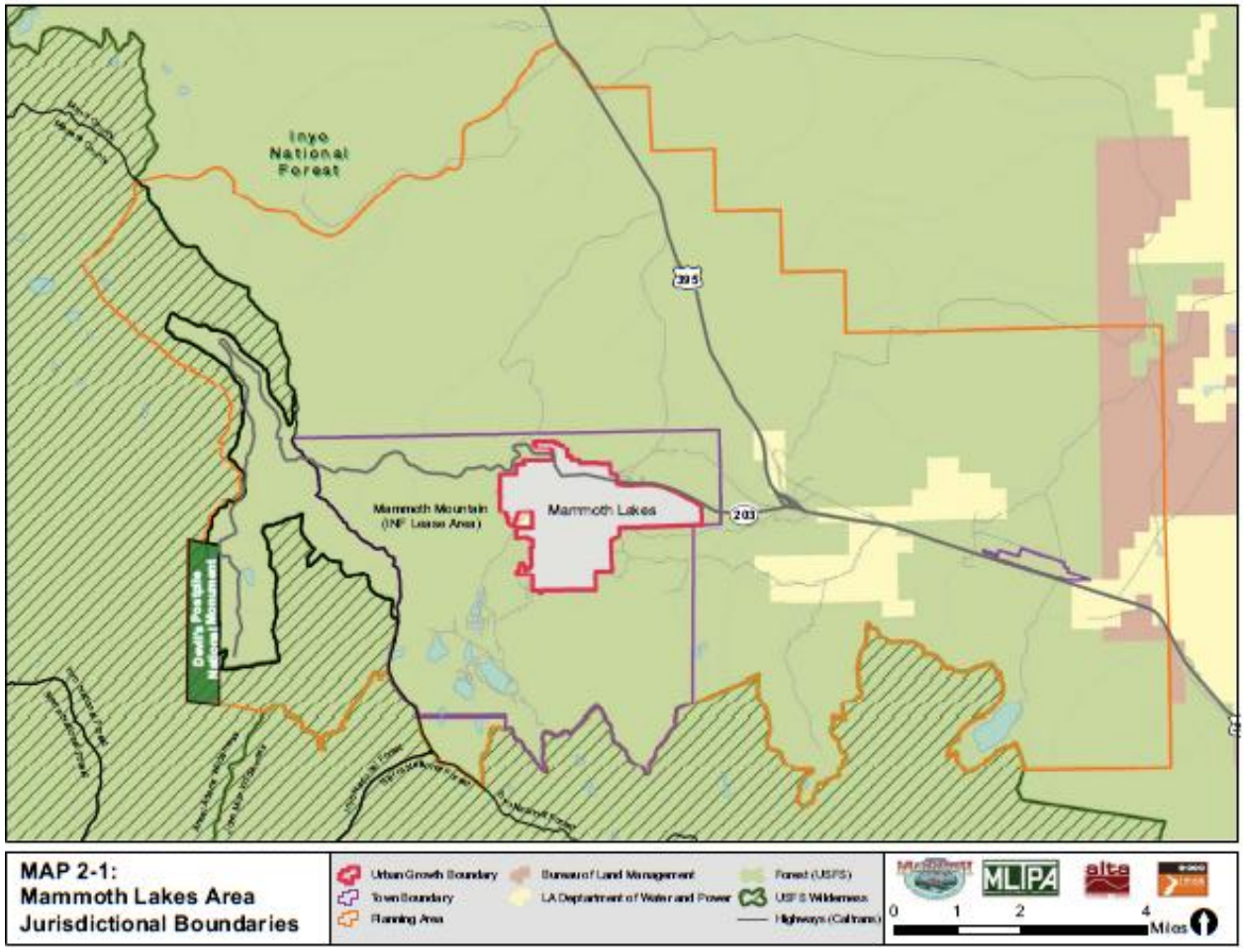
In terms of elevation, most of the area would be characterized as high-altitude (at least according to aerobic activity standards), with the Town of Mammoth Lakes at just under 8,000 feet (2,400 meters), the Lake Mary area at approximately 9,000 feet (2,750 meters), and Mammoth Mountain Ski Area ranging from 8,500 feet (2,600 meters) at the main ski area base to over 11,000 feet (3,350 meters) at the summit. As a point of reference (and discussed in greater detail in Chapters 3 and 4), the upper limit for international Nordic and biathlon ski competitions is 5,900 feet (1,800 meters).

2.5 Land Ownership and Management

As Map 2.1 indicates, the dominant landowner in the region is the US Forest Service, primarily within the Inyo National Forest. The Town of Mammoth Lakes is an incorporated municipality and comprises both the Urban Growth Boundary (primarily private land) and USFS land, of which a significant portion is leased by Special Permit to MMSA (in addition to other permit holders). The Bureau of Land Management (BLM) owns land well to the east of the study area’s primary focus. Other major holders include the Los Angeles De-

partment of Water and Power, though, again, these holdings are at a lower elevation and not within the area of this study's focus.

Map 2.2 – Mammoth Lakes Area Land Ownership and Management



For purposes of this study, the two primary entities having a regulatory stake in a Biathlon/Nordic competition facility are the Town of Mammoth Lakes and the US Forest Service (Inyo Forest, Mammoth Lakes Ranger District). Both of these entities have had a history of allowing trails and the type of uses proposed in this study. For development of a facility on USFS lands, there are a set of procedures required to evaluate any possible environmental or other impacts as would be undertaken for a forestry operation or special use permit on these lands.

For the Town of Mammoth Lakes, the adoption of the Trail System Master Plan, as well as the passing of Measure R (allocating monies for recreational needs in Mammoth), are consistent with the trails, facilities, and uses proposed here.

The one item that warrants particular consideration with respect to a biathlon facility is the Firearms Ordinance in the Town of Mammoth Lakes (Chapter 9.08). While the ordinance prohibits the discharge of firearms within a portion of the Town, an exemption includes, "Any officer or entity who has received a permit from the Mammoth Lakes police department to operate a firearms range. (Section 9.08.080 – *Exemptions*). The Mammoth Biathlon event has successfully obtained a two-day permit under this exemption. We would anticipate the potential for obtaining a longer-term permit, under conditions of specified hours, protocol, and supervisory personnel for a range that is within the jurisdiction of this ordinance.

Mono County also maintains a "Firearm Discharge" ordinance (Chapter 10.64) which would apply to areas both within and outside the Town of Mammoth Lakes. There are exemptions, including "Any person who has a received a permit from the police department of the town of Mammoth Lakes to operate a firearms range who is acting within the scope of the permit."

Finally, the Inyo National Forest does restrict the use of firearms in some areas, including across or on a Forest Development road or hiking trails, or developed recreation area or occupied area. Coordination with the USFS in this regard would be important for designating a permitted biathlon range, for use during events and training.

2.6 Mammoth Region Trails

Mammoth Lakes has the benefit of having completed a comprehensive trail planning process, documented in the *Town of Mammoth Lakes Trail System Master Plan* (see www.mltpa.org for the plan and other related resources). This effort was a multi-year initiative, updating a town-wide trails plan last undertaken in 1991, as well as related activities including a General Bikeway Plan (2007), Sidewalk Master Plan (1997 and 2003), Physical Development and Mobility Study (2006), Parks and Recreation Master Plan (2007), and the Town's General Plan (2007).

In addition to a multi-faceted inventory and set of recommendations for motorized and non-motorized trails throughout the Mammoth Lakes region, the *Trail System Master Plan* identified existing winter recreation trails and facilities and a comprehensive assessment of community members' interests. Of the 19 winter activities identified, "Nordic Skiing on Groomed Trails" followed by "Nordic Skiing on Ungroomed Trails" emerged as the most popular (based on 316 respondents). Clearly, Nordic skiing is a longstanding and popular activity in the Mammoth area, and there is demonstrated interest in expanding the opportunities for these activities.

A long and detailed list of recommendations emerged from this planning effort; outgrowths of this effort (both concurrent and after the plan was published) has included the strengthening of the Mammoth Lakes Trails and Public Access organization (MLTPA), Measure R (a vehicle for financing trails and other recreation improvements and activities, via adoption by the Town Council and subsequently voters of Mammoth Lakes in 2008). Since the

adoption of Measure R, and the completion of the major portions of the current *Trail System Master Plan*, there have been a number of concurrent efforts to implement many of the recommendations made in the plan. This includes development of important segments of the bikeway and multi-use trails, mountain biking trails for open public use (MMSA operates a privately-run mountain bike park), backcountry access (such as to the Sherwin Range, known as the SHARPS initiative), and other activities. This current study is in many respects a component of this broader Mammoth region trails initiative, funded in part by Measure R and in cooperation with the major stakeholders associated with trails and land management in the region.

2.7 Biathlon and Nordic Skiing in Mammoth Lakes Region

The Mammoth Lakes area has had a long tradition of Nordic skiing, primarily in the vicinity of the Lake Mary basin and the operations of the Tamarack Lodge facility. Dedicated skiers from coastal southern California have frequented Mammoth for several reasons. Not only is it the closest major Nordic skiing venue to the population centers of Southern California, but it boasts some of the nation's most stunning mountain vistas, plentiful and reliable snow, and multiple recreational options for all types of winter users.

Additionally, as part of the Far West region (as defined by the United States Ski and Snowboard Association), there has long been a strong Nordic skiing community for recreation and competition along the Sierra crest. Much of this concentration has been focused in the Tahoe/Donner Pass area, but Mammoth's skiers and venues have been a part of this community (albeit the drive between the two major regions can be long, particularly under winter road conditions).

Much of the growth in popularity of Nordic skiing in Mammoth over the past decade can be credited to two-time Winter Olympian, and multiple National Cross Country Ski Champion, Nancy Fiddler who made her home in Mammoth when she retired from international competition. As one of America's most successful female athletes, Nancy has inspired youngsters in Mammoth to try Nordic skiing, and coached several promising high school age competitors on to impressive results at the collegiate level.

In the past, it appears that the majority of Nordic skiing in the Mammoth area fell into three categories. Skiers who sought out groomed, technical trails for training or racing would be drawn to either the conveniently located groomed trails at Shady Rest, or the more challenging network maintained at Tamarack Lodge. The Shady Rest network can be easily accessed from downtown Mammoth and features very forgiving terrain, ideal for novice skiers. In contrast to Shady Rest, the Tamarack Lodge trail network, located just over a mile into the mountains from downtown, appeals to the more advanced skiers. While benefiting from the jaw-dropping scenery of the Lake Mary area, the Tamarack trail system predominantly make use of existing Forest Service roads. These trails generally climb from the Lodge, and therefore reach an elevation above sea level where altitude exerts a significant impact on endurance sports. An additional issue facing the Tamarack trails is the require-

ment to share access (at certain times during the season) with motorized recreational enthusiasts.

Finally, backcountry skiers who preferred untracked routes leading to alpine snow fields found access to their favorite terrain via plowed Forest Service roads and maintained trailheads.

2.8 Regional Location

Mammoth Lakes and Mammoth Mountain Ski Area would be characterized as a destination location for winter and other recreation activities. From the Los Angeles area, Mammoth is a 5 ½ hour drive; from San Diego, it is nearly 7 hours; from the San Francisco Bay Area, it is 6 ½ hours; from Las Vegas, it is 6 hours; and from the closest metropolitan area, Reno, it is 3 ½ hours. Commercial air access is offered daily, from Los Angeles, San Francisco, San Diego, and other coastal California airports, with different daily schedules during summer and winter seasons. Weather does pose a significant issue during winter months for air access, primarily due to the storms that provide the area with the ample snow for which is so well-known.

Compared to other Nordic-based destinations (and biathlon communities), Mammoth Lakes requires significant transportation logistics, but it is not dissimilar to other such destinations as the Methow Valley, Washington; Hayward/Telemark, Wisconsion (site of the American Birkebeiner cross country ski marathon); Ft. Kent and Presque Isle, Maine (host of recent major World Cup Biathlon events, located in the most remote corner of the northeastern US); and West Yellowstone, Montana (a central gathering place for the Nordic community during Thanksgiving week).

The well-established resort community centered around the Alpine area of Mammoth Mountain Ski Area, as well as a broader Nordic skiing community primarily towards the central and northern Sierra (centered in the Lake Tahoe area), also provides Mammoth with a good foundation for further Nordic skiing and related trail-based development. It does require continued enhancement of its Nordic, and trail-oriented, reputation to attract the necessary destination visitors and those who choose to locate 2nd homes or permanent residences in part because of Nordic and related amenities.

3.0 CONSIDERATIONS FOR BIATHLON AND NORDIC FACILITIES

3.1 Competition and Recreation

Although this feasibility study focuses on the development of a world-class competition venue for biathlon and Nordic skiing, it is important to mention at the outset of this chapter that such a facility is not mutually exclusive of recreational cross country skiing, or other recreational trail-based activities during the non-winter months. We recognize that the trails for any Nordic facility will only have competitive events during a limited number of days over a skiing season. Because of this, we believe it is important to design the trails, and other supporting facilities, to offer a similarly high quality experience for recreational skiers. A well-planned configuration of trails can both meet the highest standards of competition, while also offering options for users of all abilities when events are not being held.

Additionally, a sound venue design will accommodate those who are not participants in the events – including spectators as well as recreational skiers. Oftentimes, a cross country ski center or trail facility will host competitions but, during these events, will not have an alternative for recreational skiers (who are often the major revenue generators of centers charging a day pass or user fee). The solution to this problem is to plan for alternative recreational trails and experiences that are separate from the competition venues. While the discussion below provides a fair amount of detail regarding the requirements for a competition facility, we place a high priority on recreational users in the overall venue and trail layout and design.

3.2 Biathlon

Biathlon is a sport that has had a limited, but growing, following in the United States. Once dominated by military personnel, biathlon is now governed in the US by the United States Biathlon Association (USBA). Thanks in large part to the exciting lead changes which occur on the shooting range during a biathlon competition, the sport has enjoyed dramatically increased popularity internatioanally, including extensive television coverage at recent Olympic Games. It is not uncommon for weekend, World Cup biathlon competitions to draw European television audiances comparable to the Super Bowl here in the States.

In recent years, administrative changes within the USBA, the recruitment of top European coaches, and significantly enhanced funding of the U.S. athletes have resulted in improved international results for American competitors. This in turn, contributes to more interest among young, aspiring athletes. The remarkable success of the annual, Mammoth Biathlon event, which last March drew almost 200 participants (and perhaps as many spectators) is a clear indication of the rapidly growing popularity of the sport.

3.2.1 Biathlon Requirements

Because of Mammoth's elevation at generally 2,200 meters and above, it is unlikely a biathlon venue in Mammoth will ever host a major international competition (where 1,800 meters is the current, official maximum elevation). It is feasible, though, that high level training camps and even major regional or national competitions can be held at Mammoth.

It should also be noted that due to the impact of climate change in Europe and around the world, both the IBU and the FIS are currently studying the existing elevation standards. As venues which have annually held successful world caliber competitions for decades are now facing recurring challenges of inadequate snow and more moderate temperatures, locations with more dependable conditions are gaining attention, in spite of their previously unacceptable elevation above sea level. As we describe in further detail below, there are also certain international requirements (as promulgated by the International Biathlon Union, or IBU) which govern venue layout and facilities. We have undertaken our work with the IBU requirements as a guide, understanding that formal IBU licensing is unlikely.

3.2.1.1 International Biathlon Union

As discussed above, the IBU establishes the requirements for biathlon rules and venue standards. For high-level competitions, the IBU issues licenses to venues in two categories – an A-level (suitable for World Cups, World Championships, and Olympic Games) and B-level (suitable for the US Olympic Trails, NorAm Cup, and Youth and Junior World Championships). In general, we have considered the requirements of a B-License level of venue, (again, with the understanding that such a license, under current guidlines would be unlikely to be formally awarded because of elevation). Below, we provide a summary of the major requirements of a venue suitable for that envisioned in the Mammoth Lakes region.

3.2.1.2 Shooting Range

Modern biathlon requires **a shooting range 50 meters** from the firing line to a target. Although the IBU requires electronically-operated targets, it is considered acceptable to have **metal targets operated manually** with a rope strung down the range and reset after a participant has completed a shooting bout (five shots).

Because the nature of biathlon competitions has shifted to include more mass start and "pursuit"[2] style events, there is a need for sufficient target lanes, or points, to accommodate larger events. IBU guidelines require 30 points (with two spaces added in reserve). For

[2] Pursuit races include two separate races, with the first race (typically in an individual, or interval, start format) determining the order of start for the second race. A racer for the first event with a time 20 seconds behind the best competitor, for example, would then start by that same amount for the second race. The first competitor crossing the finish line in this second competition would be the overall winner of the pursuit event.

Mammoth, **a facility with 20 points would be sufficient** for major regional and occasional national-level events. Firing lanes require a minimum of 2.7 meters each, equating to approximately 54 meters in width for a range. On the sides and behind the firing line, an earthen berm of 3 to 6 meters in height provides protection for wind and added safety for shooting.

A "**cone of safety**" is also considered as part of the layout of a range, to ensure against any errant shots from the firing line endangering human safety or settlements. This cone of safety is generally defined as a 45 degree angle protruding from each corner of the firing line outward, and can be modified based on natural topography. A .22 caliber standard velocity bullet (that used for biathlon competition) can travel approximately one mile before losing the capability to be a significant safety threat. For this reason, range layout seeks to have little to no human activity or settlement within a one mile distance from the firing line within the cone of safety.

The **aspect** (layout direction) of a range should generally face to the north, to prevent participants from shooting into the sun (which generally arcs across the southern sky). This general rule-of-thumb is not absolutely firm, as natural topography (i.e., terrain and vegetation behind the firing line) and consideration of other factors (i.e., wind, cone of safety, etc.) can determine ranges that do not necessarily face northward.

Protection from wind is another important characteristic in range layout and location. Though it is certainly acceptable, and even anticipated to have a degree of wind during a biathlon competition, as it adds to the skill level required of competitors, it is considered a detriment to have a range which has strong wind gusts, especially cross-range.

The area immediately behind the firing line requires room for a **shooting ramp**, **skiing lane**, **coaches area**, and **media/spectator area**. This area can be approximately 10-15 meters deep. The most desirable access to these areas (by individuals on foot) is via a bridge overpass or tunnel underpass, where possible, which eliminates the necessity of coaches, officials , journalists and spectators walking across the prepared race course .

3.2.1.3 Stadium

The "stadium" area of a biathlon (and Nordic ski racing) facility consists of the **start, finish, spectator area, timing facilities, wax testing, and general staging areas**. The **penalty loop**, which needs to be 150 meters in distance, is also typically part of the stadium/range area. The penalty loop is typically oval or circular in shape, but can take other forms as long as it is located shortly after competitors leave the range, is accessible for entry and exit, wide enough for passing, and does not contain any sharp corners.

The start/finish area typically requires a flat space about 150 meters long by about 30 meters wide. The start lanes will be up to 11 meters wide and at least 100 meters from where the standard trail system begins. The finish area must be a minimum of 9-10 meters in width in the final 100 meters prior to the actual finish line, with an additional 10-20 meters

of transition area past the line. In general, the range, shooting ramp and coaches/media area, start, and finish areas should be clear of trees and vegetation, though selective exceptions are possible particularly at the borders or corners of these different zones.

There must also be accommodation for spectator access and viewing, often situated in the area behind all of the "field of play": the shooting range, start/finish, and related staging lanes, penalty loop, etc. These spectator areas also can be skillfully accommodated between the various competition areas or on bridges or structures.

Finally, the increasing popularity of biathlon (particularly in Europe) is, in large part, attributable to televised coverage. **Special considerations to accommodate television and media coverage** include sources of power, well-located and multiple camera locations, sections of the course that provide optimal camera angles, microphones in the range infield just below the shooting platform, and space for advertising by corporate sponsors (such as inflatable start and finish structures. Although this may not be a priority at the outset for the Mammoth facility, it may be at a later time, and incorporating consideration of these components in the original plan will eliminate the need for inefficient retrofitting of these features in the future.

3.2.1.4 Course and Trails

For biathlon, **preferred loop distances** include 2 Kilometer(K), 2.5K, 3.3K, and 4K configurations (which can be undertaken as a series of cutoffs on the same loop). Other distances to incorporate, if possible, include 1K, 1.5K and 3K. Because skating is now the only style used in biathlon competition, there is a need for trails of sufficient width. A standard width of 6 meters allows at least two competitors to ski side by side an minimizes the occurance of obstruction in races. On uphill sections, a wider trail is preferred (for biathlon) though not required under IBU standards.

Under IBU guidelines, **courses need to meet sufficient total climb requirements** for each loop distance. For a 10 kilometer course, for example, the total climb standard is from 300 to 450 meters, which translates to 100M to 150M for a 3.3K loop. A 7.5K relay course (3 loops of 2.5K) requires a total climb from 200M to 300M, or 67M to 100M for a 2.5K loop. The IBU *Event and Competition Rules, 2010*[3] identify all of the other course distances and climb requirements.

In addition to creating courses testing a range of skiers physical and technical abilities, there are some other trail considerations specific to biathlon courses. An **uphill approach to the range** has become a preferred feature, encouraging competitors to enter a shooting stage with a higher pulse (and requiring additional marksmanship skill). **Challenging loops**, either in the form of at least one significant climb or multiple climbs which offer fewer opportunities for rest, again provide the opportunity for the best athletes to separate

[3] www.Biathlonworld.com/media/files/downloads/Handbook2010_e_cap3IBUEventandCompetitionRules.pdf

themselves from a pack. **Selected paved loops** designed for rollerskiing offer off-season training and competition opportunities (applicable both for biathlon and Nordic skiing). Such loops require particular consideration of trail design, with safe turns and long runouts on downhills.

As we describe later, the course and trails for biathlon events are similar to those of other Nordic skiing competitions, as described in the FIS homologation requirements. In general, the FIS requirements are far more detailed and specific, with respect to the trails and courses, than those for biathlon and the IBU standards. Overall, a well-designed course for biathlon is also one that is highly suited for Nordic events, and vice-versa.

3.2.1.5 Supporting Infrastructure

While the range, stadium, and trails comprise the most important backbone of a world-class biathlon venue, there are additional facility requirements, depending, again, on the level of competition the venue is intended to host. A partial list of these facilities includes:

- **Main Lodge/Building**, including some or all of the following:
  - Common area
  - Bathroom and changing facilities
  - Locker/team rooms
  - Competition office
  - Jury room
  - VIP rooms
  - Media room
  - Food and beverage facilities
  - Storage areas
  - Waxing areas
  - Medical facilities
  - Anti-doping testing room
- **Wax Cabins**
  - Up to 30 separate, ventilated rooms for wax technicians and team changing
- **Parking**
- **Spectator Area**
  - 1,000 people for major events
- Extra space for **temporary structures**, such as:
  - Media trailers
  - Food and beverage tents
  - Athlete common areas
- **Grooming/Equipment Building**
- **Timing Building** (if separate from main building)
- **Range Control Building**, which supports electronic target systems and requires special building specifications such as bullet-proof siding and plexi-glass windows.
- **Other Storage Sheds**, as needed for fencing, supplies, and other equipment.

A recent trend has been to accommodate much of this supporting infrastructure in **temporary structures such as tents and trailers** (for example, the traditional wax cabins can be substituted or supplemented with trailers specifically outfitted for this purpose). This use of temporary facilities eliminates the need for permanent infrastructure. Key requirements for these temporary facilities include flat, easily accessible areas of sufficient size. Creating permanent facilities, in particular a main lodge or building, does allow flexiblity for recreational and other users during non-competition periods.

Other facilities include **snowmaking** (though likely not needed in Mammoth) and **course and range lighting**. Again, these are investments required only for venues hosting major, often international, events and may not be a priority for the Mammoth facilities at this stage.

3.2.1.6 Other Considerations

For obtaining formal IBU licensing, there are a number of other considerations that are not necessarily associated with the actual competition itself, but worth summarizing here. Again, we recognize that issuance a formal IBU license is improbable under current guidelines, but the following factors are important for high level competitions, as well as hosting elite training camps. This list includes:

- Availability of accommodations within 10 kilometers of the venue, including number of hotels, their quantity, and their fees.
- Distance to the nearest major airport, and ground transportation options from the airport, including costs.
- Medical support facilities, including a hospital and/or first aid center.
- Cultural/social events

In our view, the Mammoth region offers most of these other factors, with perhaps the exception of reliable access to an airport. While the local airport offers service, it can be cost prohibitive or unavailable during periods of poor weather. Reno provides the closest viable option, requiring an additional 3 hours drive time (although there are numerous current and former World Cup venues that have required more onerous travel arrangements).

3.3 Nordic Skiing

3.3.1 Overall Trail Planning and Design Considerations

Current Nordic competition venue design and layout focuses on a couple of factors or issues. In former times, endurance athletes were seen at the starting line then disappeared into the woods for an indeterminate amount of time before the leaders burst back into view as they sprinted the final yards to the finish line. This was equally true for high school cross country running races as well as Olympic Nordic skiing. But some time ago, designers of Olympic Nordic skiing venues began to consider the spectators. Soldier Hollow, the site of the Salt Lake Olympic Nordic events in 2002, with trails traversing a large, nearly treeless

bowl almost entirely visible from the start/finish stadium, set a new standard for spectator enjoyment. Now, all new Nordic facilities make an effort to bring the competitors within view of the spectators multiple times within a race. In designing a high level competition venue, **the spectators should be considered just as much as the athletes**.

The second issue is compliance with international course standards, known as homologation. For decades, racers from all corners of the world have been awarded points based upon their performance, relative to each other. Theoretically, by consulting the FIS (International Ski Federation) points list, it would be possible to accurately rank a skier from Japan, another from Montana to a third from Norway, even though the three may never have actually competed against each other. However, the validity of the points list depends upon the relative consistency of the race courses throughout the winter world. While there are hundreds of homologated courses across Scandinavia, there is only a handful in the USA, and many top American athletes were receiving inaccurate points by competing on courses that did not meet international standards. The FIS recently gave the U.S. Ski Team an ultimatum: no more points would be awarded on courses which had not been homologated. As a result, the U.S. Ski Team is frantically trying to get courses approved all over the nation, and at the same time, adjusting competition schedules to favor race venues which meet international standards.

Without delving into all of the details of these standards (the recent FIS manual is 70 pages long), it is useful to review a few of the relevant considerations.

3.3.2 FIS and USSA Homologation

Many of the characteristics already addressed with respect to a biathlon venue (Section 3.2) are valid for Nordic ski venues and do not need repeating. There are other requirements, as specified in the FIS Homologation Manual (latest edition, 2009).[4]

3.3.2.1 Course Length and General Layout

USSA and FIS course distances range from sprint distances (generally 1.2 to 1.8 kilometers), 2.5K, 5K, 7.5K, 15K, 20K, 30K, and 50K. For course design and layout, many of these competitions, particularly the longer distances, can be held on courses of shorter length using multiple loops. For example, a 10 kilometer race may be held using a single homologated 10K course or two 5 K loops, four loops of 2.5K, or some combination thereof. To be a bona fide homologated course, the measured distance must not be less than or exceed 5% of the actual event distance (i.e., a 5K race course can be 4.75K to 5.25K in actual, measured distance).

[4] http://www.fis-ski.com/data/document/homologation-manual-2009.pdf

Although biathlon events have a somewhat different sequence of loop distances, they are not mutually exclusive. Through careful design, one can create cutoffs for numerous loop distances.

New events have also been introduced, including same-day duathlon races, where a skier races the first half using the classic technique then changes skis midway through the event to ski the second half using the skating technique. In terms of course design, this poses a challenge, as both portions of the course must meet all homologation standards – which may or may not include the use of the same loop.

In an optimum situation, courses of different distances would "nest" within each other – i.e., a 10K course would include cutoffs to allow 7.5K, 5K, 3.75K, 2.5K, and even a sprint course. This is not always possible, but desirable. At the same time, it is preferable to have multiple loops that return , at least within sight of the stadium (i.e., start/finish) area multiple times, again for spectator interest, enhancement of the athlete's experience, and the ability to use a relatively small land footprint for multiple distances. For example, the 15 kilometers of cross country and biathlon race courses at the 2010 Vancouver Olympic Games were all contained within a single square kilometer.

3.3.2.2 Required Climbs and Terrain Elements

To meet FIS homologation requirements, a course must include a minimum number of climbs within a prescribed distance. For example, a 5K course requires two "A-climbs" of at least 30 meters, but not more than 50 meters in elevation difference (from the low point to the high point of the climb) with at least a 6% average gradient. In addition, a 5K course must also contain at least three "B-climbs," each with a minimum of 10 meters in elevation gain. For 10K courses, A-climbs have higher thresholds, although, as already mentioned, one can hold longer races using multiple loops.

These climbs should also come within prescribed sections of a course. For example, the first A-climb should not be within the first kilometer of a 5 kilometer course, and the last A-climb should not be in the last kilometer. Also, a gradient within a cross country course should not exceed 18% for any extended period, to discourage the "bottlenecking" that occurs when competitors use the "herringbone" technique in a classic competition.

Downhills must be safe but also test technical skills. One recent change in homologated course design is the discouragement of long straight downhill sections which encouraged racers to draft each other for long periods (as in a bike race). Major international competitions, such as at the Salt Lake Olympic Games at Soldier Hollow, provided an almost a comical situation where the two leaders of the four-man relay slowed down, nearly to a standstill, each athlete reluctant to take the lead, thus providing an opportunity for the other to draft coming into the stadium and recover for the final sprint for the gold medal. Today, there is an emphasis on designing downhills with multiple turns and changes in gradient to discourage drafting.

While the traditional maxim in course design used to be 1/3 uphill, 1/3 flat, and 1/3 downhill, course design and meeting the homologation standards – particularly for the required climb elements – has become much more sophisticated. Courses that have previously been respected venues for major national and even international competitions (such as the courses used in the 1980 Winter Games at Lake Placid), do not currently meet these modern homologation standards, in large part because they do not embody the required climb and terrain elements.

Finally, sprint courses require a somewhat different set of standards, with two significant climbs and, if possible, very technical turns to accentuate the strategic positioning of racers. Additionally, the climbs must be of a grade between 12% and 18% to discourage any skiers in a classic technique race from "double-poling" (eliminating the need for the slower kick wax) an entire race.

3.3.2.3 Course Width Consideration

Course homologation also requires established trail widths, depending on the type of FIS-sanctioned competition that can be held. These event categories, and their corresponding course width requirements, are as follows, according to the most recent FIS Homologation Manual:

A – Individual classic technique (minimum width, 3 meters)

B – Same as A + individual freestyle technique, relay classic technique (normal width of uphills, 4M)

C – Same as B + relay freestyle technique, mass start classic technique, sprint classic technique (normal width of uphills, 6M)

D – Same as C + relay both techniques, mass start freestyle technique, sprint free technique (normal width of uphills, 9M)

E – Pursuit competitions: two courses C or D or one course with minimum width of uphills 12M

Category A is relatively easy to accomplish. Because of Mammoth's vegetation (where trees are often large and spread apart), most areas would require minimum cutting and modest excavation to meet an A category designation.

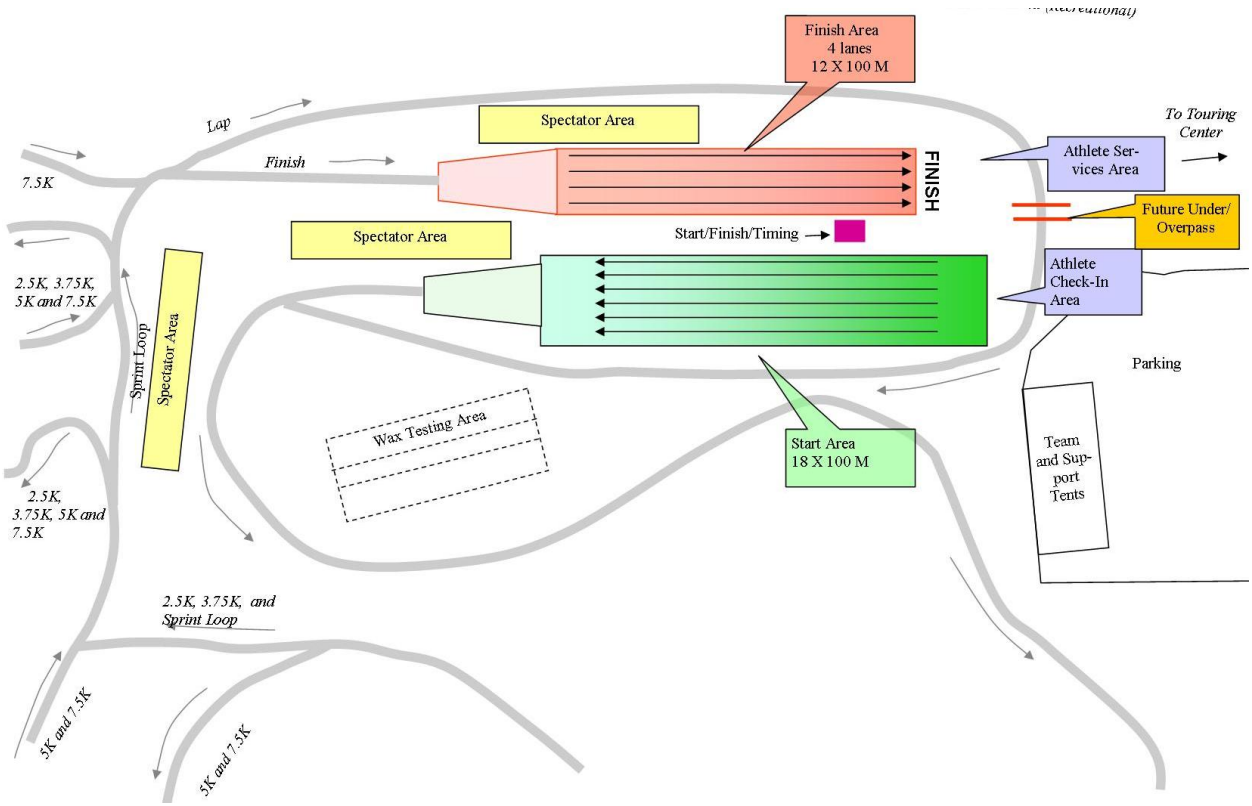
Category D provides the greatest flexibility in events, but would require major uphills constructed to a 9-meter width. If Mammoth were to pursue this level of homologation, this venue would be one of less than half a dozen existing or planned in the US at this level and would be suitable for major national, and even international, competitions. Again, though, the current elevation above sea level restrictions may not allow Mammoth to pursue formal FIS homologation, but it could be known as a venue which complies with all of the other requirements for a certified venue.

3.3.2.4 *Stadium Requirements – Nordic Ski Venues*

The stadium requirements for a Nordic venue are similar to those of biathlon venues, discussed earlier, and the two disciplines frequently share the same stadium. The primary differences include accommodation for potentially larger mass start events, specific configurations for new events (such as duathlon and same-day pursuit races), and a generally more stringent set of standards as identified in the FIS homologation specifications.

Part of the homologation process is ensuring that the stadium is sufficient in size (preferably 200 meters in length and 80 meters in width), is relatively flat (though there is a preference for a slight uphill into the finish line, and downhill starts are discouraged though not completely restricted), and designated areas for glide wax testing, a warm-up track separate from the race course, timing facilities, spectator viewing areas, lap lanes, pedestrian crossings, and staging areas for athletes and course officials and workers. Map 3 provides an illustrative stadium layout that meets current homologation standards.

Figure 3.1 - Illustrative "Stadium" or Start/Finish Area Layout for a Nordic Skiing Competition Venue



3.3.2.5 Other Homologation Considerations

Like the IBU licensing requirements for biathlon, there are some other considerations in the FIS cross country ski competition venue homologation process.

First, there is a need for adequate road access to the venue and a limited distance by which athletes, coaches, officials, or spectators would need to walk from their vehicles to the venue.

Second, there is a requirement to demonstrate adequate grooming equipment and maintenance facilities – in general at least one Pisten Bully-type machine supplemented with smaller snowmachines capable of pulling a Nordic tracking sled (such as a Tidd Tech or Yellowstone Track System, for example) are considered a minimum threshold.

Finally, an organizational history of hosting races of a higher caliber is considered; Mammoth's history of hosting both large citizen's races, as well as its biathlon race should be sufficient to meet this more qualitative, FIS homologation consideration.

3.4 Four-Season and Other Trail Uses

As mentioned earlier, trails that are well designed and carefully constructed for Nordic skiing are desirable for several other activities as well:

3.4.1.1 Mt. Biking

Mountain biking has become one of the fastest growing sports in America, and is still evolving into several specific variations. While hard core enthusiasts may seek the thrills of down mountain riding or technical, single track routes with challenging, specially constructed features or elements, a large number of riders enjoy the twists and turns, the climbs and descents of a Nordic ski course. If single track mountain biking is the primary summer activity, the vegetation can be permitted to grow on the ski trail (until late in the fall) creating the impression of single track riding. In addition, bona fide single track diversions can be added to a ski trail giving the hard core riders much of what they crave.

The Mammoth region enjoys a substantial mountain bike community, with the commercial operations of MMSA, as well as a growing public trail network which offers a combination of double-and single-track routes. One dual feature of a bonafide competition facility, albeit primarily designed for biathlon and Nordic events, is the function of staging: large areas for mass starts, spectator viewing, and many of the other components which were discussed above. Cross country mountain bike racing encourages the use of large start/finish areas, followed by double-track sections, interspersed with single-track riding supplemented with selected double-track sections to allow for passing.

3.4.1.2 Hiking and Walking

Although many hikers are motivated to reach a destination, a summit, a mountain pass or an Alpine lake, others prefer a well maintained, clearly signed loop that will get them back to their starting point. Additionally, many prefer the ability walk side by side, which most traditional hiking trails do not offer. Ski trails are ideal for this type of hiking or more leisurely walking of different durations and difficulty.

3.4.1.3 Running

Sadly, most "cross country" running in our country today is actually through sub-divisions or on golf courses. It is relatively rare that high school or college runners actually compete on trails through the woods, rare enough that a variation of the sport, trail running is gaining popularity. Nordic ski trails are ideal for this type of event because they are typically more challenging than traditional cross country courses, and they are wide enough to easily accommodate the mass starts common in the sport. In addition, serious runners frequently favor well maintained woods trails over pavement to minimize overuse injuries and stress fractures.

Mammoth's established reputation as a premier location for running would make a dedicated venue for training and competitive events a potentially highly desirable center for many aspects of running-based programs and activities.

3.4.1.4 Other Activities

In addition to the other four-season activities mentioned above (aside from biathlon and Nordic skiing), the event venues proposed would also serve as excellent sites for orienteering competitions, cyclocross races, and wilderness triathlons. In addition to competitions, the proposed venues would make desirable locations for fund raising events such as walks for breast cancer, ski-a-thons for community charities, etc. A women's ski-a-thon in Anchorage, Alasaka, scheduled intentionally every year on Super Bowl Sunday, raises hundreds of thousands of dollars to support the city's women's shelter.

4.0 POTENTIAL SITE LOCATIONS

There are numerous possible locations for the type of trail system and event venue being described in this study. As part of this feasibility analysis, Morton Trails worked with the Mammoth Biathlon Advisory Committee (MBAC) in developing a set of criteria so that a list of potential sites could be evaluated initially. A subset of sites would then be chosen from this process for more in-depth analysis by Morton Trails, particularly during the onsite field investigations in August of 2011. This chapter discusses these criteria, the evaluation of potential locations, the initial selection of three sites for on-site evaluation (Shady Rest, Panorama Dome, and Inyo Craters), and a detailed discussion of these three sites (particularly the latter two which were determined to be superior, which led in turn to the development of a conceptual venue design for each).

4.1 Criteria Developed for Evaluation of Sites

Appendix A provides a detailed matrix of criteria that was developed for the MBAC to use in evaluating potential locations. These criteria are based on Morton Trails' experience, IBU and FIS homologation guidelines as well as other factors specific to Mammoth Lakes and the expressed needs of the stakeholders involved in this study. The criteria are summarized below:

- **Altitude** – the altitude of a site may have an impact on attracting major events and an influence on the resulting design of trails (i.e., higher elevation is generally a potential deterrent)
- **Topography-Elevation Difference** – the optimal terrain for event venue and course design consists of rolling areas with sufficient flat spaces for range, stadium, parking, and other facilities. Additionally, the terrain must have sufficient possibility for adequate elevation change to meet necessary climb requirements. It is also preferable to have the start/finish area neither at the high nor low point of the course/trails.
- **Snow Cover and Temperature** – Sufficient snow cover is necessary throughout the main winter ski season (i.e., December through March), with the possibility of early season skiing (pre-Thanksgiving) as well as late spring (April and later); also a preference for sufficiently cold, but not severely cold temperatures.
- **Proximity to Center of Population** – Venue should be close to center of population for convenience (even within walking distance), but the biathlon component warrants consideration of a live-round shooting range, which may be more suitable at a site somewhat removed from major populated areas (where there may be municipal or other shooting restrictions).
- **Size of Area** – A minimum of 250 acres, or 1 square kilometer, is necessary for a competition venue. Larger areas provide more flexibility for the venue and related trail configurations.
- **Potential Size and Proximity of Range, Stadium, and Parking** – Main venue features require flat areas (or spaces that can be excavated) in proximity to parking and spectator/athlete/volunteers, etc. facilities.

- **Aspect** – Snow coverage and retention favors northerly facing slopes. Typically, biathlon shooting ranges are oriented so that the participants shoot towards the north, away from the winter sun.
- **Wind Exposure** – Prevailing wind direction as well as patterns of sustained winds and potential gusts have an impact on skiing and shooting. Strong winds across a biathlon range are not desirable.
- **Vegetation/Cover** – A mix of open and wooded areas provides variation, visibility (for participants/trail users and spectators) as well as protection from wind and cold exposure.
- **Proximity to Existing Infrastructure** – Existing warming lodges, parking, and other facilities offer appealing options to constructing an entirely new facility. Construction costs can be minimized by the use of temporary structures such as yurts, tents, and portable trailers (especially for events).
- **Ownership and Usership Constraints/Issues** – A variety of public vs. private, current vs. anticipated needs for trail operations, as well as maintenance, permit or related requirements, can often be the most significant factors in the selection of a permanent venue location. (These issues are often overlooked at the outset).
- **Proximity of Trail System to Other XC and Related Trails** – Evaluating the benefits of being within or proximate to an existing system against benefits of independent networks (i.e., separating recreational from competition/training trail uses).
- **Major Conservation, Environmental, or Land Use Conflicts/Constraints** – These issues would include wetlands, sensitive habitats, geologic activities as well as other land uses (such as industrial activities) which may or may not be compatible with a venue of this scope and character.
- **Snowmaking Possibilities (if necessary)** – lower altitude sites that may have less reliable snow could be enhanced with modern snowmaking technology, depending on availability of water, temperature patterns, and other factors.

These criteria, and specific measures for evaluating them, were provided to the MBAC. A total of 12 possible locations were considered, using the matrix as a guideline. These other sites are noted in the minutes of the MBAC meeting of July 20, 2011 (included in Appendix B).Three sites were chosen from this list for evaluation in this feasibility study:

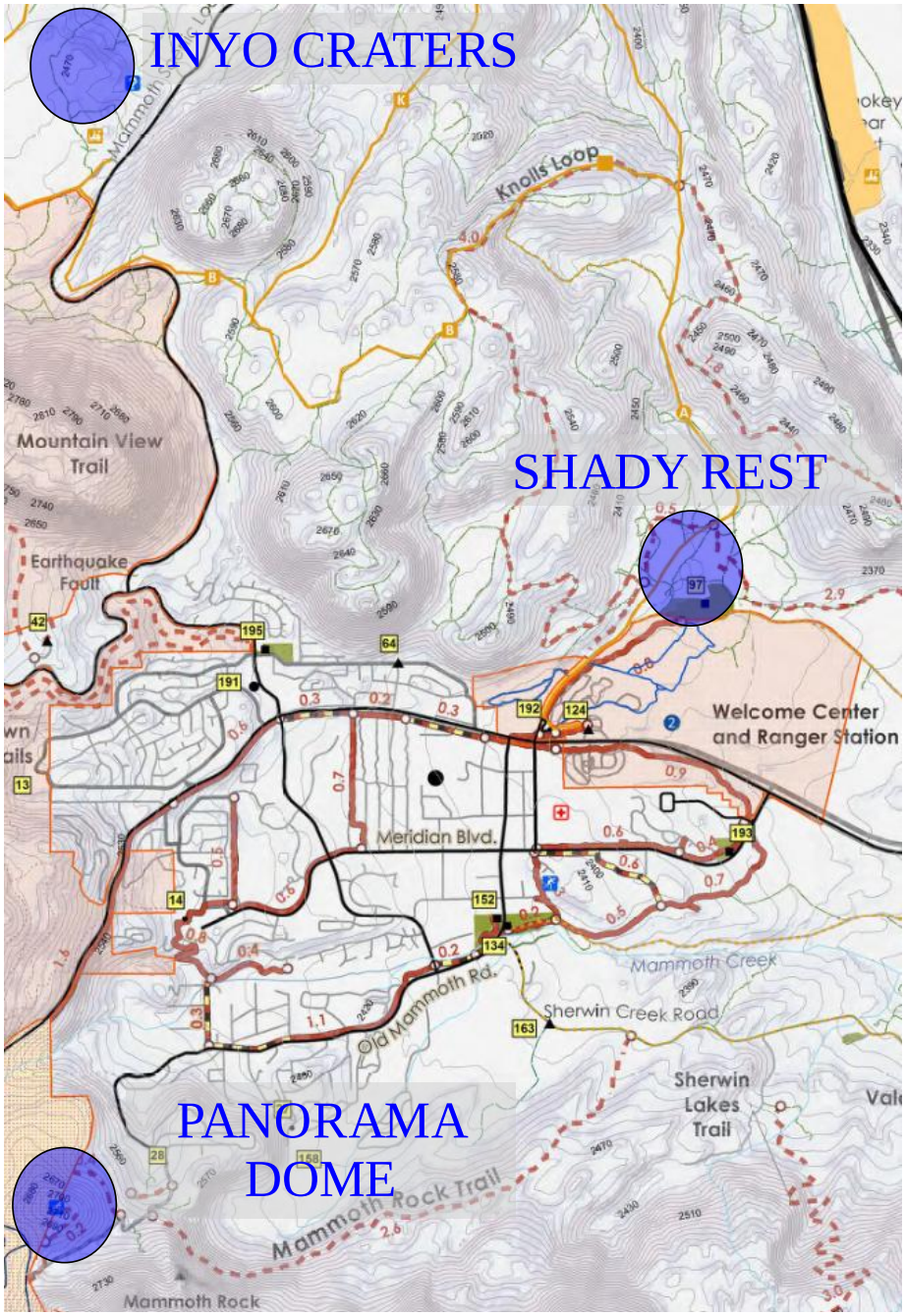
- Shady Rest Campground and Recreation Area
- Panorama/Vista Dome near Tamarack Lodge
- Inyo Craters Area

The following section discusses each of these three sites in detail.

4.2 Review of Three Sites Presented for Evaluation

Map 4.1 identifies the location the three sites evaluated in this study and through onsite field investigations. Each has its own merits and challenges, which we address in the remainder of this chapter. Please refer to Map 4.1 for a regional perspective of these sites within the Mammoth Lakes area.

Map 4.1 - Three Sites Evaluated for Feasibility of a Biathlon/Nordic Facility

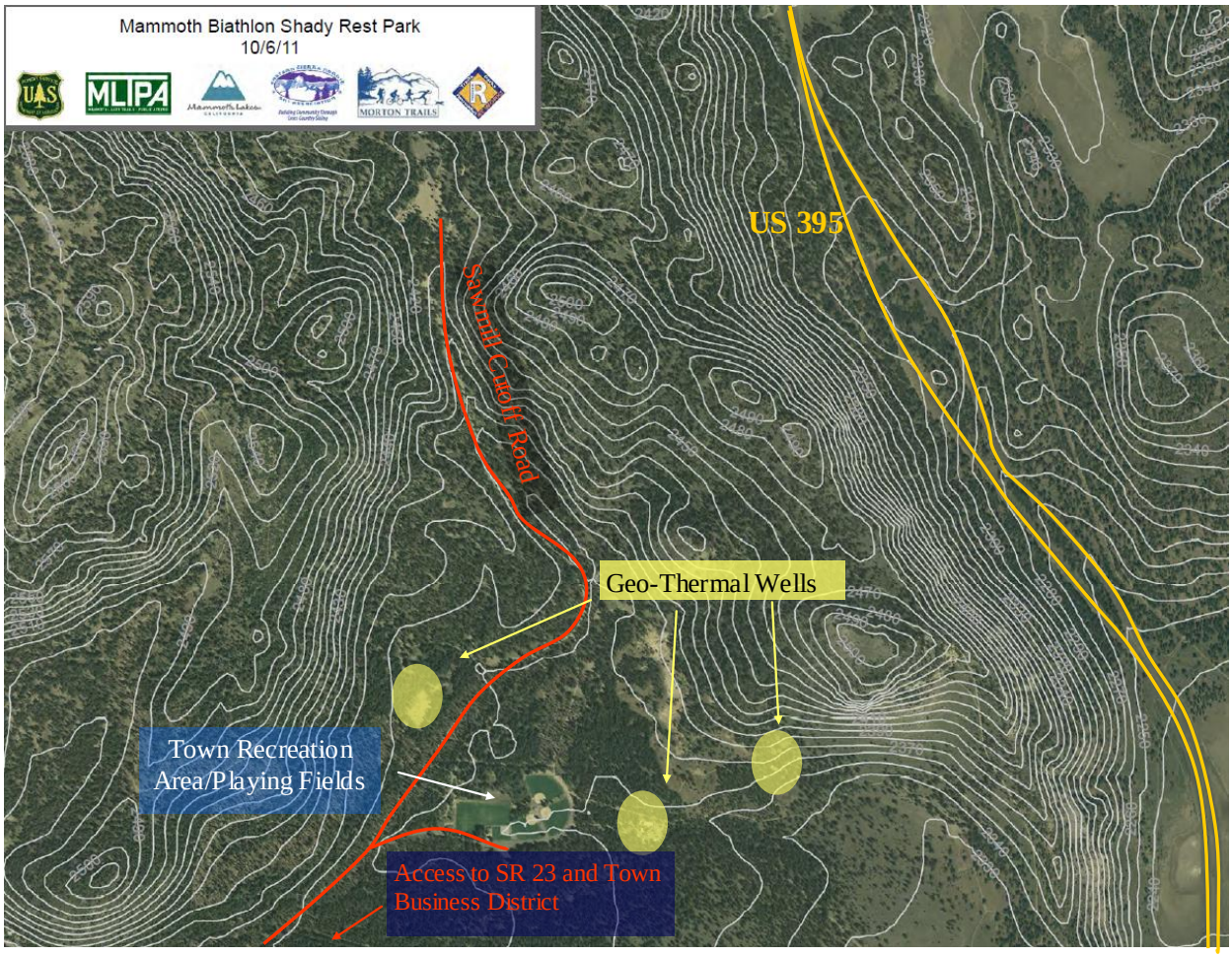


4.3 Shady Rest Area and Campground

4.3.1 Site Overview

The Shady Rest Area and Campground resides just north of SR 203 and west of US 395 near the US Forest Service Mammoth Lakes Ranger Station and Welcome Center, less than one mile from the central business district of the Mammoth Lakes. The area includes the town's recreational playing fields as well as a network of winter-use trails, which include up to 7.5 existing kilometers of groomed cross country ski trails maintained by Mammoth Nordic Foundation, a local volunteer non-profit organization, in cooperation with the US Forest Service and Town of Mammoth Lakes. In addition, this location is a major staging area for snowmachine parking and trails (Sawmill Cutoff Road, or Route A on the USFS Winter Recreation Trail Map, South). Map 4.2 – Shady Rest Area, provides an annotated aerial photographic image with topographic contours (10 meter contour lines).

Map 4.2 – Shady Rest Area



Source: Chuck Megivern, MLTPA; Morton Trails

The site offers a number of benefits for future Nordic skiing development, and, possibly, biathlon use. There are also numerous challenges, which, as concluded below, were considered to outweigh the benefits for the proposed venue at this time.

Some of the site's benefits include:

- ***Close proximity to the main business district, schools, and center of population*** – An underpass beneath SR 203, which at times has been used for motorized and non-motorized recreation, provides logical and convenient access to the Mammoth High School and the existing bike and multi-use trail system. Because of the proximity of the underpass to the downtown and the school, there is a well established, appreciative recreational user base for trails in this area.
- ***An established infrastructure, including groomed cross country skiing*** – As mentioned above, the Mammoth Nordic Foundation works to maintain and groom approximately7.5 kilometers of Nordic ski trails, with the USFS and Town of Mammoth Lakes. There are also existing roads, maintenance facilities, and the potential for access to other buildings for use as warming/meeting areas at the USFS visitor center in addition to the santiary facilities at the municipal park.
- ***Sufficient topography/elevation change*** – two major topographic features, on each side of Sawmill Cutoff Road, provide the necessary elevation change and potential grade for a system of biathlon and Nordic trails which could meet IBU and FIS/USSA homologation requirements. Towards SR 203, the area is desirable for Nordic skiing due to its rolling nature and open vistas, but it would not be adequate for the terrain characteristics needed for a higher level competition venue.
- ***Lower altitude, more moderate temperatures, and protected areas from wind*** - while the entire area evaluated would be considered "high altitude" by almost any standard of Nordic skiing, biathlon, or other aerobic sport, Shady Rest is at a lower elevation (2,360 meters, or 7,740 feet) than the other two locations evaluated. Additionally, the area is less susceptible to extreme cold temperatures, and there are multiple areas protected from wind.

These advantages should be considered when evaluating Shady Rest as a viable piece of a broader Nordic skiing, and four-season trail network in the Mammoth Lakes region. A number of obstacles, identified through on-site inspections and follow-up discussions with the MBAC, placed it in a secondary priority with respect to the type of biathlon and Nordic completion venue envisioned in this study. These challenges include:

- ***Multiple demands and uses for a relatively small area*** – because of its proximity to town, the area is very popular for multiple users, across all seasons. In addition to the recreational infrastructure of playing fields and related amenities, motorized ORV and snowmachine staging and use, and proximity to US Forest Service ranger station activities and visitors, there is another degree of usage complexity with the geothermal wells and piping associated with the Mammoth Pacific Geothermal Power Plan, operated and partially owned by Ormat Technologies. Although there are accommodations that can be made by each of these user groups, for a biath-

lon/Nordic ski trail network, the area is relatively confined considering these multiple demands as well as the existing, and anticipated infrastructure.

- ***Established infrastructure that may likely be incompatible with a competitive venue*** - the Town of Mammoth Lakes has developed and maintains baseball, softball, and soccer/all-purpose fields at Shady Rest, in addition to playground, bathroom and picnic shelter facilities. Although this open area could be conducive to a biathlon/Nordic stadium area, it would require significant change in the layout of the existing infrastructure including the removal of the fencing around each of the playing fields. Additionally, the geo-thermal wells and pipelines crisscross the area and add another complication. Finally, while there is the feasibility of relocating the existing snowmachine staging area near the ballfields (which would likely be a necessity for development of this area into an event venue as proposed in this project), it may create additional, complicated review and negotiations with numerous stakeholders who have already endured substantial, administrative change in this location.
- ***Lower reliability of snow, including a shorter ski season in the early and later winter periods*** – the lower altitude of this area results in a consequently less ample snowfall. Where skiable snow for the other two locations can be reliable from mid-November to well into April or even May, the Shady Rest Area would only sporadically have such long seasons according to long term snow records.
- ***Likely strong legal and other resistance to a permanent shooting range*** – as discussed earlier, the Town of Mammoth Lakes has a strict firearms ordinance. Although there are exceptions for regulated ranges (which has allowed the recent Mammoth Biathlon events to be held within the boundaries subject to the ordinance), the close proximity of the Shady Rest area to the business district may make this exception particularly difficult to obtain and retain permanently.

In consideration of Shady Rest's advantages and challenges (and please see Appendix B for a summation of the MBAC evaluation of the area), MBAC and the project team decided to focus on the remaining two sites for more detailed planning. As discussed below, though, this area remains highly attractive for Nordic skiing and other trail enhancement.

4.3.2 Shady Rest – Considerations for Future Trail and Venue Planning

While Shady Rest may not be the most suitable location for a biathlon and Nordic event venue as proposed here, it does offer a superb opportunity for creating an expanded Nordic skiing (and related four-season trail) network in the Mammoth Lakes area (which is discussed in further detail in Chapter 5.0 of this report). For all of the reasons cited earlier, it would allow a logical starting point near the town's center and locus of population. There are a number of possible routes for linking this system to other possible networks, such as Inyo Craters (discussed in section 4.5 in the report). By no means should this report be viewed as diminishing the importance of this location; instead, it should be seen as a key asset for a longer-term vision of Mammoth as a nationally (and even internationally) recognized center for Nordic skiing.

4.4 Panorama Dome

4.4.1 Site Overview

The Panorama Dome site along the east side of Lake Mary Road just beyond the crossing of Mammoth Creek (as one travels from the Town of Mammoth Lakes) is at the entry of one of the most popular and heavily used four-season areas within the Mammoth Lakes region. Tamarack Lodge (which includes adjacent cabins and other facilities) is owned and operated by MMSA. It offers lodging, dining, and varied recreational opportunities. During the winter, Tamarack operates a well-regarded cross country ski center, with approximately 25 kilometers of groomed trails, many of which are on closed US Forest Service roads, campground access roads, or summer bike paths. There are additional trails that are specifically designated and constructed for Nordic skiing (some of which are also used in the summer for a variety of uses).

Panorama Dome, also called Panorama Vista, is one part of the Tamarack network and includes groomed and ungroomed cross country ski trails and snowshoeing trails during winter, in addition to single and double-track mountain biking and hiking trails during non-winter months. The land is owned by the US Forest Service and operates under an umbrella special permit to MMSA. The site is also located in and near a notable historical section of the Mammoth region. Mammoth City was one of a number of populated settlements that arose during the 1870s and 1880s, located along the existing Old Mammoth Road in the valley between Panorama Dome and Mammoth Rock. A flume used for hydraulic mining operations runs generally along a contour of 2,615 meters (8,600 feet) around the northern, eastern, then southeastern flank of Panorama Dome.

In addition to these general characteristics, there are a number of features about this site that make it particularly attractive for a possible biathlon and Nordic skiing event venue, including:

- ***Relatively close proximity to town*** – Panorama Dome is approximately 3.5 miles from the Town center, and convenient to other populated areas along Lake Mary and Old Mammoth Roads. A shuttle service is already well-established throughout the year.
- ***Access to existing infrastructure*** – which includes the Tamarack Lodge, cabins, maintenance/ancillary structures, and other facilities. The venue would be located across Lake Mary Road from the touring center and at that point on Lake Mary Road where the snowplow stops, leaving the remainder of the climb unplowed to the Lakes Basin.
- ***Inclusion as part of an operating cross country skiing center –*** Tamarack is a well-established Nordic ski center, with grooming equipment, personnel, rentals, instruction, and other activities and programs conducive to a higher end venue.
- ***Outstanding views –*** areas along the northern flank of Panorama Dome (and in the vicinity of the proposed stadium/spectator area discussed in the next section) provide spectacular views of Mammoth Mountain Ski Area, the Minarets, and the Lake

Mary Basin. Along the northeastern section, there is a pronounced rock outcropping with sweeping views of the Town of Mammoth Lakes and valley.

- ***Good topography and terrain*** – although much of the terrain on Panorama Dome is located on the sides of the hill/dome and requires a careful design to create varied trails generally across contours, there are many ridges, buttresses, plateaus, meadows, and other features that make it conducive to a high quality system of Nordic (and related) trails. Most of this terrain is on the northern and northeastern sections of the area, as well as the generally flatter area in the saddle on the northern portion of the Dome. The potential elevation variation, from 2,600 to 2,650 meters, allows for incorporation of the necessary climb features for IBU and FIS/USSA course requirements. There are also adequate areas spectator access, although parking has become an increasingly problematic issue in the area of Tamarack Lodge.

These very advantageous features for Panorama Dome do not come without some notable challenges, as identified below:

- ***Relatively small area*** –much of the terrain, particularly along the eastern edge of Panorama Dome, is too steep for trail development. The area also has a relatively small area for location of a range and start/finish stadium area, as well as for parking with adjacent access (compounded by pedestrian and biking tunnel construction on Lake Mary Road). Overall, there is approximately 75 acres of usable area for the entire venue, which requires an intense amount of trail development and other cleared/excavated areas. This small area does create an intimate experience for spectators, but it will change the landscape, particularly in the forested areas on the northern flank.
- ***Sub-Optimal Aspect for Range Location*** - the range cannot be located in a traditional north-facing alignment, but instead would face towards the main side of Panorama Dome to the south. Such an orientation would require relocation of at least one of the existing hiking/mountain biking trails along the north side of Panorama Dome.
- ***Strong and persistent winds-*** the area is also quite windy, particularly in the open area just east of Lake Mary Road along the northern slopes of Panorama Dome. The range would be located as far east as possible, but would still likely experience the prevailing west to east winds of this site.
- ***Higher altitude*** – Panorama resides approximately 200 meters (600+ feet) above Shady Rest and 125 meters (380+ feet) above Inyo Craters. While this difference would not normally be of consequence for other areas of the country, Mammoth's already high altitude requires consideration of this factor, particularly in terms of any possible recognition by biathlon and/or Nordic skiing regulatory bodies.
- ***Areas of possible historical and cultural significance*** – While the Mammoth City site is located well outside the area of interest at Panorama Dome, there is a former flume used for hydraulic mining that crosses the area along a lower contour. This feature, and possibly others, would need to be evaluated and determined as to possible impacts of venue development and means to avoid, minimize impacts, or incor-

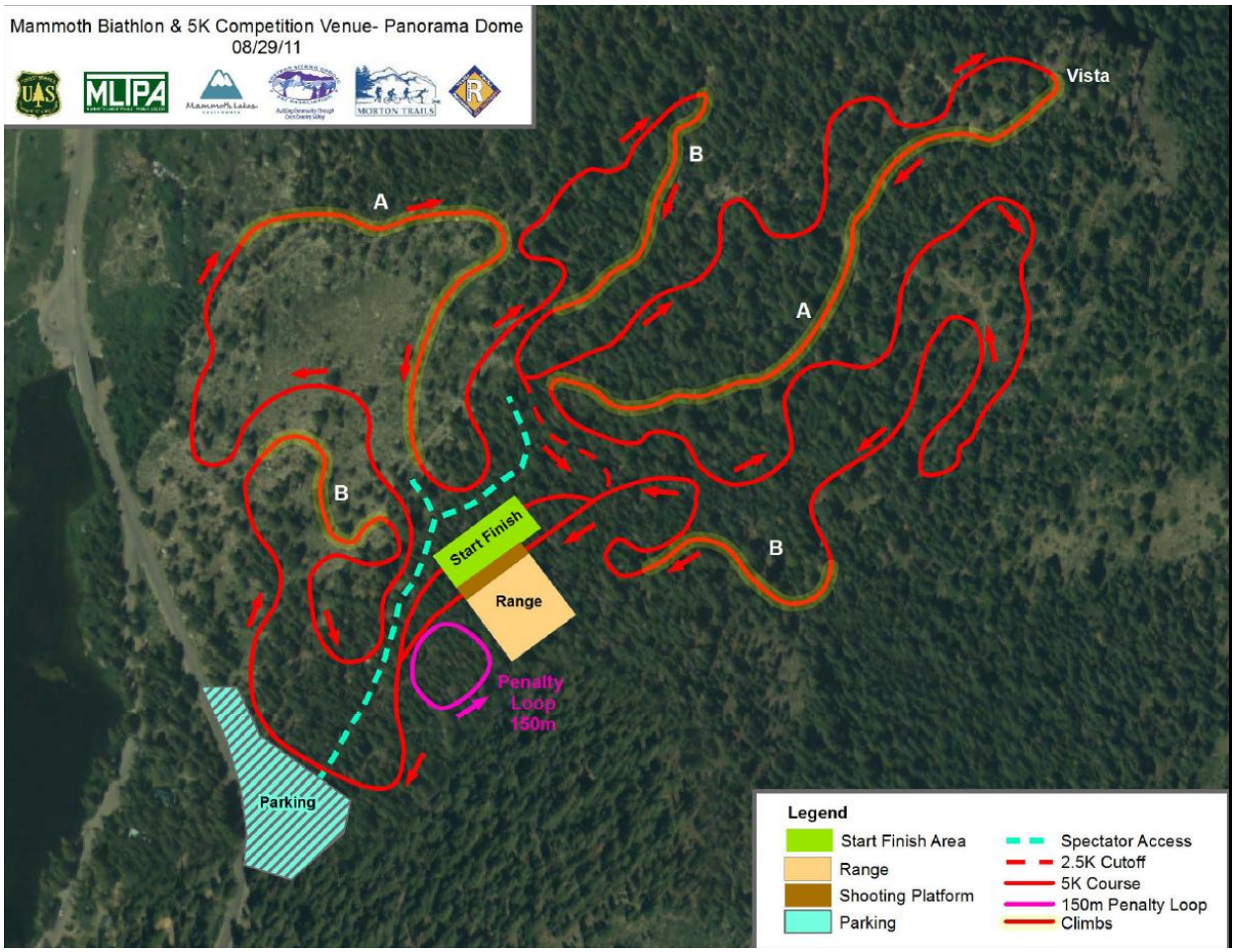
porate into the design to highlight their historical significance for trail and venue users.

These challenges are not completely insurmountable. In follow-up discussions with the MBAC, after a careful on-site inspection, we were instructed to develop a configuration for a biathlon and Nordic venue at this site. We undertook this first, conceptually, then flagged all of the required features on the ground (stadium, range trails, etc.). These initial flagged routes were GPS'ed, mapped, then inspected during a walk with representatives of the MBAC during Morton Trails' field visit in August 2011. This plan is presented in the next section.

4.4.2 Panorama Dome – Proposed Venue Plan

As shown in Map 4.3, there is a single 5K course, which is divided into two separate 2.5K loops (see the dotted red line that represents the cutoff for the first 2.5K loop). The range and stadium are located in a saddle that is generally flat and would require only modest excavation for the range, shooting platform and penalty loop Most of the area that is de-

Map 4.3 – Panorama Dome Biathlon/Nordic Venue Plan



picted as Range and Start-Finish (including the shooting platform) would need to be completely clear of trees with a few selective exceptions (i.e., large, older pines or firs which would not impede on the requirements of events or substantially obstruct spectator viewing).

The 5K loop includes all of the required homologation climb requirements (noted in yellow highlight on Map 4.3 and denoted as either an "A" or "B" climb). Although specific , shorter loops are not indicated here, there are multiple opportunities for cutoffs creating loops that would meet biathlon event requirements, other Nordic skiing events (such as a high school or junior race), and for recreational skiers of various ability levels. A novice or lower intermediate loop can easily be configured with minimal elevation gain or sharp descents.

The point noted as "Vista" is an outstanding feature of a rock outcrop with sweeping views of the Mammoth region. The trail comes within 20-30 meters of this spot and a short spur trail to this feature would represent a significant destination for cross country skiers of intermediate ability and above, as well as for mountain bikers, runners, hikers, or other trail users throughout the year. This location would be an ideal site for a yurt, warming hut, or other facility as a logical point of interest or trail destination.

To the greatest extent possible, this design incorporates existing trails, though avoiding some of the mountain bike features (i.e., banked turns) which have obviously been constructed through hours of volunteer labor (or naturally occurring through years of use). Of the 5 kilometers of trail, we would estimate that up to two kilometers may be on existing trails or clearings. A small portion of the proposed trail crosses and/or uses the abandoned flume (mentioned earlier) that runs roughly along a contour at the lower elevations of some of the proposed loops.

The trail returns multiple times back within sight of a location we have informally called "spectator's knoll," which is at the high point between the area of the start/finish and the large cleared area encompassing the first two kilometers or so of the course. This knoll will allow a spectator to see a competitor at the start and potentially six separate times on the first 2.5K loop before entering the range in a biathlon competition. The second 2.5K section of the 5K course is more removed from the spectator area, though still allowing viewers to see competitors an additional four times, depending on spectator mobility during a competition and the extent of tree clearing.

Finally, all of the trails are marked at the site in pink and black flagging; certain locations in the start/finish area are marked with orange and black flagging; and the range and penalty loops are marked in solid pink tape labeled appropriately. A GPS track identifies all of the trails and features and can be obtained from Morton Trails or Chuck Megivern at MLTPA.

4.4.3 Next Steps for Panorama Dome Venue Development

The layout of the trails and venue are a very workable draft, and, if Panorama Dome is selected as a site for venue development, this draft can be evaluated further for any possible

conservation, historical, usage, or other potential conflicts or concerns. Some of the proposed trails and features are flexible – that is, a flagline can be moved to accommodate a possible forestry, trail use, or other issue. Other areas are less suitable for relocation – we know, for example, that the range location cannot move much in either direction and still satisfy requirements of a relative flat area, avoid persistent cross winds, or minimize unreasonable costs for major excavation (into a steep sidehill for example, or the creation of major berms, if the range were to face to the north). We would also emphasize that these steps are similar to those for a selection of Inyo Craters (or other site), and our description of them below should in no way be interpreted as a particular preference for one site or the other.

The first step, then, is to evaluate the concept identified above. Recent fuel reduction and tree clearing harvests since visiting the site may warrant reconsideration of some of the stadium, range, and overall layout as the area has changed in terms of visual and forest vegetation characteristics.

A second step, once the concept has been approved, would be to carry forward final design plans in coordination with securing any necessary use permits or permissions. This would include cooperation with Tamarack Lodge and MMSA in terms of incorporating the venue into their trail system, development of a maintenance plan, and coordination with the Town of Mammoth Lakes for an exclusion to the Firearms Ordinance (under certain restrictions). With respect to additional design, there may be a need (or requirement) for use of an engineer for parking lot construction, range and stadium construction, development of any permanent structures, and trail design to the extent that such engineering is required. In general, there are scores of top-level biathlon and Nordic facilities that have not required formal engineering. As we outline below in the third step, pre-construction activities can be relatively straightforward.

The third step, in the case of moving forward with development of the site, is preparing the trails and site for tree harvest, as needed. A qualified trail designer should work closely with the appropriate forester from the US Forest Service to paint the trees to be harvested on the trail routes. This effort can be coordinated with any additional timber sales or forest management plan in the area, even to the extent of cutting the trails prior to a scheduled harvest, to be used as main skid or logging roads.

The fourth step, after harvest of the trees marked with forestry paint (creating a trail corridor of the appropriate width and dimensions to meet the standards needed for biathlon and Nordic competition), is to retain an experienced excavator operator to construct the trails according to best, sustainable practices.

A final step, both during and after construction, is for inspection by a qualified IBU or FIS homologation inspector, if the course is eligible for either a formal or informal designation by one of these bodies.

These steps are similar to those we would recommend for any site or location, including the one we evaluate in the next section (Inyo Craters). Later in this report (Chapter 6.0), we identify the estimated capital needs and costs for each of the sites.

4.5 Inyo Craters

4.5.1 Site Overview

The second location that was identified as a priority for us to conduct more detailed field evaluation included the area near Inyo Craters, approximately 4.5 miles from downtown Mammoth Lakes (see Map 4.1). This location offers a number of quite different opportunities from the other locations evaluated. As with the other sites, all of the land is within the Inyo National Forest Service, managed by the Mammoth Lakes Ranger District. It is outside the boundary of the Town of Mammoth Lakes and is therefore a part of unincorporated Mono County. This area is outside that associated with MMSA's Ski Area Permit, but it may overlap with MMSA Snowmobile Adventures SUP (separate from the Ski Area Permit). The area is also adjacent to several snowmobile trails groomed by Inyo National Forest.

Access to the area is via the Dry Creek Road, which forms the Mammoth Scenic Loop Road, starting 5 miles north from the intersection of US 395 and Dry Creek Road and proceeding counterclockwise up Dry Creek Road to the intersection with State Route 203. The site is located to the west of Dry Creek Road, off of the Dry Creek Road Spur (access road to the Inyo Craters trailhead).

This location is distinct from either Shady Rest or Panorama Dome, particularly due to its larger and less constrained physical area. Some of the most attractive attributes for the site include:

- ***Size of area –*** the location is a relative "blank slate" in that there are no other structures or constrained footprints of existing permanent uses, other than trails and recreation uses within the US Forest Service areas.
- ***Variation in Topography and Vegetation/Terrain*** - unlike Panorama Dome, there are multiple ridges and terrain features such that trail design is not dominated by negotiating one or two sidehills on a single elevation feature. The site also provides sufficient elevation change to incorporate the necessary climb requirements for IBU and FIS standards.
- ***Superior views*** – including of Mammoth Mountain Ski Area and Inyo Craters from multiple locations.
- ***Dispersal of recreational activities*** - from the main core of Mammoth Lakes, with the opportunity for forming trail linkages to the town and possibly to the Mammoth Mountain Ski Area base Alpine area.
- ***Less susceptibility to wind*** - both for skiing and shooting at the range.
- ***A lower elevation*** - by approximately 200 meters from Panorama Dome, which would contribute towards attracting competition events that may be averse to very high altitude activities.

There are other challenges to this location:

- ***Sense of Remoteness*** - while the absolute distance of 3.5 to 4.5 miles from the developed area of Mammoth Lakes is certainly reasonable compared to many other comparable venues, the location "feels" quite remote and could be a deterrent to some users.
- ***No developed infrastructure*** - including parking, and there are no utilities; this site would either be developed with a minimal infrastructure or require potentially greater expense for development into a high-quality venue.
- ***Grooming and maintenance operations*** – the remote location would make it more difficult without the established machinery and infrastructure of Shady Rest or Tamarack/Panorama. Again, this is not insurmountable, but it does require careful consideration of these implications.
- ***Topography variation near the range/stadium*** – though the terrain is more varied than Panorama Dome, there is a difficulty in finding the necessary topography within the proximity of the proposed range/stadium for a homologated course and/or sustained climbs. This desired terrain is located behind the proposed range location (which does face the traditional northerly direction) and thus eliminates the possibility for spectators to view athletes challenging the most dramatic terrain.
- **Much of terrain is relatively featureless** - although not in terms of views. This location contains sections that are largely flat or of very modest grade. This is appropriate for recreational skiing, or modest level competitions, but is not ideal for elite level competition (except for the terrain behind the range and out of sight of spectators).

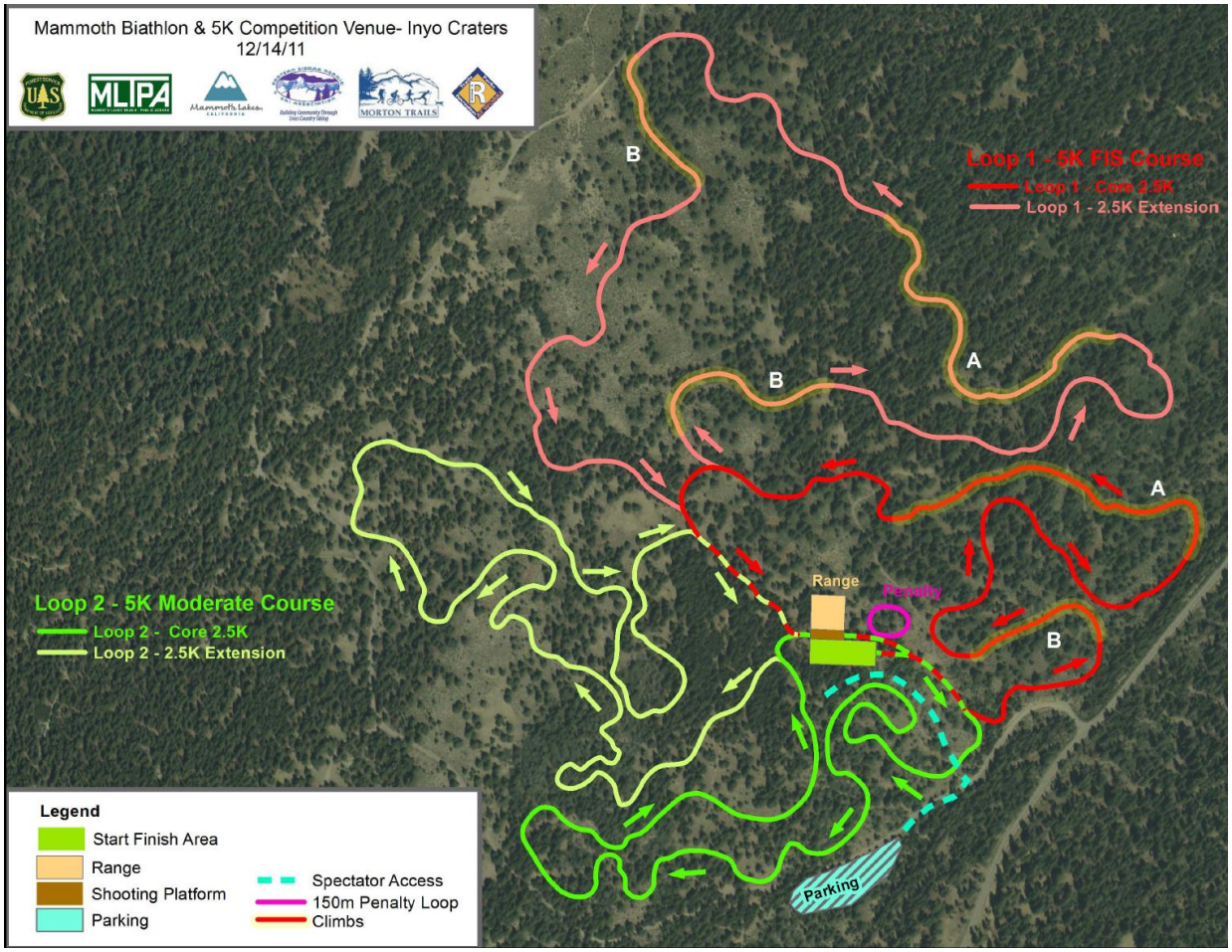
As with Panorama Dome, Morton Trails prepared a concept and flagged trails, stadium, range and other features with pink and black or orange and black striped tape. These routes have been GPS'ed, and portions of the site have been inspected by representatives of the MBAC at the end of Morton Trails' visit in August 2011.

4.5.2 Inyo Craters – Proposed Venue Plan

With these opportunities and caveats in mind, Map 4.4 presents a concept that has been flagged on the ground. It is a concept that will work – from both a Nordic competition and biathlon perspective, but it remains a concept that can be modified.

As Map 4.4 indicates, there are two sets of loops. The Green loop (Loop 2), or 5K moderate course, provides two, 2.5K loops (one is an extension of the core) and leaves in a south and southwesterly direction. These loops use a few key knolls or ridges to provide terrain variation while bringing participants within view of spectators near the stadium/range area.

Map 4.4 - Inyo Craters Biathlon/Nordic Venue Plan



The Red loop (Loop 1), or 5K FIS loop, departs the start/finish/range area in the same manner as the Green loop, then heads to the north and northeast, returning once within view of the start/finish area. This loop is challenging and would meet all FIS homologation requirements (other than the issue of elevation above sea level). Both the Green and Red loops use the same approach to the range/stadium which is on a very gentle rise (quite different from Panorama where there is a more pronounced, uphill finish to the range). The

"A" and "B" notations on Map 4.4 denote the required FIS climbs to meet the homologation (international certification) requirements for Nordic competitions.

We should note that the loops generally conform to the distance requirements, though one or two of the loops would require some refinement to meet the exact distance specifications.

The range area features a shooting range that faces north/northeast, and a stadium area within full view of a knoll to the south (an appropriate place for a yurt or warming area). Some excavation would be required to provide a flat surface of the range and perhaps a small amount of excavation for the 150M penalty loop.

Parking is assumed to be along the Inyo Craters road with spectators, volunteers, and participants walking the short distance to the venue. There is a possibility of creating a joint parking area with motorized users in this vicinity, as has been initially proposed by the US Forest Service (Inyo National Forest).

As noted with the discussion on Panorama Dome, the trails are marked with pink and black flagging, and the range/stadium area is marked in solid pink flagging with notations on many of the flags. During our walk with members of the MBAC at the conclusion of our trip, we did note that some of the flags had been removed (within a 24 hour period). We would recommend that anyone interested in seeing this design on the ground do so soon, or obtain a GPS with the routes loaded into the device. Please contact Chuck Megivern at MLTPA or David Lindahl at Morton Trails for these GPS files.

4.5.3 Next Steps for Inyo Craters Venue Development

As with Panorama Dome, there are a number of next steps based on this analysis.

First, Chapter 6 provides a description of financial feasibility, and we identify the costs associated with different levels of investment. As we have discussed above, Inyo will require a base level of infrastructure that is currently unavailable compared to Panorama Dome. In this same light, Panorama and Inyo have differing characteristics and provide good options for comparison and a decision as to where to invest resources for a venue.

Second, if a decision is made to proceed with Inyo Craters as a site for the Biathlon/Nordic event facility, the same actions as described for Panorama (section 4.4.3): coordinate final design and applicable permits as needed, including any engineering or other consultations necessary; prepare the trails and site for construction in close coordination with a qualified venue designer, forester, and other applicable expert; clear the trails, range, stadium and other areas; and design and construct any temporary or permanent facilities.

Regarding the latter step, again, Inyo will require, at a minimum, at least one yurt-like structure, with sanitary facilities available. It will also require additional road work (and long-term plowing/maintenance in winter) to provide access to the proposed site.

Finally, and as we describe in further detail in the following chapter, Inyo Craters offers an opportunity for Nordic skiing, and related, trail development, independent of its characteristics for a competition and events facility. All of the features it offers, which we describe above, would make it a superior trail system for recreational skiers and could be an additional "node" of a larger Mammoth Nordic skiing trail network.

5.0 ECONOMIC IMPACTS

As we addressed in the introduction of this report, this study is divided into two major parts. First, what would it take to create a nationally-recognized Biathlon and Nordic skiing event facility for Mammoth Lakes, particularly from a physically-feasible perspective? Chapters 2-4 address these issues in large detail. The second section addresses issues of economic and financial feasibility of such a program, and some of the organizational mechanics of developing and maintaining such a facility (we also add in an additional chapter that discusses the potential for creating an expanded Nordic-based system of trails, facilities, and programs beyond that associated with a specific event/competition facility).

This chapter focuses on the potential economic impacts of the type of facility proposed in Chapter 4 within the Mammoth Lakes region, as well as estimates of the financial investments necessary to create such a facility. This chapter does not specifically address issues of longer-term maintenance and upkeep, which directly relates to the type of organizational management for a facility (the primary focus of Chapter 6).

5.1 Mammoth's Economy – An Overview

The Mammoth Lakes region is dominated by winter-based tourism, led by Mammoth Mountain Ski Area (the largest employer by far in the region as shown in Table 6.1), other non-winter visitors, the Federal Government (primarily manifested in the US Forest Service lands and activities), and the other activities associated with a resort-oriented community. As Table 6.1 indicates, other important employers include schools and local government, lodging and eating/drinking establishments, and the Mammoth Hospital.

Table 5.1 - List of Selected Major Employers in Mammoth Lakes (15 or more employees)

ESTABLISHMENT	EMPLOYEES
Mammoth Mountain Ski Area	2,500
Mammoth Unified School Dist	400
Mammoth Hospital	370
Westin Monache Resort	280
Eagle Run	120
Vons	120
Grand Sierra At The Village	100
Mammoth Ranger District Ctr	75
Chart House Restaurant	59
Mammoth Elementary School	50

Source: InfoUSA Database, 2011, authors' estimates.

In many respects, understanding an economy such as Mammoth Lakes is quite straightforward. In the parlance of regional economic development, Mammoth's "basic economy" (those activities bringing outside dollars into the local economy) is primarily tourism-oriented as well as the attraction of new, primary and second home residents. The "non-basic economy" includes those sectors whose function serves predominantly the local or tourist population (i.e., the grocery stores, retail shops, hotels and motels, restaurants, hair salons, etc.). This economic structure is different from other rural economies where the economic base may be primarily agricultural, resource-extraction activities (i.e., mining or logging), or manufacturing.

Table 6.2 provides a more comprehensive picture of the Mammoth Lakes region economy, and, again, this tourism and recreational amenity-based structure is evident. The broad category of Services (nearly 60% of the total employment) comprises not only Mammoth Mountain Ski Area, but lodging, health services, social services, and business and professional services. It is important to recognize that this broad category comprises both "basic" sectors (which would include the two-person marketing consulting firm, defined as a business service in Table 6.2, whose clients are primarily outside Mammoth Lakes or the Mono County region) and "non-basic" activities (i.e., the hotels, motels, and RV parks).

Other categories of particular note in Table 6.2 include sectors primarily associated with construction and real estate. While the Construction sector employs just under 3% of the Mammoth's region 8,130 employees, there are 385 employees in Real Estate (or 4.7%) and additional employees and establishments associated with building materials. Overall, the construction and real estate sector likely comprises up to 10% of the direct employment in the Mammoth region's economy.

Government is another important sector, dominated by school district staff, but also by other state, local and Federal (especially the US Forest Service's Mammoth Lakes Ranger Station staff) agencies and departments.

Finally, an additional 590 (or 7.3%) of employment can be tracked to self-employed individuals and partnerships. Many of these are likely individual construction contractors, but others are a growing segment found in resort communities such as Mammoth, where an individual moves from an urban area and continues employment as an independent consultant, software programmer, or other profession where the only logistical requirements are a phone, computer with good internet, and the capability to catch a quick flight to an urban area for a client visit. Also known as "lone eagles", these individuals often have a higher median income, bring a higher than average amount of net worth and associated economic income to a region (such as stock dividends), and have been associated with providing as much as 1/3 of the total jobs in such rural economies because of their "multiplier" impacts.[5]

[5] Beyers, W.B. and D.P. Lindahl (1996), "Lone Eagles and High Fliers in Rural Producer Services," *Rural Development Perspectives*, vol. 11, no.3.

Table 5.2 – 2011 Establishment and Employment by Industry – Mammoth Lakes

	Establishments	Employees	% Empl
Agricultural/Forestry Services	**5**	**18**	**0.2%**
Construction	**37**	**215**	**2.9%**
Manufacturing	**6**	**31**	**0.4%**
Transportation	**7**	**38**	**0.5%**
Communications and Utilities	**8**	**76**	**1.0%**
Wholesale Trade	**4**	**11**	**0.1%**
Retail Trade	**112**	**1,480**	**19.6%**
Building Materials	9	63	
Merchandise and Misc. Retail	48	387	
Food Stores	6	157	
Gas-Convenience	8	63	
Eating and Drinking	41	810	
Finance, Insurance and Real Estate	**75**	**420**	**5.6%**
Banks-Lending and Investment	7	21	
Insurance Carriers and Agents	4	14	
Real Estate	64	385	
Services	**175**	**4,519**	**59.9%**
Skiing Centers and Resorts	15	2,899	
Hotels/Motels/RV Parks	31	548	
Personal Services	12	57	
Business and Professional Svcs	48	281	
Health Services	13	430	
Social Services	12	77	
Churches and Non-Profit Orgs.	14	67	
Other Services	30	160	
Government	**24**	**731**	**9.7%**
Schools and Libraries	10	553	
US Forest Service	1	75	
Other Government	13	103	
TOTAL WAGE AND SALARY EMPLOYEES	**453**	**7,539**	**100.0%**
Estimated Self-Employed		**591**	
TOTAL EMPLOYMENT - MAMMOTH		**8,130**	

Source: InfoUSA Database 2011; US Census, American Community Survey, 2010, authors' estimates.

5.2 Demographic and Tourism Trends

The discussion above regarding Mammoth's general economy warrants a related overview of its population characteristics and trends, as well as observations of its tourism economy.

Population, Housing, and Income Trends and Characteristics – Between 2000 and 2010, the Town of Mammoth Lakes' population grew by 1,141, from 7,093 to 8,234, or 16.1%.[6] This represents an annual rate of growth of 1.5%, compared to 0.9% annual growth for the US, 1.0% growth for California, and generally flat (0.03%) growth for the remainder of Mono County during the same time period. In other words, Mammoth had a very healthy population growth rate during a decade in which the state, nation, and county had very slow growth. Additionally, there is a high degree of mobility an influx of outside visitors: 14% of households surveyed in 2009 had lived in another county the previous year. This compares to only 4% of California households who had moved from another county in the year prior, based on the same survey.[7]

The housing stock of Mammoth very much reflects its tourism and second-home character. 71% of Mammoth's 9,214 housing units were vacant in 2009; these units are either rental in nature or are not primary households. This 71% vacancy compares with 8% for the State of California. Another indicator of this housing stock is that 84.3% of Mammoth's housing units were constructed after 1970, with nearly 40% constructed since 1980. While building trends slowed in the 1990s and 2000s (less than 4% of the stock was built in the last decade), this profile is very different from other parts of California where the age of housing has a more even distribution over the past five decades.

For residents of Mammoth, the median household income is $53,216, compared to $60,392 for the typical California household. 33.6% of Mammoth residents make $75,000 or more, compared to 40.2% for the state and 31.7% for the US as a whole. Mammoth Lakes, is in many respects, a resort town with a large portion of residents who are in non-professional service-oriented or part-time jobs which depend upon the seasonality of summer and winter tourists.

Tourism Trends and Patterns – A 2009 study of Mono County tourism[8] as well as a visitor use study conducted by the Inyo National Forest identified a number of findings of particular relevance to this study. Among these findings include:

- Mono County attracted 1.5 million visitors in 2008, of which nearly 50% visited the Town of Mammoth Lakes during that visit.

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[6] US Census 2010, www.census.gov

[7] US Census, *American Community Survey, 2005-2009,* www.census.gov/acs/www/

[8] *The Economic and Fiscal Impacts and Visitor Profile of Mono County Tourism in 2008*, Mono County Department of Economic Development and Special Projects, prepared by Lauren Schlau Consulting, January 2009.

- Visitors stayed in the region an average of 3.1days, spending an average of $71.58 per person per day, or a total of $738.41 per group per trip. In the winter, the average group spent $2,055 per trip (average of 3.45 days per trip), reflecting the higher expenditures of visitors to alpine ski areas, particularly Mammoth Mountain Ski Area.
- The annual household income of visitors to the Inyo National Forest is well above the profile of the nation, state of California, or typical tourists. Over 57% had incomes in excess of $75,000, with 23.7% with incomes of $150,000 and higher. This compares to 31.7% ($75,000 and higher) and 8.1% ($150,000 and higher) for the US as a whole. In sum, the Mammoth region attracts visitors of a generally very high-income segment.

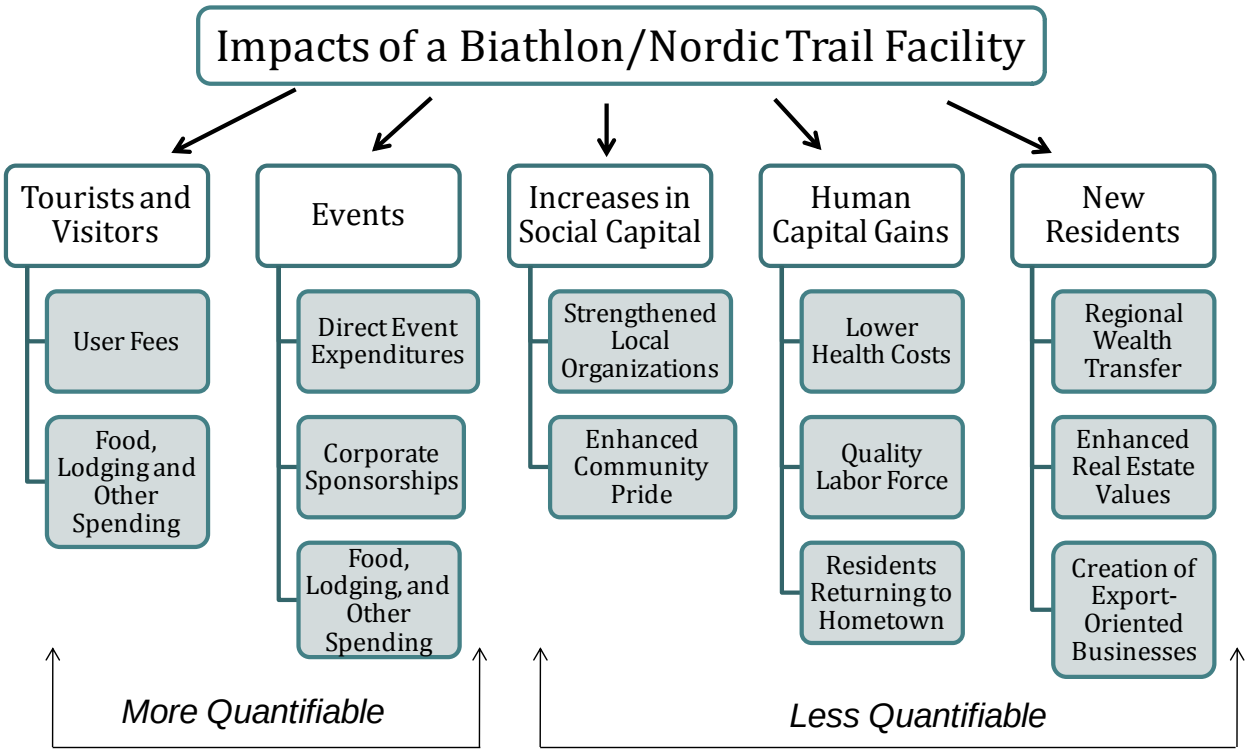
This brief discussion of demographic and tourism trends, as well as a general understanding of the Mammoth Lakes region economy, provide a backdrop for the next section which addresses the potential economic impacts of developing a biathlon and Nordic skiing venue as evaluated in this study.

5.3 Economic Impact Analysis

There are a number of approaches to evaluating the impact of an infrastructure investment, business expansion, or other activity that would have an effect on a small economy such as Mammoth Lakes (and the surrounding area). These approaches include sophisticated economic models and are frequently applied to evaluating the impact of a new policy, expansion (or contraction) of a large company or particular sector of the economy, or the closure of a facility such as a military base. Some impacts – such as the creation of a tourist attraction that brings new visitors, and associated spending, into an economy – can be quantified relatively accurately. The outputs of such analyses include reasonable estimates of total economic output, local income, and jobs. Other impacts --- such as strengthening community organizations or schools – may still have very real economic results, but the methods for estimating these impacts are not as exact.

Figure 6.1 depicts a framework for understanding the possible impacts of a Biathlon and Nordic Skiing Events Facility (as described in Chapter 4) on an economy such as the Mammoth Lakes region.

Figure 5.1 – Economic Impacts of a Biathlon/Nordic Facility



Source: Morton Trails.

The two categories on the left side – the effects of increased numbers of tourists and visitors from outside the region and that of hosting events – are more easily quantified, and we make some rough estimates of these impacts on the Mammoth Lakes economy, described below and depicted in Table 5.3. The three categories to the right of the diagram – increases in social capital, human capital gains, and the attraction of new residents – are quite real and, in our experience with other similar communities, also lead to increased economic health for a rural area. We will discuss these impacts but not address them in a direct quantified estimate.

Table 5.3 –Impacts From a Biathlon/Nordic Trail Venue and Expanded Trails

Impacts From Daily Usage	Low Scenario	Middle Scenario	High Scenario
Annual Increased Usage (Nordic Skiing)	6,000	15,000	30,000
% Non-Local Users	60%	65%	70%
Total Non-Local Usage	3,600	9,750	21,000
Avg. Spending per Day	$250	$250	$250
Total Non-Local Spending	$900,000	$2,437,500	$5,250,000
Multiplier - Indirect and Induced	1.40	1.40	1.40
Indirect and Induced Spending	$1,260,000	$3,412,500	$7,350,000
Outside Leakage and Adjustment for Margins	60%	60%	60%
Total Possible Activity in Mammoth	$504,000	$1,365,000	$2,940,000
Jobs per Level of Output	$50,000	$50,000	$50,000
# of New Jobs From Biathlon/Nordic Usage	10	27	59

Impacts From Events	Low Scenario	Middle Scenario	High Scenario
Avg. Participants	50	200	400
Avg. Spectators	100	300	600
Total Visitors per Event	150	500	1000
Spending per Day	$250	$250	$250
Total Non-Local Spending	$37,500	$125,000	$250,000
Multiplier - Indirect and Induced	1.40	1.40	1.40
Indirect Spending	$52,500	$175,000	$350,000
Potential Leakage and Margins	0.6	0.6	0.6
Total Possible Activity (per Event)	$21,000	$70,000	$140,000
Jobs per Level of Output	$50,000	$50,000	$50,000
# of New Jobs (Per Event)	0.42	1.4	2.8
# of Major Events	4	6	8
Total New Activity in Mammoth Due to Events	$84,000	$420,000	$1,120,000
Jobs Due to Events	2	8	22

Total Possible Economic Impacts From Nordic and Other Trail Usage and Related Events

	Low Scenario	Middle Scenario	High Scenario
Assumed Annual Usage	6,000	15,000	30,000
Events	Few	Moderate	Extensive
Total Economic Activity (Winter Uses)	**$637,000**	**$1,589,000**	**$3,304,000**
Total New Employment (Winter Uses)	**13**	**32**	**66**

Source: Morton Trails

Table 5.3 provides an estimate of economic impacts on the Mammoth Lakes economy under three different scenarios. The "low" scenario, assumes annual visits expand by 6,000 users, as well as the hosting four Nordic-specific events (three smaller events of approximately 100 participants and one medium-sized event of 500 participants). The "middle" scenario assumes 15,000 annual additional Nordic trail visits (this does not include use of trails during non-winter months) and six events (four smaller events and two medium-sized events). The high scenario represents 30,000 annual Nordic users and eight events (four smaller events, two medium-sized events, and two national-caliber competitions of 500 to 1,500 participants).

The assumptions for these estimates are based on other comparable studies, but we should emphasize that they can be highly variable. First, the average spending of $250 per visit per day is consistent with other Nordic areas (and actually conservative based upon findings in the Methow Valley) and is also comparable to the average expenditure of other tourists to Mammoth (and substantially lower than the average Alpine skiing visitor). Second, there is significant usage assumed that to be local (ranging from 30% to 40%), and this is likely conservative (in terms of reducing the economic impacts). In the Methow Valley, for example, non-local usage is estimated at over 90%. Third, we allow for a high degree of "leakage" (visitors who stay and/or spend outside the Mammoth area) as well as for retail margins (i.e., only a portion of dollars spent on retail goods and other services will remain in the local economy as businesses purchase goods and services from outside the local area). Fourth, we apply a "multiplier" of 1.40 (meaning that there is an extra 40 cents of economic output in the local economy for every dollar brought in as a result of new visitors to the trails). This multiplier is consistent with other tourism (and Nordic-tourism) based studies, including in the Mammoth region; it is also lower than the multiplier for other economic sectors such as a manufacturing plant.

The "leakage" issue is worth comment. Mammoth is a relatively small community and already has a base of hotels, motels, and visitor rooms. During the winter (especially during holiday weeks), there may not be sufficient rooms to host a major event such as a US cross country skiing Nationals or even larger event. While there are few options for a visitor to Mammoth to stay outside the area (i.e., in another community such as Reno), increased demand from Nordic users (event and non-event based) could spur increased demand for additional lodging and related services. The Methow Valley, Washington (over four hours' drive from Seattle in winter) – which was dominated by summer tourism, ranching, snowmachine visitors in winter, and logging – now attributes 44% of the total revenues for all businesses in the valley of 6,000 people to Nordic and non-motorized trail-based visitors.[9]

The results of this analysis indicate an economic impact ranging from $0.64M in annual economic output and 13 additional jobs in the Mammoth Lakes area for the Low Scenario

[9] Resource Dimensions (2005), *Economic Impacts of MVSTA Trails and Land Resources in the Methow Valley.*

to $3.3M in output and 66 new jobs for the High Scenario. Based on Mammoth's approximate employment (wage and salary) of 7,139 jobs, this ranges from a negligible to a 0.8% increase in employment. The calculation of jobs is based on an average of $50,000 of total economic output per job (which includes both full and part-time positions). Again, these impacts do not reflect other possible economic effects associated with any increase in new residents moving to the area, nor the possibility of creating a broader network of Nordic skiing (as described in Chapter 8), nor multi-season use of the facilities. In the Methow Valley, for example, the ratio of non-Nordic usage of the trails (i.e., running, mountain biking) to the Nordic skiing usage was approximately double. In other words, if the trail systems (and supporting venues and infrastructure) are created to support multi-season and multi-sport use, then the impacts could easily be 50% or greater than those cited in Table 5.3.

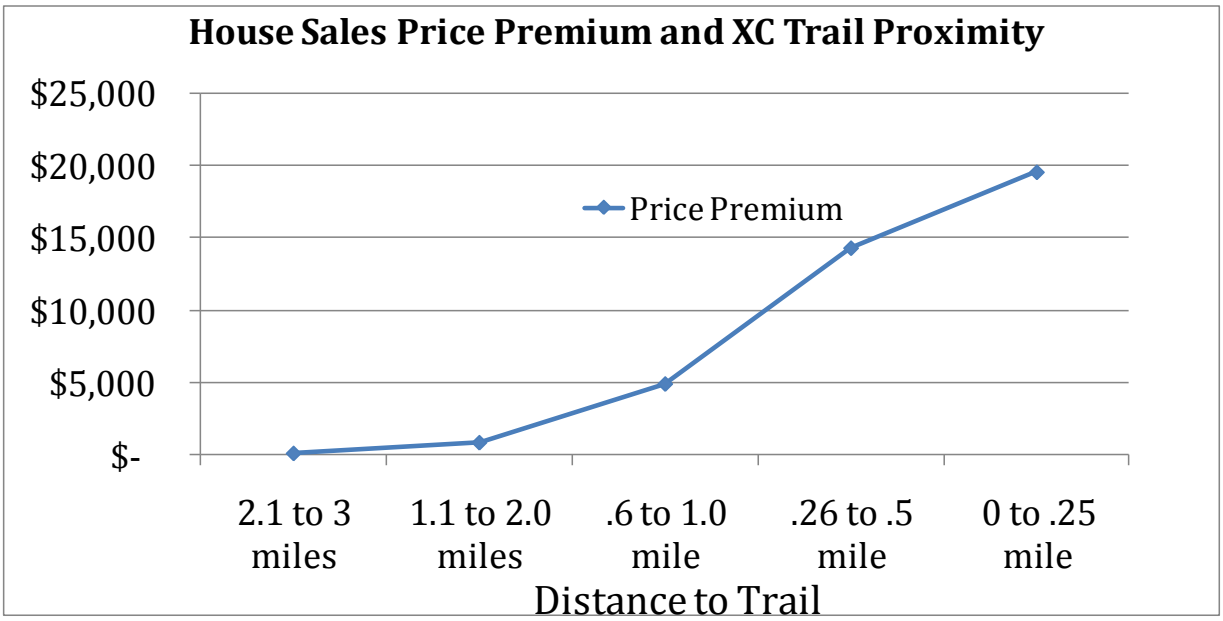
Although this analysis does not determine the sectoral breakdown of the output and employment impacts, we can expect that the types of jobs would be partially focused in the hospitality and retail sectors, with secondary impacts permeating across industries. In other locales that have gone through similar transformations, there can be twofold impacts with respect to income levels and the types of jobs: on the one hand, many of the jobs may be lower wage and, where housing prices become inflated, a workforce can emerge that cannot afford to live in the community in which it works (Jackson Hole, Wyoming is a prime example of this phenomenon); on the other hand, longer term growth associated with this form of development attracts new types of businesses (including professional services) which would have otherwise not located to the area. The Methow Valley is an example of this at a small scale; Bend, Oregon is an example of this phenomenon at a much larger scale (Bend has a population of 76,000).

5.3.1 Other Impacts

As Figure 5.2 depicts, there are other impacts not quantified in the analysis above. We briefly discuss these impacts below.

First, one of the biggest impacts of any trail system stems from effects on real estate – recent studies have indicated a premium ranging from approximately $5,000 to higher than $20,000 for units and lots proximate to a designed, quality trail system. In the Methow Valley of Washington, this premium was specific to groomed Nordic ski trails. Figure 4.3 is taken from this study, and shows that the premium is highest for lots on the trail and decreases as one moves away from the trail network. Maximizing access to a trail system – through multiple trailheads as well as general accessibility across the community – will increase the system's overall economic benefit.

Figure 5.2 – Impacts of Nordic Trail Proximity on Residential Real Estate



Source: Resource Dimensions (2005), *Economic Impacts of MVSTA Trails and Land Resources in the Methow Valley.*

Second, a high-level Nordic trail system – and all of the activities associated with it – can galvanize a small community, particularly if there are higher level events (bringing in elite athletes across the nation and even internationally) that permeate through adult residents who act as volunteers, to school children who have world-class facilities and have the opportunity to see role models of the highest caliber. This has certainly been the experience in northern Maine, with the establishment of the Maine Winter Sports Center, as well as other communities including Sun Valley, Idaho; Bend, Oregon; Anchorage, Alaska; and the Methow Valley, Washington.

Finally, there is a growing body of evidence that school-based outdoor programs – particularly those based around trail activities – have a highly positive impact on both children's health (especially in childhood obesity) and academic performance.[10] In Aroostook County, Maine (in a state with the nation's second highest rate of childhood obesity), the Nordic ski trails that were developed and integrated into the local physical education program of 17 elementary schools had the desired effect of improving health, and a stated increase in standardized test performance of 10%. These impacts, while more difficult to quantify economically (though it can be done using other methods) can have long lasting impacts on a community such as Mammoth Lakes.

5.3.2 Economic Impact Evaluation of Different Sites

[10] See, for example, Barton, J. and J. Pretty (2010), "What's the Best Dose of Nature Green Exercise for Improving Mental Health: a Multi-Study Analysis," *Environmental Science and Technology.*

This study does not distinguish the economic impacts of different locations, at least in quantified terms. From a more qualitative perspective, there is merit to the possibility that more economic impacts could be realized with a location at Panorama Dome, as this already represents the locus of Nordic skiing activity. An isolated area, such as Inyo Craters, may not yield the visits if it is a sole, isolated facility.

On the other hand, if a broader system were developed (such as that presented in Chapter 8.0), the economic impacts of either site could likely be comparable (and, taken together, greater as Mammoth develops a "critical mass" of offerings making it a destination-oriented Nordic and related trail-based community). Again, these issues are discussed in more detail in Chapter 8.0.

6.0 Financial Feasibility

Developing a Biathlon and Nordic Skiing Competition and Training Facility, as discussed in detail in Chapters 3 and 4, requires organizational commitment, community support, and financial investment. With respect to the latter category, there are both capital costs – the initial financial outlays to provide the trails, structures, and other supporting facilities for a venue, and operating costs – the ongoing costs to maintain and groom trails, host events, maintain and provide upkeep to any facilities, and undertake administrative activities to promote and oversee programs and general operations.

This chapter focuses particularly on the capital investments, with less detail on operating costs because: 1) they are far more variable depending on the entity and funding structure adopted for long-term operations, and 2) we address some of these issues in the next chapter regarding options for organizational management.

6.1 Capital Costs

There are many variables in preparing estimates of capital costs of the proposed facilities we discuss for the two locations presented. And these variables will ultimately change throughout the planning, design, pre-construction, and construction process. These variables, to mention only a subset, include: use of volunteer or in-kind services and labor; dual projects which may offset costs (e.g., a timber sale which may coincide with cutting of a trail); physical variables such as ledge outcroppings, unforeseen drainage issues, and available fill on-site (versus having to bring in fill for trail construction); regional variations in construction costs and bids; need or desire for temporary versus permanent structures; environmental, archaeological, or other review and/or permit needs; and acceptable types of construction techniques, such as the use of heavy equipment or decisions related to the use of a culvert rather than a bridge to cross a particular drainage.

There are also options for the type of facility needed. At one extreme would be a very minimal level of investment to develop the trails proposed at the lowest threshold necessary to host local and regional events, supported by facilities that are predominantly temporary. Such investment would still be a significant upgrade from what currently exists in Mammoth, but would not necessarily attract major, sanctioned events nor be regarded as a preferred facility for elite-level training camps. At the other extreme would be the construction of a facility that meets the requirements for an IBU (biathlon) B-license and/or one meeting FIS (cross country skiing) homologation requirements at one of the higher levels (e.g., category D which accommodates awarding of FIS points for a mass start freestyle race, requiring major uphills to be constructed 9 meters in width and all other sections of the trail at 6 meters). In addition, this higher standard facility would warrant more permanent structures (such as a day lodge and quality sanitary facilities), sufficient parking for major events, and facilities for storage and grooming equipment.

Table 6.1 identifies two possible scenarios of development, and we use these scenarios as a general guideline to develop capital cost estimates.

Table 6.1 - Two Scenarios of Implementation for a Biathlon/Nordic Competition and Training Facility

	Minimal, or Low, Scenario	**Full-Scale Implementation, or High Scenario**
Level of Trail Development – Homologation Standard	4-6 meters wide; Category "C" FIS homologation standard	6-9 meters wide: Category D FIS homologation standard
Range	Manually-operated metal targets; fully excavated range with 20 points	HoRA electronic target system; 20 shooting points, but extra effort to meet IBU B-license standards
Structures	Yurt, other temporary structure, or very modest warming hut. Portable sanitary facilities as needed. No wax cabins. No additional garage/shed for grooming or other equipment.	Permanent day lodge, with sufficient space to host IBU-B license level events, in conjunction with temporary facilities as needed. Permanent wax cabins for up to 10 teams, with additional needs filled by trailers or other temporary facilities. Permanent grooming equipment garage or shed.
Parking and Staging Areas	Up to 100 vehicles, with large events requiring alternative sites with possible shuttle service. Other areas excavated to provide temporary structures.	Up to 300 vehicles and larger areas to provide staging for tents, trailers, and other temporary facilities for major events.
Programming	Integration of Biathlon and Nordic skiing and trail-based activities into elementary and high school; expanded youth and racing programs; hosting of additional regional events.	Training center for elite athletes and teams; hosting of national and periodic international level events; multi-season programming of full trail system.

Based on these two scenarios, Table 6.2 provides cost estimates for the two possible locations: Panorama Dome and Inyo Craters.

Table 6.1 – Estimated Capital Costs of Two Scenarios of a Biathlon/Nordic Facility

Improvement	*Panorama Dome*		*Inyo Craters*	
COURSE, RANGE, AND STADIUM	**Basic Level**	**Premium Level**	**Basic Level**	**Premium Level**
Trail Construction	$100,000	$150,000	$140,000	$180,000
Stadium and Range (incl. targets)	$15,000	$250,000	$15,000	$250,000
Timing Shed	$10,000	$30,000	$10,000	$30,000
Electrical Power or Generator	$10,000	$40,000	$40,000	$200,000
Permitting, Other Costs and Contingency	$25,000	$65,000	$40,000	$95,000
Subtotal Course, Range and Stadium	**$160,000**	**$535,000**	**$245,000**	**$755,000**
FACILITIES				
Lodge Facility(ies)	$5,000	$200,000	$10,000	$300,000
Wax Cabins	$2,000	$400,000	$2,000	$400,000
Road Work and Parking Lot	$75,000	$150,000	$90,000	$150,000
Garage/ Storage Shed	$0	$15,000	$0	$250,000

Permitting, Other Costs and Contingency	$6,000	$130,000	$15,000	$210,000
Subtotal Facilities	**$88,000**	**$895,000**	**$117,000**	**$1,310,000**
PROGRAM INITIATION	**$50,000**	**$200,000**	**$50,000**	**$200,0000**
TOTAL RECOMMENDED IMPROVEMENTS	**$298,000**	**$1,630,000**	**$412,000**	**$2,265,000**

As one can see from Table 6.1, there is a large range between the Basic and Premium level investments; there are also some substantial differences between the two site locations, particularly at the Premium Level. Below is a discussion of each of these items including further detail, some assumptions behind their respective cost estimates, and means by which these improvements can be phased in as opposed to a full-fledged investment at once.

- ***Trail Construction*** – The primary costs for constructing trails include the cutting, and clearing of the timber on the proposed route as well as the excavation and finishing of the trail itself. Secondary costs would include any additional design, engineering, or other costs (which are partly incorporated under the "Permitting and Other Costs and Contingency" line item described below). Both the Panorama Dome and Inyo Crater sites include sections which would require minimal cutting and/or excavation, either because of the anticipated incorporation of existing trails or due to terrain which is relatively open and flat thus requiring little cutting or excavation. We have assumed approximately $20,000 per kilometer of total construction costs (Basic Level) at Panorama Dome (for a total of 5 kilometers) and the same amount for a portion of the costs at Inyo Craters (assumed 5 kilometers at $20,000, where there is significant cutting and sidehill construction) and 5 kilometers at a lower rate (where the terrain is open and relatively flat, requiring minimal construction).

  For the Premium Level, which would require a wider trails (9 meters on all uphills and 6 meters in other sections), the cost per kilometer is greater.

  The trail construction estimates do not include a detailed accounting of needed culverts, bridges, off-site fill, or other factors that could only be determined after the final route is determined and bids are procured from qualified contractors.

- ***Stadium and Range*** – The primary cost is associated with the clearing and excavation of the start/finish and range area, including construction of earthen berms behind and on the sides of the range. Both sites are similar in these requirements, and $15,000 is considered a reasonable estimate (similar to the rough excavation of a parking lot). For the Premium Level, we assume purchase of the state-of-the-art electronic target system (i.e., HoRa or comparable system, including installation consulting and construction of a small range control building to operate the targets). This additional cost could also accommodate additional terracing of the spectator area, to enhance viewing of events.

- ***Timing Shed*** – This structure can either be a temporary facility, skidded out before and after the main winter season, or a permanent fixture with a poured slab foundation and power source. It should accommodate at least two staff members during races. More elaborate versions provide room for a technical jury to meet and/or permanent timing equipment.

- ***Electrical Power*** – Although many races can be conducted with a portable generator or battery-powered equipment, a higher level facility needs power for timing equipment, waxing areas, lights in a structure, or for an electronic target system, among other needs. We assume that Panorama Dome would be proximate to a potential power source for possible permanent conduit, while Inyo Craters has no nearby power. For high level events (i.e., those that would warrant an IBU B-License), there is a requirement for a main power source and a backup emergency source such as a generator.

- ***Permitting, Other Costs, and Contingency Allowance*** – Depending on requirements for sitework, construction, legal negotiations, engineering, and final design needs, we assume a 15% addition to the "hard costs" of the previous items. This line items also accounts for a contingency allowance of 5% (for a total of 20% of hard costs allocated to this category).

- ***Lodge Facilities*** – For the Basic Level of investment, we assume very modest, temporary facilities for warming, changing, event personnel functions, and portable sanitary facilities. Because the permanent facilities of Tamarack are close to the Panorama Dome location, we assume a small yurt or other structure for a modest investment at the facility site. For Inyo Craters, we assume use of a larger yurt/temporary structure, thus the higher cost. At the Premium Level, this assumes a 2,500 square foot day lodge at Inyo Craters and a smaller one at Panorama (again because of proximity to other facilities). These permanent facilities would still be relatively modest, likely without central plumbing but would include a heating system.

- ***Wax Cabins*** – Major biathlon and Nordic skiing events typically have facilities available for teams to wax skis by designated technicians, close to the ski trails

and race course. These facilities have space, benches, and ventilation infrastructure. Additionally, they can also serve as the team gathering and changing area, so there can be a need for restroom and changing rooms. For the Basic Level of investment proposed here, we assume additional areas that are excavated (in addition to parking areas) to support temporary waxing/team facilities, typically housed in a trailer. For a Premium Level, we assume construction of permanent facilities to support up to 15 teams (any additional wax cabins would be accommodated in temporary facilities). When these facilities were not used during events, they can be used for storage, meeting areas, or changing areas for local groups and teams.

- ***Road Work and Parking Lot*** - Panorama Dome requires minimal to no road work for vehicular access, but it would require a parking area as shown in Map 4.3. We assume an unpaved lot in the Basic Level and a paved lot for the Premium Level. Additional parking could be available at Tamarack (though it is already very constrained), supplemented by shuttle service at parking areas elsewhere in the Mammoth Lakes area during very large events. At Inyo Craters, the existing Forest Road is not plowed during winter and would require upgrading and construction of parking facilities at or near the proposed location. Paving is not necessary, but we have incorporated allowance for paved parking in the Premium Level. The US Forest Service suggested to the consulting team the possibility of a winter-use (motorized and non-motorized) staging area in this vicinity, so we assume some shared expense of road and parking improvements. Under a Premium Level investment, we assume larger parking areas and/or flat areas for other temporary facility needs necessary to host major events (tents, trailers, media, etc.).

- ***Garage/Storage Shed*** - For Panorama Dome, we have assumed that all of the major grooming equipment is already stored by Tamarack Center and there would be minimal need for an additional facility. For Inyo Craters, under the Basic Level investment, we assume that the grooming machinery is not stored onsite but would require transport to the site on a regular basis. For the Premium Level, we assume a small grooming/storage shed available at Panorama Dome allowing storage of a snowmachine and tracking sled; for Inyo Craters, we have provided estimates for a facility to house a Pisten Bully (or comparable) machine and a smaller snowmachine, along with maintenance facilities and storage onsite.

- ***Program Initiation*** – While we address other programmatic, organizational management, and ongoing operations as well as maintenance issues later in this report, we have incorporated a capital investment allowance for establishing a program at the proposed facility including any personnel, gear and equipment (e.g., purchase of biathlon rifles), marketing, and other initial expenses. These expenses are identical for the two venues.

The next section addresses issues of operations and maintenance of the facility, aside from programmatic areas which are discussed in Chapter 7.0 (Organizational Management).

6.1.1 Operation and Maintenance Costs

In addition to the capital costs identified above, there would be expected annual operations and maintenance costs associated with the new facility. Some of these costs may be incorporated into existing operations of other entities – such as the US Forest Service, Tamarack Lodge (i.e., MMSA), the Town of Mammoth Lakes, or the MLTPA – without having any substantive increase in these entities' expenses (i.e., if Tamarack grooming equipment is used for a Panorama Dome site, the incremental cost of maintaining the existing garage for this equipment would be small). In other instances, these costs would be real and need to be funded by some entity. Table 6.2 provides a range of estimates for the direct, annual costs associated with the proposed facility.

Table 6.2 – Estimated Annual Operation and Maintenance Costs for Proposed Biathlon and Nordic Event Facility

ITEM	ANNUAL COST
Equipment maintenance, tools, and depreciation	$10,000 - $15,000
Parking lot and road plowing	$4,000 - $15,000
Fuel	$3,000 – $9,000
Staffing-wages	$10,000 - $25,000
Advertising	$1,000 - $5,000
Insurance	$2,000 – $6,000
Legal and related services	$1,000 - $5,000
Other administrative (supplies, office, etc.)	$4,000 - $6,000
TOTAL	**$35,000 - $85,000**

These estimates are based on other comparable facilities and cross country skiing facilities and operations. Staffing is based primarily on needs during the primary season of activity

(i.e., winter) and would mainly be one or multiple part-time positions. The figures also do not include any programmatic costs (such as hosting events or running a school-based ski program); these items are more generally addressed in Chapter 7.0 regarding organizational management and can vary tremendously depending on the mission, scope, and revenue and cost structure of the umbrella organization.

These estimates also indicate a wide range of costs, in part to reflect differences in possible use of a facility (i.e., would the biathlon range be open and supervised daily or only select times in addition to during events?), the possible location of the site (i.e., Inyo Craters would likely require higher costs for road plowing as well as fuel and grooming operator wages if the equipment is not stored on site), and any special use or other periodic permitting requirements that would necessitate legal and related consulting services.

Again, we emphasize that the cost information in Table 6.2 reflect broad estimates and, depending on the scope, location, and organizational management of the facility, we would recommend a more detailed evaluation.

6.2 Summary of Economic Impacts and Financial Feasibility

As we have discussed to this point, both the economic impact analysis and the financial cost analysis (capital and operating) reflect best estimates, though these could be substantially different based on a variety of factors. We have, for example, been involved in similar projects where the entire trail construction was funded by the off-setting revenues from harvested timber undertaken concurrently. Similarly, for one prominent project for which we designed a major competition venue, the annual visits for the cross country ski center increased by approximately 30% in the year immediately following its construction.

A means by which these two sets of analyses can be reconciled to help formulate decision is to compare the anticipated costs of the proposed facility (from Table 6.1) to the economic impact analysis of annual returns (from Table 5.3), balanced by estimated operation and maintenance costs. Taking the low end of economic impacts of $637,000 in Table 5.3 to the lower end of the capital costs of approximately $355,000 (the mid-point of the two locations), there is a payback ratio of approximately 1.8:1, or less than six months. If we include the costs of operations and maintenance, this ratio is about 1.5:1, or about an eight month payback period.

At the other extreme, we can take the highest level of investment of $1.9 million (the mid-point of the two locations) and compare it to the higher end of the economic impact returns ($3.3 million). Again, this is a return ratio of approximately 1.7:1, or about seven months payback. One final "check" would be to take the highest investment amount ($2.3M for the "Premium Level" at Inyo Craters) and compare this to the lowest economic benefit ($637,000 less $85,000 of O&M annual costs, or $552,000), we yield a ratio of 1:4, or a four-year payback period to the Mammoth Lakes economy.

Typically, a private sector return on an investment is considered feasible if there is a 7-year or less payback period. Given the most conservative results in this analysis (a 4-year payback period), this evaluation would consider such an investment a highly feasible project, from a financial/economic benefit perspective. Again, there are other variables not considered on both the benefit and costs side (e.g., event fees and pass sales on the benefits side and any additional fiscal costs, such as police and fire, on the cost side), but we would, nevertheless, consider this a project worthy of pursuing further.

7.0 ORGANIZATIONAL MANAGEMENT

A Nordic trail system, and the associated programs and activities that comprise it, includes (as we have just discussed) a great deal of capital, operating, and maintenance and management functions. Currently, a number of entities provide these services including Tamarack Center (and consequently MMSA), the Town of Mammoth Lakes (various departments particularly the Recreation Department), the US Forest Service, Mammoth Nordic Foundation, Mammoth Biathlon, MLTPA, Eastern Sierra Nordic Ski Association, and many individuals, volunteers, and supporting local businesses.

A more formalized biathlon and Nordic event/competition/training facility requires a cohesive structure to incorporate and expand upon the activities already undertaken and managed by the various organizations and parties noted above. In effect, there are three possible entities that can fulfill this role, and we summarize these below.

7.1 For-Profit Corporation or Related Entity

Some of the most notable destination Nordic facilities are privately run, for-profit entities that are either solely dedicated to Nordic skiing (and related non-winter trail activities) or are part of a larger resort. Examples of such centers include Royal Gorge (Soda Springs, California), Trapp Family Lodge (Stowe, Vermont), and Devil's Thumb Ranch (Tabernash, Colorado). These places typically offer lodging and dining accommodations, in addition to the other profit centers of an outdoor facility such as equipment rental, instruction, and gift shop or sporting good retail operations. The Mammoth Lakes area already has an example of this model – Tamarack Lodge Cross Country Ski Center.

Alpine ski resorts, such as Northstar-at-Tahoe (Truckee, California), Jay Peak (Jay, Vermont), Vail (Colorado) and many others often include a Nordic facility and operation as a largely secondary or ancillary operation to the primary operations of Alpine skiing and snowboarding.

There are also golf operations (many of which are private, membership based entities) that function as Nordic centers in winter. In addition, many smaller hospitality-based enterprises may offer Nordic facilities, either exclusively for guests or to the broader public on daily fee and/or season pass basis.

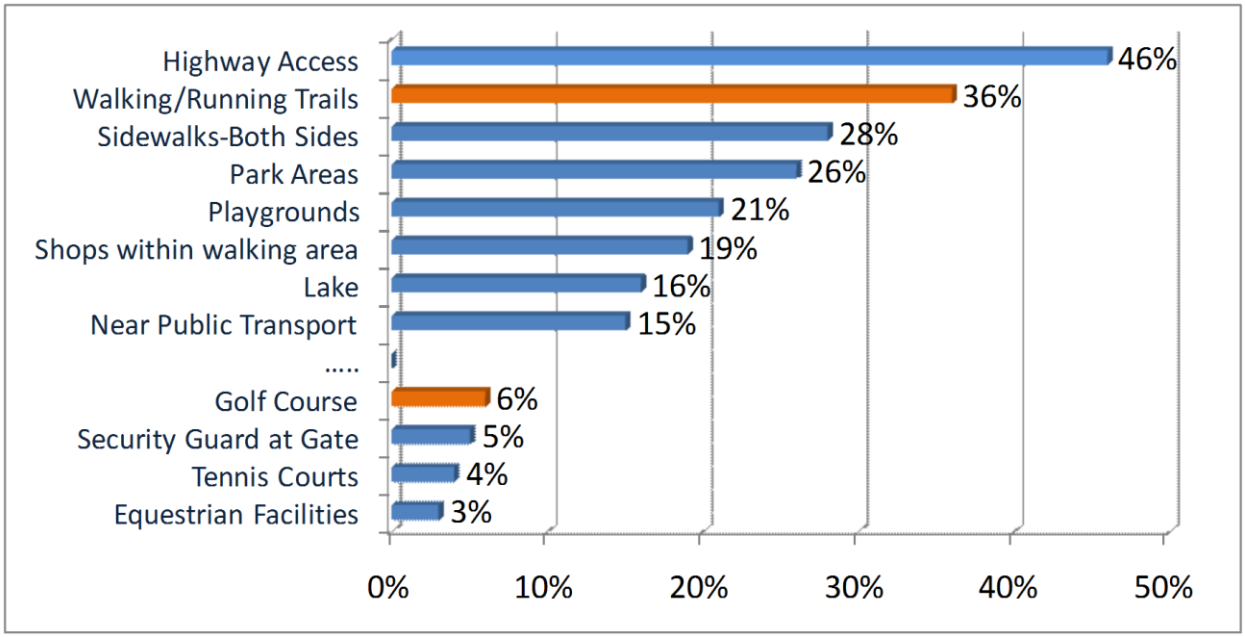
These entities comprise a variety of corporation structures, from public-shareholder corporations, S-Corporations, or limited liability corporations (LLCs), among others.

For many of these for-profit entities, there is often a real estate development component that has traditionally provided a significant source of cash flow. The highest revenue-generating Nordic operations can reach or sometimes exceed $1 million (with profit margins from 20% to 45%), but the sale of house lots, units, or rental accommodations frequently far surpass the cash flow of the trail-based operations alone. Similar to a golf-designated real estate community, the golf operations frequently pale in comparison to the

sale of houses, lots, and condominiums in the vicinity of the course; however, such sales would not be possible without the central amenity of the golf club and course itself.

Because the real estate development community has begun to recognize the monetary value of trails (as Figure 5.1 below demonstrates, trails have emerged as the, or one of, the top amenities for homebuyers, exceeding that of other more traditional amenities), a number of real estate projects (many in the planning phase) have incorporated trails as a central component (as opposed to an afterthought).

Figure 7.1- % of Homeowners Citing Various Amenities as Important or Very Important



Source: *National Association of Homebuilders*, 2002 and 2007

For the Mammoth Lakes community, a for-profit model is a possible option if it could be incorporated successfully into MMSA's Tamarack Lodge operations. More likely would be a hybrid approach where a non-profit entity (described below) enters into a licensing or other agreement with the for-profit entity, to run programs, events and other activities, similar to a ski academy or educational foundation at a major Alpine ski resort.

7.2 Public Agency or Entity

There are also other successful Nordic, and trail-based, organizations that are either entirely or partially operated and funded by a government entity. Such places include: Kincaid Park and other Nordic centers in Anchorage, Alaska; a diverse system of trails and parks in Minneapolis, Minnesota; and many systems of State and Federal "Sno-Parks," particularly across the western U.S. For county or municipal-based governments, a Parks and

Recreation Department (or related agency) fulfills all of the trail system functions, similar to operating a community pool or playing field facility.

For Mammoth Lakes, which is an incorporated municipality, the Town of Mammoth Lakes is the primary government entity that would typically take on such a role (Mono County could be an alternative, given that at least one of the locations is outside the boundaries of the Town of Mammoth and within unincorporated Mono County).

While the Town of Mammoth Lakes, particularly via the Measure R process, has been and will continue to be instrumental in assisting recreational investments and programs via grant support, funding, technical assistance, and other functions, it may be more appropriate to engage a separate entity for the day-to-day management, full and/or part-time staffing, equipment, facilities, and operations for the type of activities proposed for this project.

7.3 Non-Profit or Quasi-Public Entity

The final option, and the one we would recommend as the most viable, is the use of a current (or creation of a new) non-profit entity, likely a 501(c)3 or similar organizational structure. A variety of factors make this the most appealing alternative in the specific case of Mammoth Lakes and the Biathlon and Nordic Skiing Facility, as proposed:

- The multiple objectives of the project including economic development, education, competition, and promotion of tourism;
- Potentially widespread geographic scope, if a broader system is considered as discussed in Chapter 8.
- Ability to generate multiple forms of revenue including membership/user fees (if supportable), grants, and donations including major gifts; and
- Success of other organizations in model communities similar to Mammoth Lakes.

Table 7.1 identifies some of these other Nordic-based non-profit entities and key characteristics.

Table 7.1 - Examples of Prominent Nordic-Based Non-Profit Organizations

	Stated Mission	Staff	Annual Budget (Expense)
Methow Valley Sports Trails Association (MVSTA)	"Maintain a 200 kilometer trail system year round for cross country skiing, hiking and mountain biking in the Methow Valley. To promote outdoor recreation. To provide environmental education to the public. To stimulate the local economy."	24 incl. Exec. Director; 200 volunteers	$778,417
Jackson Ski Touring Foundation	"To provide for an maintain cross country ski trails in and about the village of Jackson, NH and to provide an educational and recreational experience of cross country skiing and snowshoeing."	36 incl. Exec. Director; 35 volunteers	$496,323
Nordic Heritage Center	"Provide facilities, coaching and support for the training and development of amateur athletes seeking to engage in, and for the general promotion of, winter sports with an emphasis on Nordic skiing and Biathlon."	NA – included in Maine Winter Sports Center	$182,067
Maine Winter Sports Center (MWSC)	"Train amateur athletes."	19 incl. Exec. Director; 3 volunteers. Supports other separate non-profit entities such as Nordic Heritage Center.	$1,937,209
Sun Valley Ski Education Foundation (SVSEF)	"...dedicated to providing winter sports programs for the youth of the Wood River Valley, regardless of each participant's economic level. The primary goal of the program is to assist each participant in reaching his/her desired athletic and academic potential, while developing the lifelong skills of goal-setting, self-discipline, sportsmanship, and time management."	99 incl. Exec. Director; 600 volunteers. Includes alpine skiing and snowboarding program.	$342,741 (XC Program Only)

Source: IRS Form 990 for 2009, from www.guidestar.org

As one can see from Table 7.1, there are a variety of activities a non-profit entity can undertake – from the fundamentals of developing and maintaining a trail system, to providing formal education and training programs (such as the Sun Valley Ski Education Foundation). In our experience, a non-profit umbrella organization can provide the flexibility to pursue all of the elements of a successful, Nordic-based community.

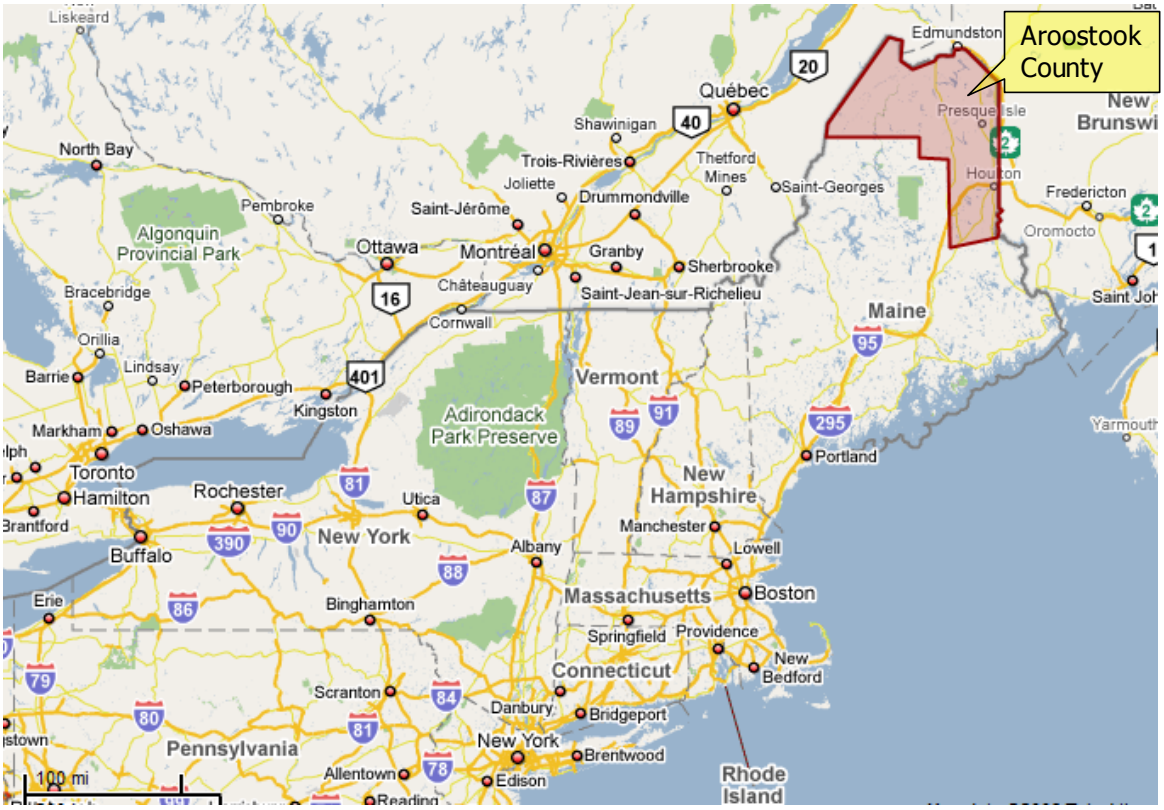
There are already a few such established organizations in Mammoth Lakes. These include Mammoth Nordic, Eastern Sierra Nordic Ski Association (ESNSA) and Mammoth Lakes Trails and Public Access (MLTPA). MLTPA is a 501(c)3 non-profit organization in California whose mission is consistent with the activities proposed here. That mission, as represented on their website (www.mltpa.org), is as follows:

"MLTPA advocates for, initiates, facilitates, and participates in the planning, implementation, management, and stewardship of a four-season trail system in Mammoth Lakes and the immediate Eastern Sierra."

MLTPA already functions as a primary entity for implementing the broad-scale programs and recommendations of the Town's recently adopted Trails System Master Plan and has been advancing the further development of the Mammoth Lakes Trail System (MLTS). Broadening its activities to include a public-oriented biathlon and Nordic skiing facility (and associated programs) could be a very logical step. Another option would be for MLTPA to create a related, subsidiary organization focused on the biathlon/Nordic skiing activities; however, the four-season nature of the proposed facility may make such a sub-organization duplicative. One model that may be instructive is described in further detail in the case example of Box 1, "Maine Winter Sports Center." Here, an umbrella organization (the Maine Winter Sports Center) provides funding and overall support for multiple facilities and programs across Maine. We should also note that Box 2 ("Methow Valley Sports Trails Association, MVSTA"), included in Chapter 8, provides another excellent example of a trail-based community with a non-profit entity managing many of the types of programs proposed in this report.

In summary, there are multiple options for funding and providing the longer term management of a biathlon and Nordic skiing facility (or expanded system and programs); however, our recommendation would be to establish a non-profit or quasi-public-non-profit entity within Mammoth Lakes, either independently or, preferably, in strong conjunction with MLTPA. Establishing such an entity would be a high priority for solicitation of funds, procurement of needed services, base establishment of programmatic activities, and effective integration of a biathlon and Nordic facility into the MLTS.

Box 1- Case Example – Maine Winter Sports Center



Just over a decade ago, three Nordic skiing enthusiasts formulated a plan to "reestablish Nordic skiing as a lifestyle in Aroostook County, ME." The project had multiple objectives. Among them:

- To inspire, motivate and lead the youth of northern Maine (where the incidence of childhood obesity was ranked second in the nation) to embrace a healthier, more active lifestyle and to open their imaginations to the possibility of national, even international travel through Nordic skiing competition.
- To develop a sustainable, positive impact on the northern Maine economy (which had been dealt a severe blow by the closing of Loring Air Force Base) by establishing the region as a widely recognized destination for Nordic skiing, including competitive cross country and Biathlon as well as recreational cross country touring.
- With its relatively long winters, cold winter temperatures and typically abundant snow cover, Aroostook County seemed like a promising location for a training center for some of America's Olympic Nordic skiing hopefuls. Proximity to these dedicated international caliber athletes would have the additional benefit of inspiring the local youth, some of whom could be reasonably expected to pursue the Olympic dream themselves.
- To create at least a couple of world class competition venues capable of hosting national, North American or World Cup level competitions with the dual purposes of bringing a geographically diverse assortment of elite athletes, coaches, competition

Box 1 (cont.)

officials and spectators to the relatively remote communities of Aroostook County, and in addition
providing the opportunity to rally hundreds of local volunteers to collaborate on exciting projects which promote, inspire and financially benefit their communities.

Early in the project, it was determined that six significant components were required for the vision to become reality:

Program Leadership: The success of the project required capable leadership, both in terms of organizational skills, community activism, event management, as well as sport specific coaching and program direction.

Community Support: The concept could not succeed without the enthusiastic support of the communities. Community leaders and groups, such as schools, Rotary Club, and other organizations would have to embrace the project and adopt it as their own.

Favorable Climate and Terrain: Although Nordic skiing can be enjoyed virtually anywhere there is snow, world class Nordic venues typically require gently rolling, hilly terrain. There is an obvious advantage to locations that might get natural snowfall early in the winter, experience temperatures that preserve that snow cover, and generally hold adequate snow cover for skiing into the spring.

Facilities: Although the differences may appear subtle, trails designed for Nordic skiing can be far more enjoyable than pre-existing routes (logging roads, power lines, etc.) which have been pressed into service for skiing. In general, there is a distinction between trails intended for competitive events and those intended for recreation. In a best case scenario an event venue should be proximate to the population, easily accessible for both athletes and spectators, and designed to maximize spectator interest. Ideally, the trail head or access point will have adequate parking, and a comfortable warming facility with rest rooms and perhaps a food concession. The event venue should also have facilities for timing, results production, media, officials, VIP's, ski waxing, and the many other ancillary pieces for holding a major competition.

Funding: One of the distinctions that was established early in the development of the Maine Winter Sports Center was that it was unrealistic to assume that the program would eventually be self-sustaining financially. Using the analogy of the baseball diamond in every schoolyard and community park in America, no one expects the local Little League team to pay for the creation, and ongoing maintenance of those ball fields. Instead, in most cases, the cost of building and maintaining those fields is typically absorbed by the school or the community as one of the benefits of living in a healthy, productive society.

Shared Olympic Vision: For several locations across the nation, an association with the Olympic Games has become a powerful, positive aspect of the community identity. For the past few decades, Colorado Springs, Colorado has been the home of the U.S. Olympic Committee, and as a result the culture of the Olympic movement has been adopted by the city.

Box 1 (cont.)

> Although primarily a mountain resort town 5 hours north of New York City, Lake Placid will always be recognized as the site of the '32 and '80 Winter Olympics and fondly remembered for the remarkable "Miracle on Ice."
>
> Eugene, Oregon is the home of the University of Oregon, but for decades it was the epicenter of Track and Field in America. If competitive cycling is your passion you would be surrounded by like-minded, cycling enthusiasts in Boulder, Colorado.
>
> For young athletes devoted to Nordic skiing, the Winter Olympic Games becomes a powerful motivation. Several communities in the northern U.S., such as Anchorage, Alaska, Minneapolis, Minnesota, Putney, Vermont and Rumford, Maine, take justifiable pride in developing young skiers who went on to represent their communities and the USA in the Olympic Games. In so doing they not only distinguish themselves, they inspire citizens across the nation to be the best we can be.

In eleven years, the Maine Winter Sports Center has established a remarkable list of achievements;

1. *The creation of more than a dozen, first rate, Nordic ski trail networks, many out the back door of local schools*, making skiing as convenient to children in the winter as baseball is to most children in the summer. Two of the skiing venues, The Tenth Mountain Division Center in Fort Kent and the Nordic Heritage Center in Presque Isle, were created to comply with international competition standards for Biathlon and cross country skiing. As a result, both facilities have successfully hosted multiple, national, NorAm and international championship events. Recent Biathlon World Cup events in Presque Isle and Fort Kent hosted athletes from more than twenty nations, infused several million dollars into local economies, and showcased northern Maine to more than 100 million television viewers in Europe (a TV audience comparable to that of the Super Bowl here in the United States).
2. *Several of America's top Nordic athletes have relocated to northern Maine to live and train under the guidance of the Maine Winter Sports Center coaches*. MWSC athletes have won dozens of national and NorAm championships in Biathlon and cross country. A recent example is Dartmouth College sophomore Sam Tarling (from coastal Maine) who won the 10 kilometer freestyle event at the 2011 NCAA Championship.

3. As predicted, *the presence of elite athletes who have relocated to northern Maine from other parts of the country has, over the past decade, inspired the local youth*. Several young athletes from Aroostook County have earned national recognition in Biathlon and cross country, have been recruited by prominent NCAA collegiate ski teams, and have advanced to representing the USA in world caliber competitions. Perhaps the best example is Russell Currier, a self-described "couch potato" as an eighth grader in the tiny village of Stockholm, ME. Over the past decade, Russell has emerged as one of the most promising young biathletes in America. His accomplishments to date include: five-time Maine State Cross Country Champion, member of three U.S. Biathlon Junior World Teams, 2006 U.S. Jr. National Cross Country Champion, 2010 U.S. Biathlon Senior National Champion, and member of the 2011 U.S. Biathlon World Cup Team.

Box 1 (cont.)

4. Over the past decade, *hundreds of residents of Fort Kent, Presque Isle and the surrounding communities have volunteered at events ranging from high school championships to Biathlon World Cups*. They have gained the experience and developed the skills necessary to bid for, plan, organize, solicit sponsorship funding, and conduct technically challenging competitive events, viewed via live television coverage by more than 100 million, discriminating, European sports fans. Achieving this level of international success has created a sense of community pride and accomplishment that was dormant before the creation of the Maine Winter Sports Center. Residents with relatively mundane assignments like coordinating remote parking lots for spectators or driving shuttle buses do so with professionalism, and proudly wear their volunteer's jacket throughout the year. The region's psyche has been transformed from a struggle to survive the closure of Loring Air Force Base (and the loss of 10,000 related jobs), to a sense of accomplishment related to successfully hosting world class sporting events.

8.0 DEVELOPING A BROADER NORDIC TRAIL NETWORK CONCEPT

Creating a world-class biathlon and Nordic skiing venue for competitions and events, as well as for enhanced recreational skiing and four-season use has, so far, been the focus of this report. Each of the three areas we have evaluated (and likely those that were considered by the MBAC but not addressed in this report) would provide the opportunity for a significant and quality expansion of the Mammoth area's existing Nordic skiing, and trail, offerings.

Our knowledge and assessment of the Mammoth area (both during our visits for this project and from a longer history in our own skiing careers), as well as experience with many other skiing and trail-based communities across the country, leads us to a conclusion that the region has many of the necessary components to become a leading Nordic skiing community in the nation. Such a position could have substantial benefits for the local and regional community, as well as its economy, similar to its current status as a destination for Alpine skiing, backcountry recreation, and other resort-oriented activities.

For this to develop, there are a number of key components necessary to both build upon (that already exist) and to develop. Among these are:

- A **"critical mass"** of groomed and ungroomed Nordic ski trails, at a particular threshold of quality (i.e., not including the short section of bike path that just happens to get groomed now and then between a few blocks in town);
- **Multiple nodes of high quality skiing**, meeting a diverse set of user needs and experiences which would attract destination-oriented visitors;
- **Connections between nodes and point-to-point trails**, which allow skiers (or four-season users of the trails) to experience more "expedition" oriented outings while also providing the opportunity for skiers to "ski home to the lodge", meet another group starting at another node, or simply enjoying the experience of a large, comprehensive network, similar to the experience that Alpine skiers enjoy at Mammoth Mountain Ski Area resort;
- **Nordic and Biathlon-based programs**, which enhance the current experience of Nordic and biathlon skiers of all ages while attracting new participants;
- **Enhanced school-based Nordic skiing activities**, which have been demonstrated to improve youth health, educational performance, and social interaction;
- **Development of a Nordic skiing, and trail-based, culture**, similar to the existing Alpine skiing and mountain biking communities that can be extended to Nordic (and biathlon) activities, be it on the trails or in numerous other venues.

In this section, we discuss some of these concepts in further detail, particularly as they apply to Mammoth Lakes and within the framework of the venues we have explored in previous chapters.

8.1 Concept for a Multi-Node Nordic Skiing Trail Network

There are a few Nordic skiing destination communities and/or resorts in the United States and Canada. These are places where there is a level of size, quality, diversity, programs, supporting amenities, reliable snow, and reputation which draw visitors from their respective regions, across the country, and even internationally. These highly regarded Nordic skiing destinations include the Methow Valley, Washington; Trapp Family Lodge in Stowe, Vermont; Royal Gorge and the broader Lake Tahoe, California/Nevada area; and Silver Star/Sovereign Lakes, British Columbia.

The Methow Valley, Washington has emerged as a leader in only the last two decades and now boasts over 200 kilometers of groomed cross country ski trails (which also serve as running, hiking, and mountain biking trails during summer). Box 2 provides a case summary of the Methow Valley (in the North Cascades of Washington State, about a 4-5 hour drive from Seattle).

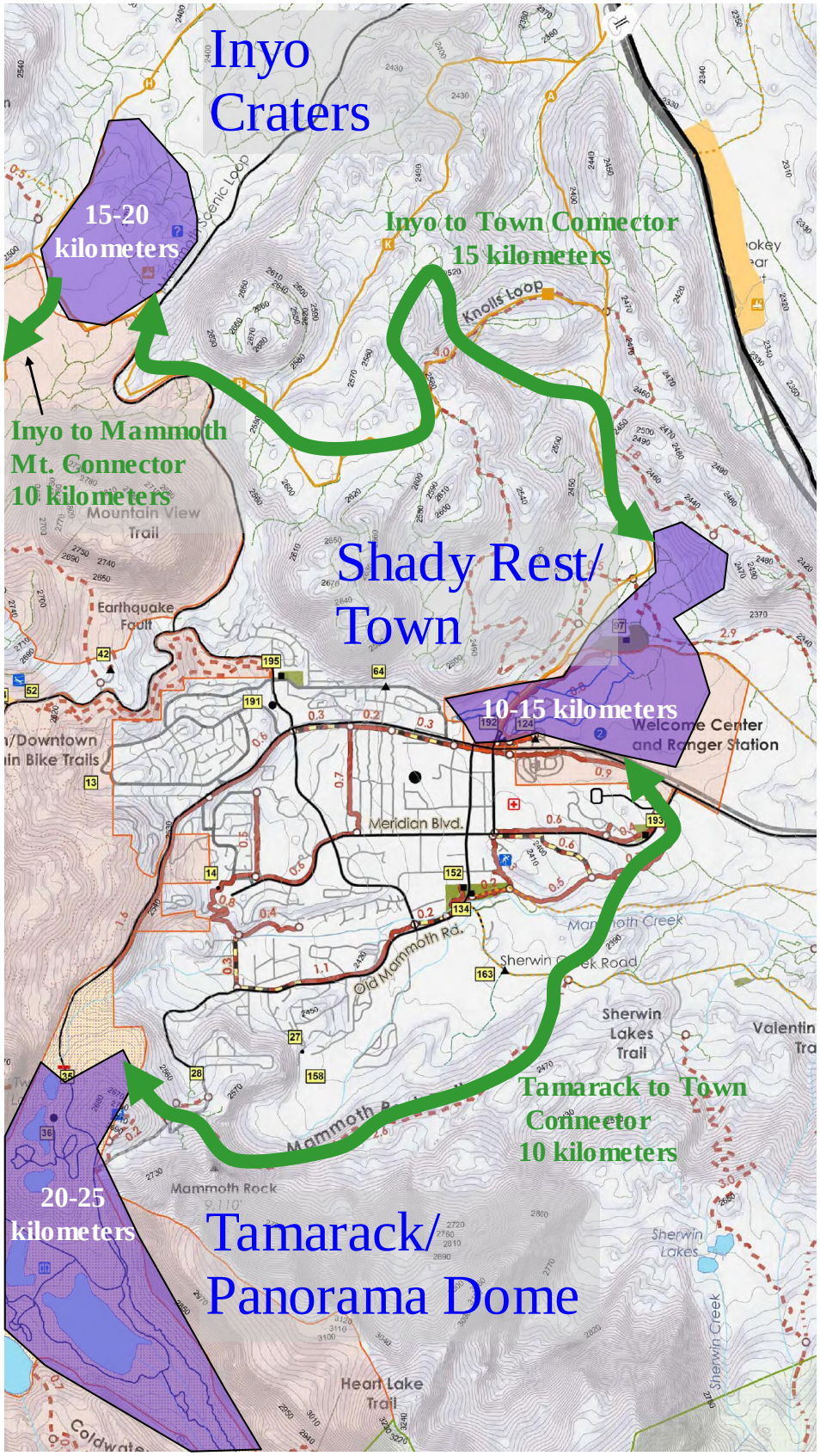
One of the distinguishing characteristics about the Methow Valley, and some of these other destination-Nordic communities, is not only a critical mass of groomed (and to a lesser extent, ungroomed) trails of +/- 100 kilometers, but a comprehensive network that provides distinct trail systems meeting varied experiences and skill levels connected by arterial trails between the systems.

But perhaps more significant than the total number of groomed trails, is the overall quality of the trails: whether they were well designed and thoughtfully planned for competition, training or recreation? Although competitors and recreational skiers alike appreciate variety, both groups can also be quite content with a well designed and skillfully built trail network of much less than 100 K's. For example, a member of the U.S. Biathlon Team who makes her home in Fort Kent, Maine might be perfectly content to train several times a week on the 5 kilometer competition loop at the local 10th Mountain Division Center, branching out occasionally for distance workouts on other trails (or nearby Nordic centers) a couple of times a week.

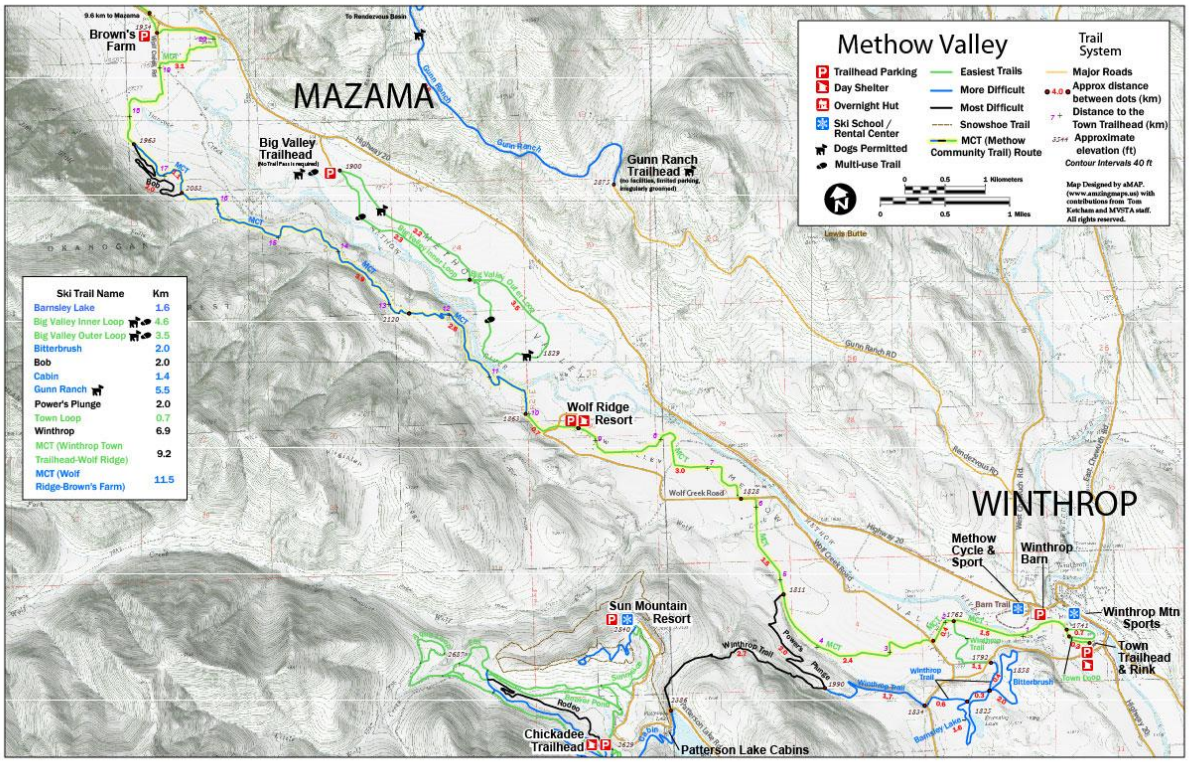
In our view -- to establish itself as a Nordic destination, for competition, training and recreation -- Mammoth would need to develop several trail networks, similar to the ones described here. How many is several? The answer is probably more than two, but fewer than five.

Map 5.1 provides a **highly conceptual** depiction of how this vision might look. With each trail system – Shady Rest, Tamarack/Panorama, and Inyo Craters – representing their own independent nodes, they would be connected by point-to-point trails, similar to the multi-use network being developed under the town's Trail Master Plan. This system would offer from 80 to 95 kilometers of trails, rivaling many of the leading Nordic ski destinations in North America.

Map 8.1 – Conceptual Multi-Nodal Network of Nordic Skiing in Mammoth Region



Box 2- Methow Valley Sports Trail Association (MVSTA), Washington State



The Methow Valley, located at the eastern edge of the North Cascades National Park in northwest Washington State, has emerged as a leading Nordic trail-based community and year-round destination for many visitors, largely due to the over 200 kilometers (120 miles) of dedicated and maintained non-motorized trails. The Methow (pronounced MET-how) physically extends from the Methow River's headwaters in the North Cascades to the town of Pateros, 80 miles southeast where the river enters into the Columbia River. The trail system for which it has become increasingly well-known, generally encompasses a 10-20 mile stretch of the Valley between the settlements of Mazama and Winthrop, though this system also includes downstream towns including Twisp and Carlton.

A Rural Community

The population of the Methow is modest – approximately 2,000 residents along the central 20 mile region. Its traditional economic base had been ranching, logging, mining, and, with the opening of the North Cascades Highway in 1972, summer tourism. A single public middle/high school serves the valley, with an enrollment of approximately 290 (grades 7-12). Aside from the central valley floor and other feeder watersheds, the majority (52%) of the land for the trail system is owned by the US Forest Service (Okanogan-Wenatchee National Forest) via a special use permit, another 5% on other public lands (Federal and State), and the remainder on lands of approximately 170 private landowners (most of whom provide trail access through permanent, legal agreements and easements).

Box 2 (cont.)

While the idea for a formal network of trails began with a small group formed in the late 1970s, the Methow Valley Ski Trail Association was formed in 1980 (it is now called the Methow Valley Sports Trail Association, or MVSTA). By the mid-1980s, there were already a few dedicated Nordic skiing trail systems – one at the Sun Mountain Lodge above the town of Winthrop and another 10 miles up the valley in Mazama. Although these systems did have some dedicated patrons during the early years, in large part the valley became quiet during the winter months since the North Cascades Highway (State Route 20) would close typically between mid-November and mid-April. Closing of the highway increases drive time between Seattle (the closest major population center) and the Methow from about 3 ½ hours in summer to 4 ½ hours (or longer, depending on weather) in the winter. Tourist and retail based businesses often closed their operations during the winter months, capitalized on a fairly reliable base of snow-machine visitors, or experienced very limited additional winter visitors to the valley for backcountry skiing and other activities.

Formation of a Nordic Skiing Trail Network

By the early 1990s, much of the existing trail network had been established and included a multi-faceted plan. First, the well-regarded trail networks of Sun Mountain Lodge and Mazama were connected via a 20-kilometer long Community Trail that ran the length of the valley (largely through formal and informal agreements with private landowners). Second, a more extensive system in an area called the Rendezvous, incorporated both existing USFS roads and some new trails along with a hut system, where visitors reserve, ski in, and stay overnight at one of five permanent structures. Most of the huts are accessed by groomed, cross country ski trails, and there are services that allow groups to ski in while having their gear brought in separately by snowmachine.

The network of 200 or so kilometers of trails quickly became popular during non-Winter months as well. While ski season continues well into April and even May at the high elevations, the Methow has become well-known for two other activities that use the wider XC ski trails after the snow is gone: trail running and mountain biking. A trail running race series begins May 7 with the Sunflower Relay and Marathon, ending with the signature “Cutthroat Classic,” that is primarily on traditional hiking trails. Single track mountain bike trails have been added to the diversity of the wider trail network, with a culminating Fall Bike Fest in late September.

The MVSTA

The organizational structure of the MVSTA is a traditional, 501(c)3 non-profit entity, that collects approximately $525,000 in program-related revenues (i.e., trail passes, event fees) and an additional $175,000 in funds from contributions and grants. Daily winter trail pass fees are $20, with various other fee structures for three-day, snowshoe, and afternoon passes. The organization also maintains a community ice-rink (with expenses and revenues generally equaling each other at $30,000 annually). Trail passes are sold at businesses and other venues throughout the valley.

While events have been an important component of the Methow’s recognition and success, they have waxed and waned in number as the geographic extent of some of these events can pose significant demands on a base of citizen volunteers. Resident season passholders receive reduced rates for volunteering at events – which include a popular two-day “Pursuit XC Ski Race” (a total of 50-75 kilometers of skiing over two days, with the first day using the classic style, and the second the skating technique, where the second day start order is based upon the

Box 2 (cont.)

previous day's finishing results). Recently, in part due to the challenge of holding large events combined with the increased

popularity of the trails among recreational users, there has been a move to de-emphasize the hosting of a large number of events. In fact, the increase in recreational usage has been in part due to the success and prominence of these very events.

Economic Payoff

The economic benefits of the trail system have been documented independently in a series of longitudinal studies, the most recent one completed in 2005 by Resource Dimensions.[11] Highlights of this comprehensive, survey-based economic impact report include some of the following:

- Trail users spent an average of $1,469 per trip (average trip visit of 4 days), or $361 per day in the local area.
- 42% (summer) and 44% (winter) of the area's business establishment revenues are generated by trail users.
- Nearly 1/3 (332 out of 1,050) of the region's jobs can be directly or indirectly attributed to the trails.
- 93% of surveyed homeowners and buyers indicated trails were "important" or "very important" to their real estate purchase, with up to a $20,000 premium for out-the-door access to the MVSTA trail system.

[11] Resource Dimensions (2005), *Economic Impacts of MVSTA Trails and Land Resources in the Methow Valley.*

8.2 Other Trail System Considerations

8.2.1 Mammoth Lakes Schools

The Mammoth area already has a well-established middle and high school Nordic ski racing program through the Eastern Sierra Nordic Ski Association. Developing a dedicated facility, such as proposed in Chapter 4, or a broader network where as proposed in the previous section could yield substantial educational, health, youth enrichment, and other benefits for Mammoth. Providing ski opportunities out-the-door is a hallmark of some of the most successful programs (see Box 1 regarding the Maine Winter Sports Center). In these communities, Nordic skiing is not simply another sport choice or extracurricular option, but it is integrated into physical education and the general curriculum. This is certainly possible for Mammoth Lakes.

8.3 Point-to-Point Trails and Events

Although it is possible, and in some ways, desirable to host a major distance event, such as a 50 kilometer cross country ski race, on a relatively short loop to maximize spectator interest, there seems to be a preference among citizen racers for extended loops, or even point-to-point courses. The American Birkebeiner -- America's largest, annual ski marathon -- typically hosts a field of at least 6,000 participants on a 55 kilometer trail which links the northern Wisconsin communities of Cable and Hayward. The organizers alternate the course direction every year.

Mammoth already has a history of hosting skiing marathons with its Mammoth Marathon event in early April at Tamarack Lodge and Lake Mary. With the colorful history of skiing in the Sierras, especially regarding Snowshoe Thompson carrying the mail, the possibility to a point to point marathon ski event seems very appealing. Although perhaps logistically challenging, the possibility of an event capitalizing on the unsurpassed scenery, and unspoiled beauty of the High Sierra would draw Nordic enthusiasts from across the nation.

8.3.1 Hut System

Hut to hut skiing has flourished in Europe for decades. It is possible to ski the length of Norway, more than 1,000 miles, staying in mountain huts and lodges along the way. One of the most famous, point-to-point excursions in Europe is the Haute Route, a trail through the Alps linking Chamonix, France and Zermatt, Switzerland. In our own country, Colorado's Tenth Mountain Division Trail linking Vail and Aspen, has become so popular that Nordic skiers have to make reservations in the cabins months in advance. Though still in its infancy, Maine's Huts and Trail system, when completed will stretch 180 miles through the mountains of western Maine from Newry to Greenville. The dozen huts, (more accurately, comfortable, rustic lodges) will provide 400 beds and excellent meals along the route. The first few huts and trail linkages have been enthusiastically embraced by Nordic skiers from throughout the region and beyond.

In the Methow Valley, Washington (see Box 2), a system of five huts are situated high above the valley floor and are available for overnight rental. A service is also available to bring gear into the hut by snowmachine, allowing users to ski primarily on groomed trails unimpeded by backpacks of pulk sleds.

9.0 SUMMARY AND MAJOR RECOMMENDATIONS

Mammoth Lakes has the opportunity to create an elite-level biathlon and Nordic skiing competition and training facility which would, after constructed, place it on the national and even international map for biathlon, cross country skiing, and possibly Nordic combined. Many of the key elements for creating such a facility are already in place, including reliable and ample snow, a resort-oriented community with supporting facilities and diversified amenities, available land, and a base of committed individuals and organizations to implement such a program.

Creating such a facility will require a continued investment of time and financial resources, but the potential rewards are multiple, and significant, including economic benefits (from 13 to 62 jobs and $0.6M to $3.3M of economic activity per year added to the region), community pride, and a continued attraction of additional visitors and residents with a focus on active, outdoor lifestyles. These benefits, in our assessment, provide a high return on investment and represent a financially feasible project.

Our recommendations to fulfill this vision are summarized as follows:

- **Choose one of two locations for a facility: Panorama Dome or Inyo Craters** – either of these two sites is, in our assessment, feasible for a facility meeting the needs of elite-level biathlon and Nordic skiing competitions and training programs, as well as providing four-season, trail-based recreation and events. Each has its merits, challenges, and levels of immediate and longer term investment. This study should provide the MBAC and other stakeholders with the fundamental information to help make such a decision.

- **Determine the level of investment for the chosen facility** – as we describe in Chapter 6, there is a range of possible trail and infrastructure investment depending on the type of events, athletes, and programs. The most important piece of the infrastructure are the trails, the range/stadium, and a basic level of supporting facilities. A program can be implemented in phases, beginning with the "Basic Level" and moving towards a "Premium Level" over time.

- **Establish, or expand upon, an appropriate entity to oversee and manage trail-related development and operations** – which we would recommend as an umbrella not-for-profit organization in a 501(c)3 or similar structure. The MLTPA may be the appropriate entity for such a structure.

- **Collaborate with other recreation and land management initiatives** – Mammoth has already made tremendous steps towards making it a nationally and even internationally known trail-based community. This effort should be integrated with all trail initiatives such that they are complementary in terms of use, funding, programs and other activities.

Similarly, the US Forest Service, which owns practically all of the land that has been proposed in this study for possible facility development, can take an active role in its cost and time-efficient implementation. For example, any planned timber sale should be closely coordinated with a possible trail venue such that the trail design can be incorporated into a timber operations' system of temporary logging and skid roads.

- **Engage the efforts of regional and national organizations for biathlon, Nordic skiing, and other related activities** - The Mammoth Biathlon event has already attracted the attention of the US Biathlon Association and the US Olympic Committee. Additionally, the USSA, the US Nordic Combined Team, and other related entities should be informed of Mammoth's plans, which could greatly facilitate attracting events, training camps, and a community similar to that which has emerged for long-distance running in the Mammoth area.

- **Generate widespread ownership of the project** – This project has had its genesis in a growing interest in the sport of biathlon and building upon a tradition and community of Nordic skiing. The benefits of the types of investment proposed, though, will be seen across many groups of trail users and outdoor enthusiasts, public and non-profit organizations, and local businesses.

- **Consider developing a region-wide Nordic skiing trails master plan** – which would build upon the overall Mammoth Lakes Trails Master Plan and the concepts presented in Chapter 8 of this report of a broader Nordic trails (and related) network.

APPENDIX A– CRITERIA MATRIX FOR INITIAL SITE SELECTION

Attribute	Measure	Comment
Altitude-Elevation	Feet/Meters of Site	Current elevation limits for major international competitions is 1,800 meters or above 5,900' (although in recent years there have been exceptions due to lack of snow). All factors being equal, a lower elevation at Mammoth would be preferable to higher elevation.
Topography	Sidehill, Rolling, "Bowl" like, Other descriptors; steepness of slopes; soil type – rock or soil?	A pure sidehill, while not being impossible, is less favorable than terrain that has variation (i.e., rolling). Also, a large, relatively flat area is necessary (see below re: stadium and parking/facilities) that, preferably, can have key terrain features (climbs and descents) within view of the stadium. Soil type is related to issues of construction and slope (i.e., ledge is much more difficult to move than glacial till).

Attribute	Measure	Comment
Elevation Difference on Site	Low Point and High Point; elevation of likely "stadium"	FIS requires at least two 30M climbs for a certified course, as well as places for climbs of at least 10M. Site needs enough terrain for the climbs, but not overwhelming (i.e. climbs of 50M or greater to get to certain terrain). Potential stadium (trailhead) is preferably neither at the low or high point of the location.
Snow Cover and Temperature	Avg. Date of Measureable Snow; Avg. snow depth by month. Average max., min. temperatures from November to early April.	Preferably, would want to have reliable snow for skiing by Thanksgiving and the ability to host a spring series in late March and early April. Temperature is a factor for hosting events (neither too warm generally or too cold) as well as the feasibility of snowmaking if a lower elevation area is identified.

Attribute	Measure	Comment
Proximity to Center of Population	Miles/Kilometers from Town; Quality of Access to Venue (Vehicular and possibly pedestrian); possible noise effects of a shooting range near settled areas.	Ideally, a venue should be easy for spectators and participants to reach the venue. The 1994 Olympics in Lillehammer Norway was a short walk from the town. Road access (width, plowability, steepness) is also a factor. Biathlon venues can be safely established in almost any location with proper berms surrounding the shooting range, though the sound of a .22 caliber rifle and its effects should also be considered.
Size of Area	Acres/Sq. Kilometers	Needs to be at least 1 Sq. KM or 250 acres. Thanks to increased attention in creating interest for site and TV spectators, competition venues can have a much smaller "footprint" than in previous generations. Greater acreage is certainly welcomed but not necessarily a requirement depending on the quality of the site's other characteristics. The Vancouver Olympics encompassed 15 kilometers of XC/Biathlon competition trails on a 1K by 1K footprint.

Attribute	Measure	Comment
Potential size of Stadium/Range Area	Meters X Meters	Need 60M X 150M + 60M X 50M for range; flat area for penalty loop.
Proximity of Potential Stadium/Range Area to Parking	Meters or Feet.	Topographical constraints for walking/skiing and vehicle access
Parking Areas and Other Flat Areas	Meters X Meters, Acres	Need sizeable area for parking and logistics for large events (tents, trailers). Parking should accommodate at least 100 cars, with opportunity for shuttles.
Aspect	North, South, East, West facing	Snow coverage (i.e., better facing north), but southeasterly will be more comfortable for spectators. Range needs to face generally north so as not to shoot into a lower mid-winter sun.
Wind Exposure	Prevailing wind direction; protected or unprotected, esp. in range/starting area	Prevailing strong cross winds near the range can make shooting extremely challenging; also consideration of comfort for spectators.
Vegetation/Cover	Type of predominant vegetation; open areas versus wooded	Seek a good mix of open and wooded. All open areas are generally a disadvantage because of wind/cold exposure.

Attribute	Measure	Comment
Proximity to Existing Structures/Potential Support Buildings	Lodging, warming huts, etc. that would not have to be constructed from scratch	
Ownership and Usership Constraints/Issues	Public, private.	Characterization of existing uses – potential acceptability of site by various stakeholders/users
Proximity of Trail System to Other XC Trails	Isolated venue or connected; opportunity to completely separate competition from recreation during events	
Major conservation or environmental constraints	Wetlands, sensitive habitat, volcanic-related activity	
Special amenities/attributes	Views, natural features, other features of interest to distinguish place	
Snowmaking features (if necessary)	Low altitude site – proximity to water sources.	

APPENDIX B– MAMMOTH BIATHLON ADVISORY COMMITEE MINUTES

Mammoth Biathlon Advisory Committee
Partner meeting: July 20, 2011; 12:00 p.m. to 5:30 p.m.; Mammoth Ranger Station Conference Room
Notes taken by Kim Stravers (MLTPA Foundation)

In attendance:

- Roy Moyer (Tamarack Cross-Country Ski Center/MMSA)
- Hank Garretson (Eastern Sierra Nordic Ski Association)
- Ron Cohen (MMSA)
- Jennifer Girard (specialist)
- Mike Schlafmann (INF)
- Danna Stroud (Mammoth Biathlon)
- Ray Jarvis (TOML)
- John Wentworth (MLTPA Foundation)
- Kim Stravers (MLTPA)
- Tony Colasardo (TOML Recreation Commission)

Deliverable: Identification of site options for biathlon facility; prep work for Morton Trails's visit in the last week of August (5 to 6 days in duration, likely starting Aug. 23).

I. **Siting Brainstorm**
   a. Proposed sites (not captured; for warm-up purposes only)
II. **Criteria Review**
   a. See revised criteria table for details.
III. **Validate Criteria/Field Visit**
   a. Informal
IV. **Siting Analysis/Sites & Criteria**
   a. See site-specific notes below.
V. **Preliminary Ranking:** *Phasing should be addressed by Morton with final site selection.*
   a. **Top 3 Selections and Issues for Further Exploration**
      i. **Panorama Dome:** Examine user conflict/multiple use & size/potential growth (priority 1)
      ii. **Shady Rest:** Examine user conflicts/multiple use/adaptability of existing infrastructure (priority 1)
      iii. **Inyo Craters:** Examine user conflict/multiple use/cost/specific siting (priority 2)
   b. **Other Sites Considered, Yet Eliminated** ("silver bullets" follow)
      i. Sherwin Creek Campground: Lacks proximity to town
      ii. Obsidian Dome: Lacks proximity to town
      iii. Sierra Star: Shooting restrictions in town pose a problem
      iv. Sledz: Unsuitable terrain
      v. Sierra Meadows: Exposure to wind, snow conditions undesirable

vi. June Mountain: Lacks proximity to town
vii. Reds Lake: Accessibility is problematic
viii. Twin Lakes: High levels of potential user conflict
ix. Football Field at Mammoth High School: Shooting restrictions in town pose a problem; would potentially have big impact on immediate neighbors

SITE-SPECIFIC NOTES for top 3 recommendations: Sites were analyzed by attributes from the table originally supplied by Morton (see revised document) that were sorted into five categories: Course, Range, Infrastructure, Economics, and Community. Discussion points supporting each selected site are organized by these categories in the notes that follow.

1. Panorama Dome

- **Course**
  - **Elevation:** Site is advantageous for high-altitude training, but less advantageous for homologation.
  - **Topography:** This location features a flat area and rolling terrain.
  - **Elevation Difference:** There is adequate elevation difference at this site (30 to 50 meters).
  - **Snow Cover and Temperature:** The site fits the criteria as described in the table.
  - **Vegetation:** This site is wooded and consistently so.
  - **Ownership/Usership:** Much existing recreation activity occurs in this area, both fee-based and free and in all seasons.
  - **Proximity to Existing XC Ski Trails:** This site is close to an existing system.
  - **Environmental/Cultural Constraints:** The current fuels-reduction project may impact this site. Flumes (cultural resources) exist in the area.
  - **Special Attributes:** This site provides a unique natural experience.
  - **Multi-Purpose Infrastructure and Facilities:** Biathlon activity may be coordinated with existing uses at this site.
- **Range**
  - **Potential Size of Stadium/Range Area:** This site may be less than advantageous in terms of increasing the footprint, but the stadium could be placed at the elevation midpoint.
  - **Aspect:** The aspect of this site is manageable, but not ideal.
  - **Wind Exposure:** This site is somewhat exposed, though protected on the east side.
- **Infrastructure**
  - **Proximity:** This site is slightly less advantageous in terms of transit to and from town.

    - **Size of Area:** This site provides good opportunity for public viewing of the events.
    - **Parking:** It would be challenging for this site to provide close parking.
    - **Snowmaking:** This would not be needed at this site.
- **Economics**
    - **Snow Cover and Temperature:** This site is advantageous for springtime camps.
    - **Size of Area:** The smaller footprint of this site may be advantageous in terms of snowmaking/grooming efficiency.
    - **Proximity to Existing Structures:** Developed infrastructure is near to this site (private concessions).
- **Community**
    - **Proximity:** This site is more advantageous in terms of impact on neighbors, which would be comparatively minimal.

2. Shady Rest

- **Course**
    - **Topography:** Terrain past the public park appears to be especially advantageous, but the area's terrain is generally of a rolling nature.
    - **Snow Cover and Temperature:** This site offers good snow, but not as good as other choices, or for as long a period of time; it has a comparatively shortened season.
    - **Vegetation:** This site is wooded.
    - **Ownership/Usership:** This site is advantageous in terms of users, but responsibility is currently divided between the Town of Mammoth Lakes and the Inyo National Forest. The impending Ormat geothermal project may have impacts in this area. Additionally, there are permitted uses in certain areas of the site that will need consideration, such as snow storage, helicopter landing, and sheep grazing.
    - **Proximity to Existing XC Ski Trails:** This site already hosts XC ski trails.
    - **Special Attributes:** This area provides beautiful natural scenery.
    - **Multi-Purpose Infrastructure and Facilities:** Existing structures or new facilities could accommodate a range of uses at this site, including summertime mountain biking. There is much community support for the existing facility, which lends also a wealth of local knowledge regarding how XC ski trails may be best groomed and sited in this location. The capacity for expansion and increased multiple-use integration at this site is substantial.
- **Range**
    - **Potential Size of Stadium/Range Area:** This site features a flat area for a stadium, which could be placed at the elevation midpoint.
    - **Aspect:** This site may offer north-facing placement.
    - **Wind Exposure:** This site is wind and sun sheltered in some places and moderately protected in others.

- **Infrastructure**
  - **Proximity:** This site has good accessibility to town, including for public transit and pedestrian access, and offers good opportunity for the public to view events. This also makes the area accessible to teams.
  - **Size of Area:** This site is very scalable.
  - **Parking:** This site features existing parking facilities and event staging areas. Winter-specific facilities, however, are not currently in place for parking.
- **Economics**
  - **Size of Area:** This area, being scalable, offers the opportunity to start by designing a compact course and then later expanding it as needed. This offers efficiencies with grooming.
  - **Proximity to Existing Structures:** This site is close to existing utilities, though not as close to other support facilities as other sites may be.

3. Inyo Craters

- **Course**
  - **Elevation:** The elevation at this site is approximately the same as in town and at Shady Rest.
  - **Topography:** This site offers rolling topography.
  - **Elevation Difference:** There is 30 to 50 meters of elevation change during climbs on site.
  - **Snow Cover and Temperature:** The northern exposure at this site can keep the snow of good quality in this location.
- **Range**
  - **Potential Size of Stadium/Range Area:** The area features a flat area for a penalty loop. It is also scalable in terms of size.
  - **Aspect:** The site features a northern aspect.
  - **Wind Exposure:** Some parts of this location are sheltered from the wind.
- **Infrastructure**
  - **Proximity:** Transit access is yet to be developed, but is not impossible.
  - **Size of Area:** There is a large, flat area available for placement of a stadium, which can be designed at the course midpoint.
  - **Parking:** Limited parking exists currently, but there is room for expansion. There is also opportunity to implement a shuttle program. Event staging also could be developed here; this site has infinite potential.
- **Economics**
  - **Size of Area:** This area is not readily visible to passers-by, which makes it less advantageous in this regard.

- **Proximity to Existing Structures:** Mammoth Mountain Ski Area currently grooms this area, which could lend efficiencies.

- **Community**
  - **Proximity:** Due to its relatively remote location, there would be no impact to immediate neighbors. The site is essentially a blank slate, and expansion and integration of uses is definitely possible.