MISSOULA CONSERVATION LANDS MANAGEMENT PLAN

MISSOULA PARKS AND RECREATION

June 1st , 2010

Missoula Parks and Recreation Department
Operations Division
100 Hickory Street
Missoula, MT 59801
(406) 552-6277
www.missoulaparks.org

TABLE OF CONTENTS

APPENDICES

Appendix A: Soil Map Unit Legend and Brief Descriptions
Appendix B: Maps

1. Properties Managed by the Conservation Lands Program
2. Soil Absorbed Runoff Potential (available upon request)
3. Soil Leaching Potential (available upon request)
4. Soil Map Units (available upon request)
5. Soil Solution Runoff Potential (available upon request)
6. K Factor Whole Soil Erodibility (available upon request)
7. Percent Slope (available upon request)
8. MFWP Designated Elk Winter Range
9. MFWP Designated Mule Deer Winter Range
10. MFWP Designated White-tailed Deer Winter Range
11. Bird and Fish Species of Concern
12. Plant Species of Concern
13. Spotted Knapweed Infestations (available upon request)
14. Leafy Spurge Infestations (available upon request)
15. Dalmatian Toadflax Infestations (available upon request)
16. Sulfur Cinquefoil Infestations (available upon request)
17. Cheatgrass Infestations (available upon request)
18. Mueggler and Stewart Grassland Habitat Types
19. Current Forest and Riparian Habitat Types
20. Native Grassland Health Indicators
21. Recreational Trail Use
22. Ownership

Appendix C: Bighorn Sheep and Domestic Sheep Interaction Protocol
Appendix D: Rangeland Species List
Appendix E: Economic Benefit of Conservation Lands
Appendix F: Conservation Lands Permit Application
Appendix G: Recreational Inventory
Appendix H: Chapter Six from the Mount Jumbo Management Plan

TABLE OF FIGURES

TABLE OF TABLES

LIST OF ACRONYMS

Abbreviation	Title
CLMP	Conservation Lands Management Plan
CLP	Conservation Lands Program
CWG	Conservation Lands Management Plan Citizens Working Group
CLTAC	Conservation Lands Management Plan Techincal Advisory Committee
CLTWG	Conservation Lands Technical Working Group
ERG	Ecosystem Research Group
FRCC	Fire Regime Condition Class
FVLT	Five Valleys Land Trust
GIS	Geographic Information System
GPAC	Greenough Park Advisory Committee
MCL	Missoula's Conservation Lands
MCWD	Missoula County Weed District
MJAC	Mount Jumbo Advisory Committee
MP&R	Missoula Parks and Recreation Department
MFWP	Montana Fish, Wildlife and Parks
MNHP	Montana Natural Heritage Program
OSAC	Open Space Advisory Committee
SOS/RLT	Save Open Space/Rattlesnake Land Trust
UM	University of Montana
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service

GLOSSARY OF TERMS

Conservation — Official supervision of rivers, forests, and other natural resources in order to preserve and protect them through prudent management, or the careful utilization of a natural resource in order to prevent depletion.

Conservation Lands — Lands that are managed as natural areas, such as riparian corridors along creeks and rivers, wetlands, grasslands, open or wooded hillsides.

Criteria — Standards of judgment or criticism; rules or principles for evaluating or testing.

Ecology — The study of the interactions of living organisms with their environment. The environment as it relates to living organisms.

Open Space	These lands include Conservation Lands, Agriculture Lands, Scenic Viewsheds, Urban Parklands and Trails. Characteristics of these types of open space may include: Lands that are in primarily a natural state and contain few or no structures; and/or they contain significant natural, aesthetic, and recreational features that warrant protection.
Preservation	The act of preserving, to keep from harm or injury, and make lasting. To protect and maintain and reserve a resource for its continued survival.
Rangeland	Vast natural landscapes in the form of grasslands, shrublands, woodlands, most deserts, marshes, and wet meadows.
Recreation	An activity that refreshes, recreates and renews your health and spirits by enjoyment and relaxation. A pastime, diversion, exercise, or other resource affording relaxation and enjoyment.
Restoration	The act of restoring; renewal, revival, or reestablishment. A return of something to a former, original, normal, or unimpaired condition.

ACKNOWLEDGEMENTS

Missoula City Parks and Recreation Board and Staff wish to thank the following citizens, elected and appointed officials and consultants for the numerous hours devoted in the development of this plan. It is through citizen efforts that Missoula remains a desirable place for all to live, work and play. Missoula's Open Space System is one of the many defining characteristics of the Missoula valley. Missoula has a legacy of excellence in developing and providing access to quality parks, recreation, trails and Conservation Lands. Responsible stewardship of our Conservation Lands is an essential component for maintaining harmony between human use and preservation of our local natural environments. We recognize and acknowledge the following citizens for their roles in developing the framework by which these valuable public assets will be managed.

Conservation Lands Citizen Working Group (CWG)

The Conservation Lands Citizen Working Group studied factors and made recommendations to the city and its consultant on various aspects of Conservation Lands management planning. This group, with significant input from the public, was responsible for developing the guiding principles and goals by which the Conservation Lands System will be managed. These citizens remained dedicated to the process through countless hours of night meetings, public open houses and editing.

Spencer Bradford	Allen Byrd	Beverly Dupree	Loren Flynn
Scott Hauser	Aaron Kindle	Jake Kreilick	Stephanie Lauer
Peter Lesica	Bert Lindler	Kathleen Kennedy	Colleen Matt
Wendy Ninteman	Alina Niklison	Kylie Paul	Michael Pecora
Graham Roy	Steve Shelly	Dave Spildie	John Weyhrich
Virginia Tribe (Facilitator)			

Conservation Lands Management Plan Technical Advisory Committee (CLTAC)

The Conservation Lands Technical Advisory Committee provided a technical sounding board for Park's staff and their consultants during plan development. This group was composed of local experts in natural and recreational resource management. Many of these members have been actively involved with the management of Missoula's Conservation Lands for years. These individuals provided sound technical and scientific input from a local perspective. This input was critical for developing a Conservation Lands Management Plan unique to Missoula.

Vickie Edwards	Amy Gannon	Jed Little	Jerry Marks
Mary Manning	Marilyn Marler	Giles Thelen	Kevin Verlanic
Ronald Wakimoto	Janet Sproull – proofing		

City Parks and Recreation Board

Dale Harris	Patrick King	Heidi MacDonald	John O'Connor
Norma Nickerson	Susan Ridgeway	Janet Sproull	
Tim Bechtold*	Charlie Vandam*	Kevin Verlanic*	

*Past members.

Missoula City Council

Ed Childers	Dick Haines	Lyn Hellegaard	Roy Houseman
Bob Jaffe	Renee Mitchell	Marilyn Marler	Stacy Rye
Dave Strohmaier	Pam Walzer	Jason Weiner	Jon Wilkins

Missoula Mayor

John Engen

Missoula Parks Department Staff (involved in CLM process)

Donna Gaukler, Director Missoula Parks and Recreation
Morgan Valliant, Conservation Lands Manager
Jacquelyn Corday, Open Space Program Manager,
Becky Goodrich, Communication Specialist
Betsy Willett, Administrative Secretary
Amy Gould, Administrative Assistant
Diane Levine, Administrative Assistant

Consultant Team

Ecosystem Research Group
www.ecosystemrg.com

The following were unanimously approved during the creation of this plan:

Approval of Budget for Plan – City Council, August 2008
Approval of Conservation Lands Citizen Working Group –Missoula Parks Board, February 19, 2009
Approval of Conservation Lands Technical Advisory Committee –Missoula Parks Board, March2009
Approval of Final Plan – Missoula Parks Board
Adoption of Final Plan – Missoula City Council and Mayor

SYNOPSIS OF MISSOULA'S CONSERVATION LANDS MANAGEMENT PLAN

Missoula's Conservation Lands system (also referred to as Missoula's Open Space System) has grown to include 100's of acres of open grasslands on gentle to steep hillsides, mixed coniferous forests, riparian areas ranging from half mile wide floodplains, to cattail wetlands, to narrow woody draws, and unique cushion plant communities. The great diversity of land types on the City's 3,600+ acres of Conservation Lands provides important wildlife, fish, and bird habitat and numerous recreational opportunities for citizens and visitors. These lands are the beautiful background to our downtown, the University, and many of our neighborhoods and thus provide tremendous economic benefits. Additionally, conservation lands provide important ecosystem services such as improving water quality and quantity, enhancing air quality, and serving as flood control.

Along with the growth in number of acres acquired over the past 20 years, has come substantial population growth and increased recreational use of these lands. The need to comprehensively address management of all Conservation Lands together as a system was recognized as crucial for maintaining their environmental viability. This plan has been created in order to help balance the needs of citizens who love to utilize these lands for recreation, environmental education, and rejuvenation with protecting the natural resources. Management of the habitat types to promote healthy native plants and wildlife is a critical component of this plan. By far the largest threats to native habitats on Conservation Lands are non-native invasive species (weeds!) and human-caused impacts. Throughout chapter four are recommendations to mitigate impacts and priorities for non-native plant management.

Given the close proximity of our Conservation Lands to the City, they offer quick and easy access for all types of recreation. A well designed system of trails, trailheads and recreational programs helps minimize negative impacts intensive recreational use can cause. Guidelines for trail and trailhead development (section 5.2.1) were created. Additional recommendations for drafting a policy for special use permits, enforcing rules and mitigating damage were also developed. The importance of using Conservation Lands for educational activities and to promote volunteerism is addressed. Through classes, field trips and research, stewardship grows within our community. Volunteerism has been and will continue to be a major component of this plan.

Development of Management Goals

The framework for much of this plan was developed by a Citizens Working Group with input from two public open houses and a public opinion survey. The following goals, and their related policies (see Chapter 3), provide recommendations on how Conservation Lands should be managed.

- Complete and maintain an up to date inventory of each land parcel prioritizing its conservation values.

- Establish, implement and publicize general rules and management policies that apply to Conservation Lands.
- Maintain habitat types and vegetation types on Conservation Lands including special plants and habitat types.
- Restore native and disturbed habitat on Conservation Lands.
- Provide a diverse and appropriate range of recreational and educational activities on Conservation Lands while limiting impacts by users to the ecological and cultural resource.
- Evaluate the results of management strategies on Conservation lands and adjust management for desired results accordingly
- Develop adequate funding sources, partnerships and program to realize Management Plan goals.

These goals provide the framework for managing and preserving this incredible natural resource for present and future generations. Chapter six includes specific strategies to implement these goals.

To sit in the shade on a fine day and look upon the verdant green hills is the most perfect refreshment. - Jane Austin

1. INTRODUCTION

1.1 PURPOSE AND NEED

The City of Missoula's Conservation Lands (MCL) system has grown significantly in the last 20 years. Acquisitions, donations, and access easements have all contributed to the expansion of these valuable public assets. Most of this growth occurred following the passage of an Open Space Bond in 1995. This five million dollar bond allowed the city to purchase many important open space cornerstone properties and save them from development. However, while funds were available for land acquisition, little was allocated for land management. Consequently, management of these lands has not kept pace with their purchase.

In 2005, great strides were made towards responsible management of these lands when the Conservation Lands Program (CLP) within the Missoula Parks and Recreations Department (Parks Department, MP&R) was created and year-round funding of the CLP properties began.

In 2008, the Missoula City Council voted to fund the development of a comprehensive management plan for the Conservation Lands system. This *Conservation Lands Management Plan* (CLMP) will set a vision with principles, goals, and priorities to guide and ensure continuity in the future management of MCL.

1.2 PLAN DURATION, AMENDMENTS & USING THE PLAN

This Plan should be thoroughly reviewed on an approximately l0-year cycle to determine if a substantial update is needed. An annual update regarding implementation of the Plan to the Missoula Parks and Recreation Board (Park Board) is recommended. The Plan may be amended whenever the MP&R determines that conditions or demands in the areas covered by the Plan have changed significantly or when new information/research provides new management tools or guidelines.

The type or degree of public involvement necessary for a Plan amendment depends on the extent and scale of the amendment. The more expansive the scope of an amendment is, the more public involvement opportunities should be available. A minor amendment, such as for a small land area, minor text changes, procedural implementation of the Plan, map updates, or minor map amendments may require meetings with affected adjacent public or private landowners or land trusts. Such changes may be approved as an action item by the Park Board.

A Plan amendment process for a large area, for major policy changes, or for major changes to approaches to land management should include

collecting opinions, taking an inventory of resources, and engaging citizens in an appropriate process, which may include public meetings, open houses, written comment periods, or similar. Approval of changes which substantially affect the current plan goals should be approved by the Park Board and the Missoula City Council.

When making decisions based on this Plan, not all of the goals, policies, and recommended actions can be met to the same degree in every instance. Using the Plan requires balancing its various components on a case-by-case basis and selecting the goals, policies and recommended actions most pertinent to the issue at hand. The cumulative effect of using the Plan, however, should be to address its goals and policies in a comprehensive manner.

1.3 CURRENT MANAGEMENT STRUCTURE

Missoula's Conservation Lands management is directed by a variety of public entities including

Figure 1-1 View of Mount Jumbo looking East

the City Council, Mayor, Open Space Advisory Committee (OSAC), neighborhood councils, Park Board, Greenough Park Advisory Committee (GPAC), Mount Jumbo Advisory Committee (MJAC), Conservation Lands Technical Working Group (CLTWG), and other special resources shown in a management structure organizational chart (Figure 1-2). The public entities shown have differing roles and structures as described in the following paragraphs.

Open Space Advisory Committee

OSAC implements the Missoula Urban Area Open Space Plan and provides the City Council with recommendations concerning open space conservation proposals. It consists of 12 members serving three-year terms including six city residents, five members who reside within 4.5 miles of the city, and one member appointed by the Park Board. They work with the City Council's Conservation Committee.

Neighborhood Councils

Neighborhood councils do not have a formal role in advising Conservation Lands management policy or action. The Neighborhood Council Liaison in the City Clerk's office supports the neighborhood councils. However, some neighborhood council leadership has been involved in advising and requesting management actions on Conservation Lands, organizing volunteer events, and fundraising for management activities or park improvements.

Missoula Parks and Recreation Board

The Park Board consists of seven members, each serving three-year terms. They oversee the public use of parks, open space, greenways, and trails; make necessary rules to protect and

promote the growth of trees and plants in these areas; provide penalties for the violation of these rules; and serve as an appellate body for any appeals made by property owners regarding city tree maintenance. This board provides primary guidance for management and maintenance of City Parks and Open Space.

Greenough Park Advisory Committee

GPAC assists the Parks Department, Park Board, and elected officials with planning for Greenough Park. It consists of seven members appointed by the Mayor, each serving four-year terms. A majority of the members reside in the Rattlesnake valley, and at least one member is a resident of the city from outside the Rattlesnake valley. Qualifications include a technical knowledge of trees, shrubs, and natural park areas and experience in long-range planning of natural areas.

Mount Jumbo Advisory Committee

MJAC makes recommendations on and oversees implementation of the Mount Jumbo Management Plan. It consists of 13 members appointed by the Park Board. Each member serves three-year terms; Park Board members and agency representatives are excluded from term limits. Membership includes at least one member of the Park Board, one representative each from Montana Fish, Wildlife and Parks, and the Lolo National Forest (both agencies own parcels of land adjacent to City-owned land on Mount Jumbo), one member owning property adjacent to Mount Jumbo, and up to eight members from the community, with up to two residing in Missoula County. Qualifications for members include knowledge of vegetation, wildlife, recreation, geology, culture/history, and education as they relate to Mount Jumbo.

Conservation Lands Technical Working Group

The CLTWG consists of eight members assigned by the Park Board. They provide interim technical expertise to advise the decisions of MP&R staff to comprehensively manage Conservation Lands in lieu of a management plan. The group is made up of a variety of technical experts in the Missoula area.

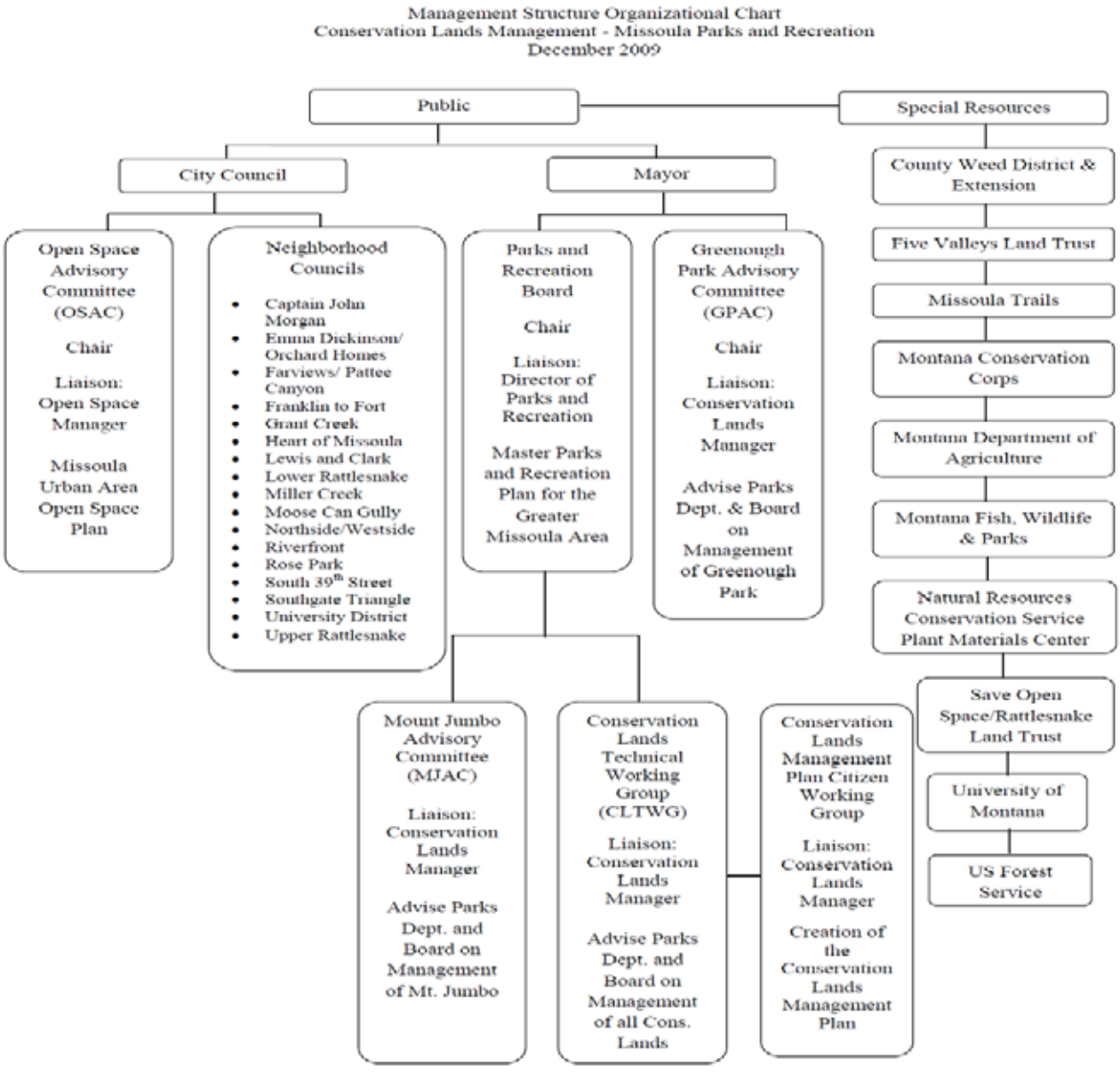
Conservation Lands Management Plan Citizen Working Group

The Conservation Lands Management Plan Citizens Working Group (CWG) was formed to make recommendations to the City and its consultant on drafting the CLMP. It is a temporary working group composed of 20 members.

Conservation Lands Management Plan Technical Advisory Committee

The Conservation Lands Management Plan Technical Advisory Committee (CLTAC) includes CLTWG members as well as other local experts in natural and recreational resource management. This temporary committee is composed of 11 members and was formed to help review the CLMP.

Figure 1-2 Management structure organizational chart



1.4 MISSOULA CONSERVATION LANDS INVENTORY AND ACQUISITIONS

MCL comprise the largest type of parkland in the Missoula area with over 3,600 acres. Conservation Lands are intended to preserve or enhance the natural environment rather than provide lands for intensive human use. The 2006 Open Space Plan defines Conservation Lands as follows:

> Conservation Lands exist in a natural state or have been reclaimed to approximate the natural state. They support flora and fauna and their habitat and may also serve as significant areas of floodwater storage and aquifer recharge. Conservation Lands are either publicly owned and dedicated to such use, or privately owned with a legally binding limitation on use, such that the maintenance of the natural condition is emphasized (e.g., through conservation easement, deed restriction, or common area management plan). Conservation Lands often support secondary uses such as recreation and education, where such activities are compatible.

Conservation Lands have both natural and human-use values. An inventory of lands managed by the Conservation Lands Division is provided in Table 1-1. The Clark Fork Natural Area, Jacob's Island and Greenough Park are managed cooperatively with Missoula's Park Maintenance Program.

Table 1-1 Conservation Land Parcels, Acreage, and Dates of Acquisition

Parcel Name	Acres	Date Acquired
Alvina	0.5	1974
Bancroft Ponds	8.6	1967
Ben Hughes	11.8	1980, 2003
Blackthorn Addition	0.1	1994
Cattail Corner	3.0	1998
Clark Fork Natural Area	11.0	Approximately 1997
Cohosset	2.4	N/A
Creekside Trail	1.7	N/A
Dinsmore-Orchard Homes	5.9	2003
Floral Park	2.5	1957
Fort Missoula Triangle	16.5	1998
Greenough	43.0	1902
Hamilton	2.4	1958
Hellgate Park	3.9	1973
Hemayagan	13.5	1945, 1957
High	10.8	1964
Highland	19.3	1964, 1976
Hill View Heights	1.4	1971
Homestead	3.2	1995
Jacobs Island	10.0	1976
Khanabad	0.2	1971
Kim Williams	126.8	1987
Meadowlark Acres	7.7	N/A
Moose Can Gully	20.8	1971
Mount Jumbo	1,608.1	1996, 2009

Parcel Name	Acres	Date Acquired
Mount Sentinel	506.8	1999, 2003
Ninkpata	2.0	1945, 1988, 1993, 1996
North Hills-Randolph Homestead	470	1996
North Hills-Schilling Kreitzberg	120	1997
Northview	8.8	1958, 1959, 1961, 1965
Oziya	1.1	1946
Papoose	0.9	1994
Peery	3.0	1971
Powerline Easement	52.9	1991, 1996
Rattlesnake Trail	35.8	1987
Riverside Natural Area	1.2	1987
Stanley	0.4	N/A
Takima-Kokaski	4.4	1945
Tiortis	0.8	1945
Clark Fork Native Prairie (in Toole Park)	2.4	N/A
Tower Street Conservation Area	119.4	2001, 2004
Willow Wood	1.3	N/A
Woodbine	2.2	1998, 2000

1.5 PUBLIC PROCESS

Missoula citizens were very involved in the development of the CLMP; two public open houses were held, plus a Citizen Working Group (CWG) and Technical Advisory Committee (CLTAC) were formed.

CWG was composed of 20 members. They studied various aspects of conservation land management planning and subsequently composed the desired results, guiding principles, and recommended goals and policies that formed the CLMP. Their specific tasks were:

- To review and synthesize information from the Parks staff, technical advisors, and the consultant, pertaining to the conservation lands and their surroundings, as well as existing and future natural, cultural and recreational resources and associated management needs;
- To make recommendations on existing plans, policies, procedures, rules and adequacy of existing facilities or improvements as it relates to demand;
- To make recommendations on guiding principles and criteria for development of management practices and lands uses;
- To explore useful and realistic funding mechanisms and recommended strategies for obtaining these funds;
- To make recommendations on methods and options for engaging the public after plan adoption;
- Community outreach including but not limited to involvement and synthesis of public comments as well as presentations to Park Board and City Council.

CLTAC included resource experts who provided valuable technical and scientific support throughout the project. Their scope of work was:

- To brief and provide the CWG, Parks staff, and the Park Board with technical and scientific information throughout the process;
- To provide background information on such matters as historic and existing conditions of the conservation lands; current and projected uses and management regimes; infrastructure costs; risk assessments of management priorities and other information as needed;
- To provide input on management recommendations from consultants and the CWG;
- To provide support for public meetings held by consultants.

On March 19, 2009, a public open house was held to provide the Parks Department with citizen input on important factors for managing the City's Open Space/Conservation Lands system. To gain additional public input, a public opinion survey was distributed at this meeting and online until April 6, 2009. Forty-six individuals were at the open house. Eighty-three surveys were completed throughout the comment period. The results of the public comments can be summarized into four categories; recreation, park specific locations, trails and trailheads, and vegetation management. The following are the details for each of those categories.

During the open house, public comments relating to recreation included:

- Hang-gliding access on Mount Sentinel
- Paragliding access on Mount Jumbo
- Special events including footraces in the North Hills and Mount Jumbo
- "Unnecessary" elk closure on Mount Jumbo
- Bike etiquette and education
- Connectivity/bike access through the North Hills from Orange Street to Duncan Drive
- Too much regulation of use conflicts (horses and people)
- Better access to conservation land maps
- Bicycle-free trails
- Additional trailheads on the east side of Mount Jumbo.

The public comment related to park locations was: "Multiple jurisdictions are confusing. Simplify this by, for example, transferring the county lands adjacent to Tower Street Complex to the city."

Public comments related to trails and trailheads included:

- Trail connectivity
- The conservation lands have too many trails. Many should be closed to protect resource values. No more should be developed until some are closed.
- Trails in and around the South Hills
- Maintenance
- Trails for fire protection and anchor points.

Public vegetation management concerns were:

- Effectiveness of sheep for weed management
- Active vegetation management needed to restore the ecological health of the conservation lands

- Dog walking as job not appropriate use of open space
- Better weed management plan for the North Hills: spraying appears to be killing both lupine and arrowhead balsam (arrowleaf balsamroot). Cheatgrass is taking over.

Table 1-2 shows the results of public comment from the Parks Department public opinion survey.

Table 1-2 Results of the Public Opinion Survey (Missoula Parks and Recreation 2009b)

Statement	Percent of People that Agreed or Disagreed with the Following Statements				
	Strongly Disagree 1	**2**	**Neutral 3**	**4**	**Strongly Agree 5**
I find it easy to find my way on conservation lands because they are well signed.	2.4%	18.1%	34.9%	28.9%	15.7%
Conservation lands should be managed for habitat first and recreation second.	6.1%	20.7%	23.2%	35.4%	14.6%
Dog regulations should be more strictly enforced.	19.3%	20.5%	24.1%	13.3%	22.9%
There are not enough trails.	25.3%	25.3%	27.7%	16.9%	4.8%
I am concerned about the impact users are having on native flora & fauna on conservation lands.	7.3%	8.5%	24.4%	28.0%	31.7%
Dogs should be allowed under voice control on some properties.	2.4%	8.4%	9.6%	20.5%	59.0%
I would support paying more taxes if city would spend more to maintain conservation lands.	6.1%	3.7%	28.0%	35.4%	26.8%
More benches & resting areas should be constructed.	32.5%	25.3%	25.3%	13.3%	3.6%
The current mgmt of conservation lands is appropriate.	6.1%	19.5%	46.3%	23.2%	4.9%

The survey also required the public to rank the most important management activities for the Parks Department to emphasize. Table 1-3 shows the results.

Table 1-3 Results of the Public Opinion Survey (Missoula Parks and Recreation 2009b)

Issue	Rank 1	Rank 2	Rank 3	% of People that Ranked this Issue as One of their Top Three
Increase outdoor education & outreach	12	13	14	14.39%
Improve ecological conditions	23	13	13	18.08%
Improve existing trails	8	12	7	9.96%
Create more trails	6	4	2	4.43%
Reduce fire risk & fuel load	3	1	2	2.21%

Issue	Rank 1	Rank 2	Rank 3	% of People that Ranked this Issue as One of their Top Three
Control noxious weeds	13	13	10	13.28%
Protect native plants	10	7	6	8.49%
Address recreation user conflicts	6	6	11	8.49%
Protect wildlife	5	15	16	13.28%
Enforce rules & regulations	1	4	6	4.06%
Other Issues	8	1	0	3.32%

While the public comments vary, the public survey results show that the Parks Department should first and foremost emphasize: improving ecological conditions, increasing outdoor education and outreach, controlling noxious weeds, and protecting wildlife.

1.6 DEMOGRAPHICS OF MISSOULA COUNTY

Missoula County's demographics are an important component in this plan because management of MCL is greatly influenced by those who use the lands.

1.6.1 Population

Missoula County is one of the population centers of Montana. Its population density in the year 2000 was 36.9 people per square mile as compared to 6.2 across Montana (U.S.Census Bureau 2002). Missoula County's population growth rate is higher than both the state of Montana and the Nation. Figure 1- shows the population in Missoula County from 1969 to 2007. Missoula County's relatively high population density coupled with a high rate of population growth likely indicate ever increasing use of MCL. As recreational use of these lands increase it will become particularly important to manage use so that valuable natural resources are not degraded.

Population Projections

As the population of Missoula grows, MCL management must consider how a larger population will impact Conservation Lands. The visions and goals outlined in this Plan will provide direction for management of these lands as Missoula grows.

Two population projection models are available for Missoula County (Table 1-4). The low projections are based on an analysis by James Sylvester in 1999. The higher projections are based on population trends in U.S. Census data from 1990 to 2000. The Sylvester Report included birth, death, and migration rates in Missoula County and was created before the 2000 Census data was available. Sylvester assumed a 1.1% growth rate until 2000, and 1.0% growth rate from 2010 to 2020.

U.S. Census projections use an average growth rate of 2.3% from 2000 to 2010 and 2.0% from

2010 to 2020. Table 1-4 provides the range of population projections for Missoula County through 2020.

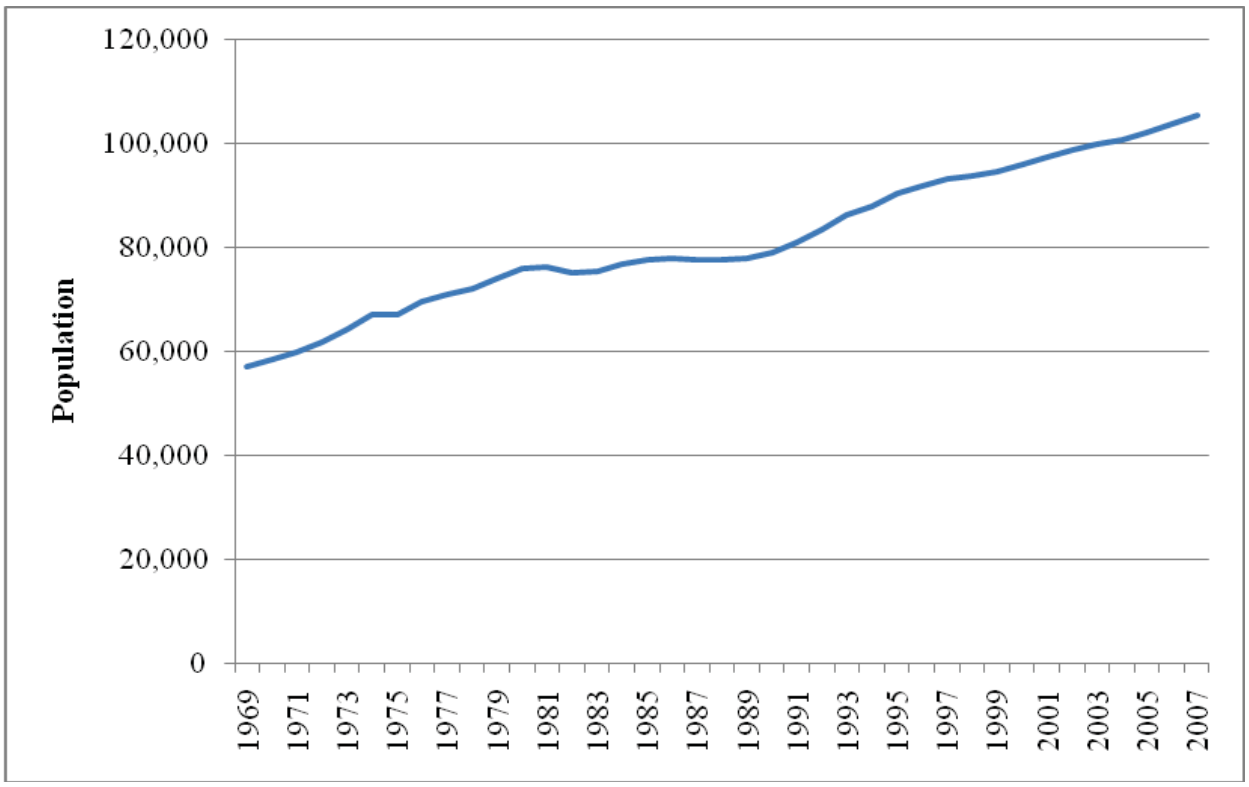


Figure 1-3 Population of Missoula County, 1969–2007 (BEA 2009)

Table 1-4 Population Projections for Missoula County (Missoula County 2002)

Year	Low Projection–Sylvester	High Projection–Census
2000	95,802	95,802
2010	106,877	120,262
2020	118,058	146,597

1.6.2 Employment and Income

Personal income per capita in Missoula County is similar to the state of Montana; both Missoula County and Montana have consistently lower personal income per capita than the United States (see Figure 1-).

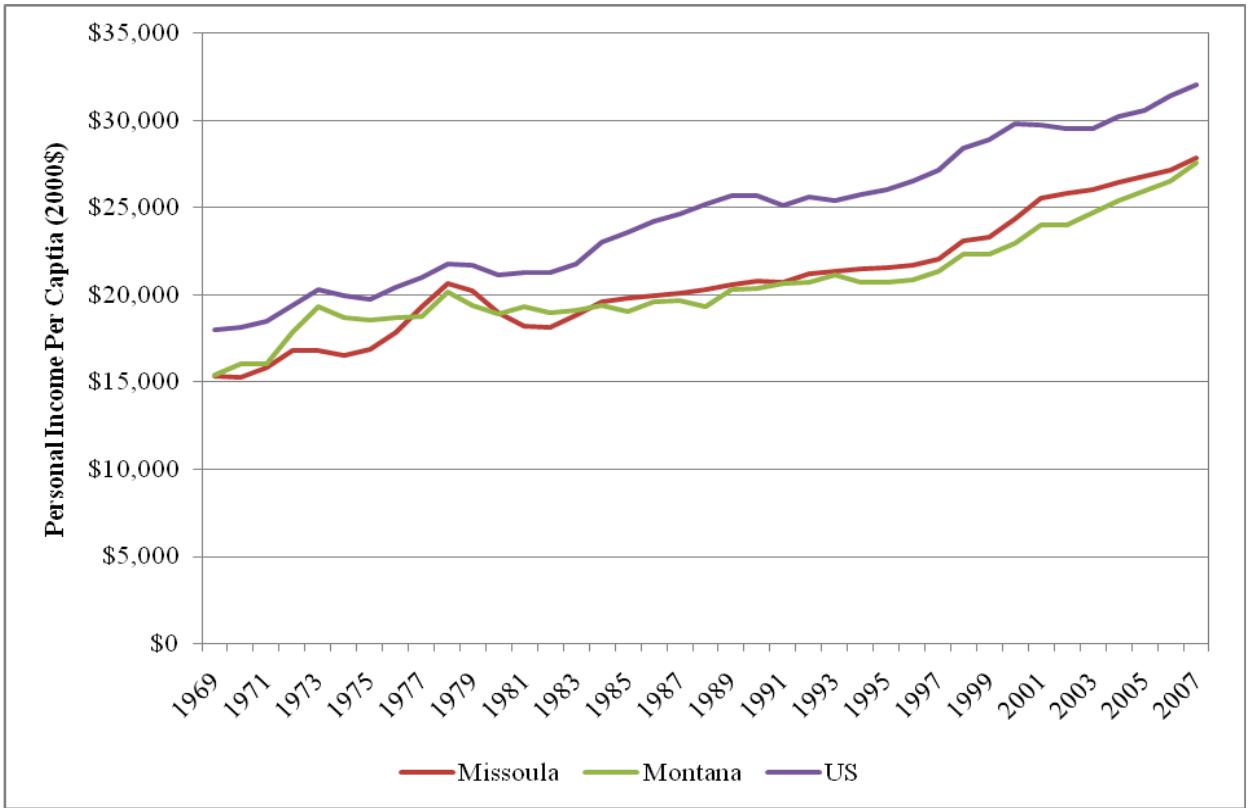


Figure 1-4 Personal income per capita (2000), 1969–2007 (BEA 2009)

The proportion of labor to non-labor income in Missoula County has decreased since 1970. This indicates a larger proportion of income received from personal dividends, interest, and rent (sometimes referred to as investment or property income) and personal current transfer receipts or payments to individuals and non-profit institutions by government and businesses for which no current services are performed. In part, this is explained by migration of retired persons to places with desirable environmental characteristics and recreational opportunities, as discussed in Chapter 5.

Table 1-5 Labor and Non-labor Income in Missoula County (BEA 2009)

Category	1970	1980	1990	2000	2007
Total Personal Income	$201,195	$691,917	$1,246,773	$2,342,773	$3,548,086
Labor Sources	$154,235	$493,122	$809,806	$1,553,736	$2,336,016
Non-labor Sources	$46,960	$198,795	$436,967	$789,037	$1,212,070
Dividends, Interest, & Rent	$28,865	$119,516	$252,299	$490,280	$732,008
Personal Current Transfer Receipts	$18,095	$79,279	$184,668	$298,757	$480,062
Labor Percent of Total	76.66%	71.27%	64.95%	66.32%	65.84%
Non-Labor Percent of Total	23.34%	28.73%	35.05%	33.68%	34.16%

Missoula County and the state of Montana's unemployment rates have been lower than the nation since 2001. However, in 2008 they both increased to closely approximate that of the nation (see Figure 1-5).

Many Missoulians claim that intact natural environments and abundant recreational opportunities in the area are what keep them in Missoula despite the low income (compared to the nation) and rising unemployment.

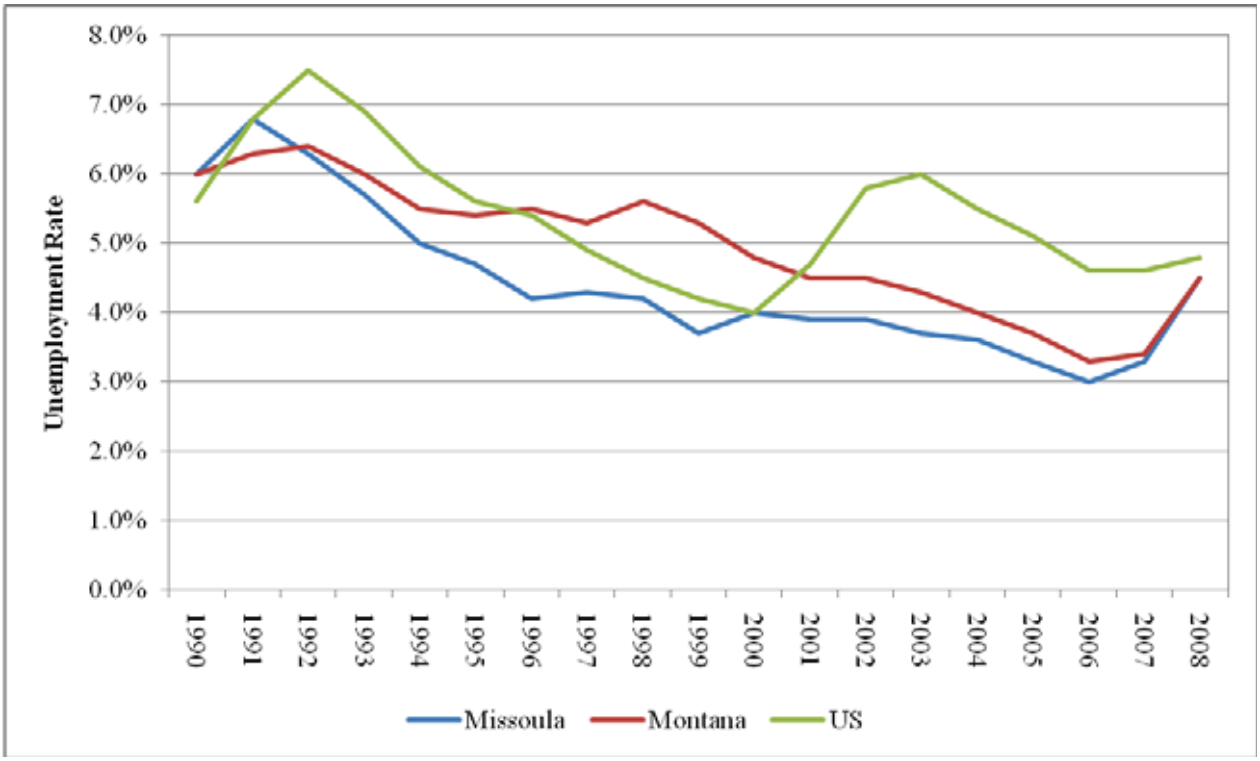


Figure 1-5 Unemployment rates for Missoula County, Montana, and the United States, 1990–2008 (U.S.Bureau of Labor Statistics 2009)

1.7 ENVIRONMENTAL BENEFIT OF CONSERVATION LANDS

Inherent in their definition, Conservation Lands provide important ecological benefits. The following outlines several of these benefits.

Flood Control

By allowing infiltration of rainwater and snowmelt into the ground, undeveloped land helps protect against flooding. Flood-prone lands adjacent to rivers and streams provide storage volume for floodwaters. The extensive placement of fill in the floodplain, channelization of waterways and in some circumstances removal of vegetation, significantly diminishes the water storage capacity of the floodplain, thereby exacerbating downstream flooding.

Surface Water Quality Protection

Conservation Lands contribute greatly to maintaining the quality of rivers and streams in the community. Where intact and healthy plant communities are present, infiltration of rainwater and snowmelt is increased thereby reducing run-off. Undisturbed vegetative cover holds the soil in place thus preventing excessive soil erosion into streams. Additionally, vegetative cover plays an important role in reducing the amount of pollutants entering the water supply.

Maintenance of Groundwater Systems

By encouraging infiltration of precipitation into the soil, undeveloped land cover promotes replenishment of natural groundwater supplies. In the Missoula valley, groundwater enters from the east and flows west beneath the city and residential areas before discharging into the Clark Fork and Bitterroot Rivers on the west side of the valley. Groundwater is the primary source for drinking water in the Missoula valley and most is found only 30 to 40 feet below the soil surface. Protection of Conservation Lands contributes to protecting our aquifer.

Groundwater systems also have an impact on surface water systems. Many wetlands are fed by groundwater. Groundwater often seeps from springs into the surface water system, helping maintain year-round flow in streams.

Air Quality and Climate

Vegetative cover on Conservation Lands traps the particulate matter of airborne pollutants; tree and shrub leaves absorb ozone and sulfur dioxide. Trees absorb carbon dioxide from the atmosphere and store it as carbon while oxygen is released back into the atmosphere.

Additionally, undeveloped open space lands are much better at absorbing solar radiation than urban developments. This ability to absorb solar rays translates into cooler ground temperatures and less overall evaporation of important water resources. In areas of dense urban development, where solar radiation is reflected off buildings and pavement, summertime temperatures are significantly hotter than on similar undeveloped lands.

Wildlife Habitat, Corridors, and Fisheries

The lands surrounding Missoula are home to a diverse population of wildlife. The Bitterroot and Clark Fork River corridors with their adjacent floodplains and riparian vegetation are extremely important to hundreds of species, including dozens of birds, amphibians, insects, fish and mammals such as, white-tailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), moose (*Alces alces*), red fox (*Vulpes vulpes*), and black bear (*Ursus americanus*). Some of these species are potentially at risk, including the birds, red-eyed vireos (*Vireo olivaceus*) and lazuli buntings (*Passerina amoena*) (MNHP 2009).

Conservation Lands, particularly along tributary streams, allow for natural riparian corridors and stream function along with the listed surface water and ground water benefits. Montana is unique in that our famous river trout fisheries are supported solely by high-quality habitats and natural reproduction in tributaries. Development along tributary streams and river corridors is one

of the greatest threats to Montana's trout fisheries and the scenery that accompanies them. Conservation Lands are a significant contributing factor in protecting these resources and the tourism they attract.

Figure 1-6 Kelly Island

1.8 CULTURAL, HISTORICAL, AND COMMUNITY BENEFIT OF CONSERVATION LANDS

Multiple cultural and historic features on Conservation Lands are valued by local citizens. Missoula's surrounding hillsides contain geologic formations resulting from the last ice age that remind us of this area's interesting history. Many Native American tribes and explorers utilized Conservation Lands as prime hunting and camping grounds. Family homesteads with historic barns, hay fields, and livestock pastures are evidence of the early settlement of the valley.

Prehistoric people camped and hunted on Mount Jumbo, leaving behind arrowheads, spear points, and flint and chert fragments. Missoula's Conservation Lands provided important food resources including bitterroots (*Lewisia rediviva*), biscuitroots (*Lomatium spp.*) and wild game. A rare ponderosa pine (*Pinus ponderosae*) along the Rattlesnake Trail still shows evidence of where natives harvested the sweet cambium layer for food. A Sentinel Pine once graced the southwest slopes of Mount Jumbo until vandals cut down this medicine tree in the 1930s.

Blackfeet Indians often laid in wait within Hellgate Canyon to ambush Salish and Kootenai hunting parties returning from the Great Plains laden with buffalo hides and meat. According to numerous reports, the entrance to the Canyon became so littered with bones and skulls that French trappers referred to it as "La Porte d' Enfer" or the Gate of Hell. To avoid ambush, the Salish Indians may have relied primarily on a trail through Pattee Canyon. Additionally, the Salish, Nez Perce, and Kootenai Indians traversed Mount Jumbo's saddle en route to and from the Great Plains.

In 1806, Meriwether Lewis traversed the south end of Mount Jumbo on the return trip of the Lewis and Clark Expedition. The explorers took a sample of mock orange (*Philadelphus lewisii*) for the plant collection that was later sent to President Thomas Jefferson. In 1859, Army Lieutenant John Mullan directed the construction of a military road from Fort Benton on the Missouri River to Fort Walla Walla in Washington. The Mullan Road, which passed through Hellgate Canyon, became the primary travel route after its completion, eliminating the fear of ambush. During the stagecoach era, however, the Mullan Road was often too muddy

for travel and the route over Mount Jumbo's saddle was used as a detour.

As early American settlers moved to the area, homesteads appeared throughout the valley and many of the hillsides were used to graze livestock. The Moon-Randolph homestead, preserved by the City in 1996, is one of only a few remaining in the Missoula valley. Early entrepreneurs in the valley, the Greenough Family, dedicated the City's first park. The fact that Greenough Park was gifted as parkland to be preserved in a natural state, perhaps represents an early interest among Missoulians in conserving native landscapes.

The cultural and historic features on Conservation Lands provide multiple opportunities for learning about our natural surroundings and help us develop a greater understanding and sense of respect about the world and humanity's place in it. Missoula teachers frequently utilize the river trails, Greenough Park, Mount Sentinel, Mount Jumbo, and other Conservation Lands parcels as outdoor classrooms where their students absorb lessons in ecology and learn an appreciation of the natural world. These outdoor classrooms are available for people of all ages to enjoy free of charge and within close proximity to the City of Missoula.

1.9 IMPORTANCE OF VIEWSHEDS

Landscapes that are seen and experienced as people live within and travel through an area are referred to as viewsheds. Viewsheds are an important recreational amenity often not considered in recreational analyses. High quality scenery enhances people's lives and benefits society in general. Economists recognize that tourism is becoming a leading industry in many regions of the United States, and tourists are often drawn to areas with scenic beauty. Residents also appreciate the high-quality scenery, and use it as a day-to-day reminder of the quality of their environment.

For the purposes of this CLMP, the viewshed of the Missoula valley includes the North Hills and Rattlesnake Wilderness to the north, Mount Jumbo and Mount Sentinel to the east, the South Foothills to the south, and Blue Mountain Ridge to the west. This 360° panorama contributes greatly to the Missoula quality of life and the local economy (Section 1.9 and Appendix E).

Residents of the Missoula valley and visitors have a strong interest in maintaining the viewshed that first attracted them to the area. Even though many changes have taken place over the years, the high-quality scenery and the feeling of open space are still present in the valley.

1.10 ECONOMIC BENEFIT OF CONSERVATION LANDS

In addition to the great ecological, cultural, historical, and community benefits of Conservation Lands, these lands also provide economic benefits to Missoula. Conservation Lands provide two primary but often conflicting benefits that contribute to the economic health of an area, recreational use and environmental

protection. If lands are correctly managed to maximize the overall benefit of these two uses, the lands will also provide secondary economic benefits such as expenditures by local residents on the goods and services associated with the use of Conservation Lands, expenditures by tourists to the area that are attributable to the open space environment, increases in property values which generate increases in tax revenue, commercial-use permits such as wildlife filming, and increases in businesses and individuals migrating to Missoula for these amenities which also generate increases in tax revenue. While the primary economic benefits are non-market goods and difficult to quantify, the secondary benefits can be measured in additional dollars generated to the City and to the local economy. More information on the economic benefit of Conservation Lands is provided in Appendix E.

2. RELATIONSHIP TO PREVIOUS PLANS

The City of Missoula has a long list of planning documents to assist in managing its Conservation Lands. The following documents were considered in the development of this plan. Some of the documents provide more detailed information than was included in the CLMP and should be referred to as appropriate. Plans and other relevant documents are hyperlinked as available to assist in continued research and management.

2.1 MISSOULA COUNTY GROWTH POLICY, 2005 UPDATE

The *Missoula County Growth Policy* was developed to meet state requirements and provide a framework for continued planning efforts in Missoula and Missoula County. Its goals are to manage growth in a proactive way considering immediate and cumulative impacts, and to create a healthy community by (1) protecting critical lands and natural resources such as wildlife habitat, riparian resources, hillsides, air and water quality, and open spaces; and (2) enhancing the community's resources in the areas of health and safety; educational, recreational, and cultural resources; employment; housing and the valued characteristics of communities. The document includes a profile of Missoula County, goals and objectives, information about implementation of the growth policy, and a process for review.

2.2 MISSOULA LONG-RANGE TRANSPORTATION PLAN, 2008

The *2008 Missoula Long-Range Transportation Plan* revises the existing *Long-Range Transportation Plan* and provides the community with an opportunity to envision a new, integrated transportation system. The plan's goal is to meet the requirements on planning organizations from the federal Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users. The plan includes an evaluation of relevant planning documents, transportation needs, committed and recommended projects, fiscal constraints of the plan, and air quality.

2.3 MASTER PARKS AND RECREATION PLAN FOR THE GREATER MISSOULA AREA, MAY 2004

The *Master Parks and Recreation Plan* is the current plan for parks and recreation within the urban Missoula area. It supersedes the *1997 Missoula County Parks and Conservation Lands Plan* and complements the *1998 Missoula Area Urban Comprehensive Plan*. The *Missoula Area Urban Comprehensive Plan's* focus is on the broader community vision, land use and growth management, and it includes some reference to parks. The purpose of the *Master Parks and Recreation Plan for the Greater Missoula Area* is to:

- Develop a detailed inventory of parklands
- Develop classifications and level-of-service standards that become policies to direct the

provision of parks within the urban area for the City and County

- Identify parks and facilities needed for leisure-time recreational activities based on the expressed desires of the community
- Identify future park-related projects and integrate them into the existing plans for trails and conservation areas
- Identify potential funding and acquisition strategies
- Develop an action plan for implementation.

The plan presents an inventory of existing parkland, an issue and needs analysis, recommendations based on the issues and needs, and implementation and funding.

2.4 MISSOULA COUNTY NOXIOUS WEED MANAGEMENT PLAN, 2006

The purpose of the *Missoula County Noxious Weed Management Plan* is to comply with the County Noxious Weed Management Act, Title 7, Chapter 22, Sections 7-22-2101 through 7-22-2153 and to provide a framework for rational and effective noxious weed management in Missoula County. The plan outlines criteria for weed management, splits weed types into management groups, and discusses mapping, prevention, management areas, education, and research and new technology in Missoula County.

2.5 MISSOULA URBAN AREA OPEN SPACE PLAN, 2006 UPDATE

The *Missoula Urban Area Open Space Plan* was adopted in August 1995 as an amendment to the *Missoula Comprehensive Plan* and in 2002 as an amendment to the *Missoula Growth Policy*. In 2005, the update process began with the Open Space Advisory Committee (OSAC) and a citizen working group. The highest priority of the plan is to protect the natural habitats and geologic features of the area. This plan defines open space and five types of land and landscapes (conservation lands, park lands, scenic views and vistas, agricultural lands, and trails), discusses the need for more open space, presents an inventory of current open space lands, and discusses future goals and implementation of those goals.

2.6 MOUNT JUMBO MANAGEMENT PLAN, 1999

The *Mount Jumbo Management Plan*'s purpose was to ensure preservation of the mountain's natural resources and to provide for compatible recreation. The plan developed management objectives, describes Mount Jumbo's natural and cultural values, provides information on research and educational attributes, presents management strategies and user protocols for recreationists, recommends monitoring and rehabilitation strategies for vegetation, and presents management strategies to reduce potential conflicts between elk and recreational activity during winter and early spring. The visions and goals outlined for management of Mount Jumbo in the Mount Jumbo Management Plan (MJMP) are consistent with those outlined in this plan. Following adoption by City Council, the Conservation Lands Management Plan will supersede the MJMP for management policy as it relates to Mount Jumbo. However, this plan

has adopted Chapter Six (Appendix H) of the MJMP as it relates to management strategies for reducing recreational impacts on the Mount Jumbo elk herd.

2.7 NEIGHBORHOOD PLANS

Detailed plans have been developed for specific neighborhoods. These plans provide guidance on the future land uses envisioned in each neighborhood as well as the need for and conceptual locations of future parks and trail connections. For the purposes of this plan, the Farviews Pattee Canyon Parks Study is considered in detail in Chapter 8 (Wonder Land 2008).

2.8 2001 NON-MOTORIZED TRANSPORTATION PLAN

The 1994 *Guidelines for Creating a Non-Motorized Travel Network in the Greater Missoula Area* (*Non-Motorized Plan*) is an amendment to the *Missoula Urban Comprehensive Plan*. The *1996 Missoula Urban Area Transportation Plan Update* includes chapters on bicycle and pedestrian system analyses. The *2001 Non-Motorized Transportation Plan* was coordinated with these documents. The goal of this plan is to aid in the development of an interconnected, continuous system of non-motorized facilities throughout the community and includes the sections, "Planning, Facilities and Physical Design," "Operations and Support Services," "Policy, Related Transportation Issues," and "Conclusions and Recommendations."

Figure 2-1 Non-motorized trail

2.9 MONTANA STATEWIDE COMPREHENSIVE OUTDOOR RECREATION PLAN, 2008–2012

The *Montana Statewide Comprehensive Outdoor Recreation Plan* outlines Montana's five-year plan for outdoor recreation management, conservation, and development. The plan inventories the state's supply of outdoor recreation facilities, evaluates the demand for more outdoor recreation facilities, establishes goals and objectives from the supply and demand evaluation, and develops a strategy and action plan based on the goals and objectives. The ten statewide goals for outdoor recreation are:

- Increase the quality and/or quantity of local swimming facilities
- Enhance parks and local recreation facilities for youth
- Continue access to, and maintenance of, rural and backcountry trails and use areas for hiking, biking, skiing, equine and motorized (OHV, snowmobile) recreation

- Increase miles and maintenance of urban and rural trails
- Enhance access for water-based recreation activities (fishing, boating)
- Improve access for wildlife-based recreation activities (hunting, wildlife viewing)
- Implement Americans with Disabilities Act improvements to recreation facilities and sites where needed
- Build awareness of, and participation in, the SCORP process and Land & Water Conservation Fund program among local and state recreation facility managers and local communities
- Create sufficient funding and stable resources to manage and maintain outdoor recreation facilities
- Refine and streamline the Land & Water Conservation Fund local program and grant process in Montana to be as user friendly as possible.

2.10 THE MONTANA WEED MANAGEMENT PLAN, MAY 2008

The purpose of the *Montana Weed Management Plan* is to strengthen, support, and coordinate private, county, state, and federal weed management efforts in the state and promote the implementation of ecologically-based, integrated weed management programs. The plan outlines current weed management programs and budgets for all responsible parties across Montana, highlights the strengths of current programs, and identifies ongoing needs for the programs.

2.11 THE UNIVERSITY OF MONTANA NATURAL AREAS VEGETATION MANAGEMENT PLAN, 2006

The *University of Montana (UM) Natural Areas Vegetation Management Plan* provides a vegetation management plan for UM natural areas including Mount Sentinel and Fort Missoula. This plan complies with the Montana Code Annotated Section 7-22-2151 (HB 395), which requires that all state agencies within weed control districts enter into cooperative noxious weed management agreements with their respective weed boards. This document's goals, objectives, and management criteria should be considered in the cooperative management of Mount Sentinel, City and University lands.

2.12 VEGETATION MANAGEMENT PLAN FOR SELECTED CONSERVATION LANDS, 2001

In 2001 Missoula's City Council adopted the Vegetation Management Plan for Selected Conservation Lands. This document outlined broad goals, vegetation management tools and priorities for Missoula's North Hills, Mount Sentinel, the Kim Williams Trail, and Clark Fork Native Prairie. Development of this plan was necessary to comply with Montana Code Annotated Section 7-22-2151 (HB395). This plan will be superseded by the adoption of the Conservation Lands Management Plan by the City Council.

3. OVERALL MANAGEMENT

The CLMP was developed with extensive public input. The Citizen Working Group constructed the vision and desired results, guiding principles, and recommended goals and policies for the plan based on the assumptions provided by the Parks Department and input from a public open house and public survey (Missoula Parks and Recreation 2009a). The foundation for the CLMP follows.

3.1 PARKS AND RECREATION DEPARTMENT ASSUMPTIONS

Seven assumptions were provided to the Citizen Working Group (CWG) by the Parks Department to assist in the planning process.

1. While the values and principles by which we manage MCL will remain consistent throughout the years, actual on the ground management should be adaptive and flexible to incorporate new ideas, scientific findings, and community needs.

2. Missoula's Open Space lands are valuable public assets. Management should promote community stewardship, responsible recreation, and outdoor education.

3. Not all properties in the system should be managed under the same set of conservation values and principles, though all lands and impacts should be considered when making land management recommendations. Areas that provide critical native habitat and/or are of high conservation value should be managed accordingly.

4. During the process, criteria for determining new trail construction, trail closures/rehabilitation, and appropriate types of on-trail recreation will be developed.

5. The Conservation Lands Management Program within the Parks and Recreation Department Operations Division is relatively young and under funded; efficiency, cost-effectiveness, and long-term maintenance should be considered during all aspects of plan development.

6. Capital improvements at trailheads and to Conservation Lands that address the land's values, Missoula's population growth, and associated recreation demands will be addressed in the recommendations.

7. Public enjoyment of Conservation Lands is critical to promote continued support of future open space acquisitions.

3.2 VISION AND DESIRED RESULTS OF CONSERVATION LANDS MANAGEMENT PLAN

The CWG vision states, "The Conservation Lands Management Plan will provide a framework within which Parks and Recreation is able to"

- Make criteria-based decisions and set priorities based on the types/categories/characteristics of parcels including decisions related to funding among competing priorities;
- Identify appropriate uses of individual parcels;
- Honor existing agreements and commitments;
- Apply management strategies that promote and improve the ecological condition of MCL;
- Apply management strategies where appropriate that support the community's recreational values;
- Provide for place-based educational opportunities;
- Apply an adaptive management approach to accommodate the unique qualities and challenges associated with individual parcels;

- Facilitate public and private funding opportunities.

3.3 GUIDING PRINCIPLES

The CWG adopted the following Guiding Principles for the CLMP and management of Conservation Lands:

- We believe that, as a system of natural parks and open spaces, MCL should serve a variety of uses and purposes, but that all uses/purposes may not be served on every parcel;
- We believe that management of individual parcels should consider, recognize, and honor the intent of the original acquisition agreements;
- We believe that the current and long-term management decisions and strategies should be based on assessment and prioritization of conservation and recreation values for each parcel;
- We believe managing for the conservation values of lands is important so people may enjoy natural spaces, native vegetation, and views;
- We believe that the Conservation Lands Management Plan should be designed to allow flexibility to address changes in future conditions that may demand management adaptations;
- We believe that existing management plans should influence management decisions and strategies for those parcels which have plans;
- We believe that user restrictions are appropriate tools for protecting conservation values and the experiences of other users. While we view incentives for good behavior as effective management tools, we recognize that they do not replace the need for establishment and enforcement of rules, regulations, and restrictions;
- We recognize that an effective Conservation Lands program requires adequate funding for management and enforcement;
- We believe the ability to responsibly manage a parcel should be considered prior to its acquisition;
- We believe Conservation Lands offer opportunities for education and cooperation among Missoula residents and agencies as well as opportunities for partnerships that further the management goals on Missoula's Conservation Lands;
- We believe that recreational opportunities should not preclude responsible management of natural resources; and
- We recognize that conflict may occur between users and user groups and that this Management Plan will not be able to successfully address every conflict situation.

3.4 RECOMMENDED GOALS AND POLICIES

The following goals and policies provide direction for management activity as well as criteria for assessing conservation values (see Section 3.5). Goals and policies are not listed in order of importance; each is equally significant.

Goal 1: Complete and maintain an up-to-date inventory of each land parcel, prioritizing its conservation values.

Policies:

1.1 Identify and inventory Conservation Lands by

- Size
- Habitat types, taking special note of habitats with high conservation value (e.g., cottonwood

floodplains, intact native grasslands, woody draws)

- Connectivity for wildlife movement and trail access. Where MCL parcels are located in relation to other Missoula Conservation Lands and open lands managed by other agencies and private landowners allowing public access
- Current and potential use (recreation, education, preservation, wildlife)
- Existing and potential conditions of ecosystems
- Accessibility for education and recreation
- Current infrastructure and services on site and their condition.

Goal 2: Establish, implement, and publicize general rules and management policies that apply to Conservation Lands including, but not limited to, the following:

Policies:

2.1 Restrict human access and/or individual recreational uses where and when natural resources are at risk or sensitive.

2.2 Apply physical designation (single track, 2-track, road) and use designations (pedestrian, bike, horse) for trails based on topography, environmental factors (soils, vegetation, wildlife), recreation uses and the amount of use.

2.3 Construct and maintain trails to minimize erosion regardless of trail designation.

2.4 Discourage the creation of "social trails" and mitigate them when they occur to prevent widening or unintentional change in trail designation.

2.5 Close all Conservation Lands to motorized use except for administrative purposes, such as land management and emergencies, and prior access agreements. Administrative use shall be limited whenever possible to reduce ecological damage.

2.6 Plan for and manage the scenic viewshed where pertinent.

2.7 Protect (and interpret where feasible) anthropological, historical, geological, and ecological resources on Conservation Lands.

2.8 Implement education programs for the public about user responsibility, trail usage, and land stewardship ethics.

2.9 Develop management actions for each parcel that maintain the parcel's most valued characteristics.

2.10 Manage individual Conservation Land parcels to honor commitments made during the parcel's acquisition and existing management plans.

2.11 Rules and Regulations should be clearly posted and enforced throughout the system.

Goal 3: Maintain habitat types and vegetation types on Conservation Lands including special plants and habitat types.

Policies:

3.1 Where appropriate manage forested Conservation Lands to promote old growth.

3.2 Manage Conservation Lands to protect people and structures from fire (thinning and burning where appropriate).

3.3 Promote healthy wildlife habitat on Conservation Lands.

3.4 Where rare plant species are present, protection and restoration of the native plant community on-site should be a management priority.

3.5 Manage wildlife habitat as a priority on parcels that have been identified as critical to native wildlife populations.

3.6 Maintain native plant communities and special plant communities where they exist.

3.7 Manage for no net increase of noxious weeds per parcel.

Goal 4: Manage Conservation Lands that adjoin other properties in cooperation with those landowners.

Policies:

4.1 Maintain, enhance, and encourage landscape connectivity between Conservation Lands, other parklands, federal, state, and private properties.

Goal 5: Restore native and disturbed habitat on Conservation Lands.

Policies:

5.1 Evaluate restoration opportunities on a cost/benefit basis and invest in restoration activities where they are likely to result in effective, measurable recovery of lands.

5.2 Involve citizens in restoration activities to create a sense of responsibility among users.

5.3 Restoration plans for any given parcel should consider the historic conditions of that parcel.

5.4 Where appropriate seek to incorporate natural processes like fire and flooding back into the ecosystem.

Goal 6: Provide a diverse and appropriate range of recreational and educational activities on MCL while limiting impacts by users to the ecological and cultural resource.

Policies:

6.1 Inventory individual Conservation Lands for their current and potential recreation uses, current and predicted usage levels, and impacts on ecological and cultural resources.

6.2 Develop and implement general and, where appropriate, parcel-specific management strategies and regulations to address uses including, but not limited to, dog walking, bike use, paragliders, hang-gliders, horseback riding, organized recreational events, hunting, research, formal education activities.

6.3 Maintain open communications and conduct public information and education campaigns concerning the general and specific regulations, including the reasons for the regulations.

6.4 Create citizen volunteer stewardship programs for Conservation Lands.

Goal 7: Evaluate the results of management strategies on Conservation Lands and adjust management for desired results accordingly.

Policies:

7.1 Establish appropriate monitoring studies aimed at evaluating trends in natural resources, recreational usage and management activities.

7.2 Implement a formal adaptive management process for the different categories of Conservation Lands and, where appropriate, specific parcels. Involve citizens where possible.

Goal 8: Develop adequate funding sources, partnerships, and programs to realize Management Plan goals.

Policies:

8.1 Develop an "adopt a park" program for smaller parcels (e.g., under 10 acres, located within an established neighborhood, near a school, etc.) to encourage community engagement in the property's management.

8.2 Work with neighborhoods near or adjacent to individual Conservation Lands and the community at-large to encourage citizen involvement in management activities, responsible use and education, funding, and ongoing advocacy.

8.3 Encourage nearby schools to use Conservation Lands for educational purposes. Involve students and staff in management activities, public education, funding, and ongoing advocacy for Conservation Lands.

8.4 Determine viability of corporate sponsors for stewardship of Conservation Lands based on meeting the goals of the CLMP.

8.5 Seek outside funding opportunities through grants, private philanthropy, and active fundraising. Develop infrastructure within the Parks Department to promote funding from these sources.

8.6 Explore adequate funding for Conservation Lands through maintenance districts, mill levies, general obligation, impact fees, tourism, or local option taxes and other possible long-term permanent funding mechanisms.

3.5 CONSERVATION LANDS CATEGORIES

Parcels managed by the Conservation Land Program (CLP) are divided into three categories as defined by the Missoula's Master Park Plan and based on the following designations (see Map 1 in Appendix B).

1) *Park Preserves*: are generally greater than 100 acres. These properties protect large areas with natural resource values of community-wide significance. They provide opportunities for nature-oriented outdoor recreation. Management priority is on preserving and improving native habitats and achieving an appropriate balance between resource protection and public use. Preserves typically have dirt trails with associated signage. Some preserves also have single-lane dirt road systems established prior to

City's acquisition of the property. Areas are largely undeveloped except at access points where user amenities (e.g., trash receptacles, parking, signage, pit-toilets) may exist.

2) Public Natural Areas: are usually no less than 10 acres. There properties serve to protect natural values and ecosystem functions. They provide opportunities for nature oriented, outdoor recreation and often include multi-purpose trails and more developed park amenities than Park Preserves. Management emphasis is on resource protection with appropriate public access provided. Level of development is commensurate with level of public use so long as resource values are preserved. Developments may include roads, parking lots, paved and dirt trails, environmental education/interpretative areas, picnic sites and visitor support facilities.

3) *Urban Parklands with Special Resources Present*: Size varies depending on location. These parcels may protect important natural, cultural, historic and other community values. These properties may include areas of significant vegetation, important habitats, scenic areas, or areas that contribute to the urban shaping and buffering goals of the community. In some cases these parcels have no facilities while others may contain a significant level of park infrastructure but still play an important role in habitat protection (e.g., parks along the Clark Fork River). Management emphasis is site specific and dependent on resources present.

3.6 SCORING OF CONSERVATION LANDS

In Table 3-, select properties managed by the CLP are scored based on their current and potential conditions. Parcels were scored by the Conservation Lands Manager, Open Space Manager and members of the Technical Working Group. Table 3- depicts the average of all individual scores. This scoring provides an indication of how well a parcel is currently managed and what the potential is for its improvement. Only Park Preserves and Public Natural Areas were scored.

CWG goals and policies are utilized in the scoring system as follows (see Section 3.4 for all goals and policies): Goals 1, 7, and 8 were not scored as they are primarily administrative actions for all Conservation Lands and do not apply to specific parcels. Goal 2's policies are included in parcel scoring, as these policies are goals in themselves. Goals 3, 4, 5, and 6 are included as scoring goals.

Table 3-1 Current and Potential Scoring of Missoula Conservation Land Parcels: Parcels are scored on a scale from 1 to 5 with 1 being low (goal not being met) and 5 being high (goal completely met). Current scores represent the level to which each goal is being met on an individual parcel. Potential Scores represent the highest possible level managers may attain given restrictions and limitations present on each parcel.

Parcel	Maintain healthy habitat and vegetation types including special and sensitive plants, animals, and habitats		Restore native and disturbed habitat		Maintain healthy wildlife		Provide an appropriate range of recreational activities		Mitigate for recreation user impacts		Maintain the scenic viewshed		Use lands for educational activities		Manage Conservation Lands and adjoining lands cooperatively for connectivity		Interpret (and protect where appropriate) anthropological, historical, geological, and ecological themes	
	Current	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*
Ben Hughes	2.3	4.0	2.3	4.0	2.7	4.7	2.8	4.3	2.0	4.3	3.0	4.3	1.0	3.0	1.0	3.0	1.0	4.0
Cattail Corner	3.4	4.0	3.1	4.0	3.6	4.3	3.8	3.7	3.3	4.5	3.8	4.5	1.7	5.0	3.0	2.0	4.0	4.5
Clark Fork Natural Area	3.0	4.3	3.2	4.3	3.0	4.3	4.3	4.7	3.3	4.0	4.3	4.7	1.7	4.0	4.0	4.3	3.7	4.3
Cohosset	1.3	3.3	1.3	3.3	1.3	3.3	1.0	3.3	1.3	3.3	2.3	4.7	1.0	2.3	1.7	4.7	1.0	2.0
Dismore-Orchard homes	3.0	4.1	2.7	4.0	3.5	4.6	2.5	4.3	2.3	4.7	4.0	4.9	1.3	3.7	2.7	4.7	1.0	4.0
Floral Park	2.7	3.7	1.5	4.0	2.3	3.7	1.3	3.3	4.0	4.0	3.0	4.3	1.0	2.3	2.3	4.0	1.0	3.0
Greenough	3.5	4.9	2.7	5.0	3.8	4.5	4.8	5.0	3.7	4.7	4.0	4.9	3.7	5.0	4.0	4.7	3.7	5.0
Hamilton	1.3	3.0	1.0	3.0	1.7	3.0	2.3	3.7	1.0	4.0	2.3	3.7	1.0	2.7	1.3	4.3	1.0	2.5
Hellgate Park	2.0	4.0	1.5	4.0	1.5	4.0	1.7	4.3	1.3	4.3	3.0	4.0	1.0	2.0	2.3	4.3	1.5	4.0
Hemayagan	2.3	4.0	1.5	4.0	2.7	4.7	1.7	3.3	1.7	3.3	3.0	4.7	1.3	2.0	2.0	3.7	1.5	2.5
High	3.3	4.0	3.0	4.0	3.3	4.3	3.0	3.3	2.7	3.7	4.0	4.7	1.0	3.0	2.7	4.0	1.5	2.5
Highland	3.7	4.3	2.5	4.7	3.3	4.3	2.0	3.7	2.0	4.0	3.3	4.7	1.3	2.7	2.3	4.0	1.5	2.5
Homestead	3.3	4.3	2.5	4.3	2.7	4.0	2.3	3.3	1.5	4.5	3.5	3.7	1.0	2.0	1.5	4.3	1.0	2.5
Jacobs Island	3.0	4.3	3.0	4.0	2.0	3.7	3.3	3.3	2.3	4.3	3.3	4.0	1.7	2.7	1.0	3.7	1.5	3.5

Parcel	Maintain healthy habitat and vegetation types including special and sensitive plants, animals, and habitats		Restore native and disturbed habitat		Maintain healthy wildlife		Provide an appropriate range of recreational activities		Mitigate for recreation user impacts		Maintain the scenic viewshed		Use lands for educational activities		Manage Conservation Lands and adjoining lands cooperatively for connectivity		Interpret (and protect where appropriate) anthropological, historical, geological, and ecological themes	
	Current	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*
Kim Williams/Hellgate Canyon	3.6	4.6	3.3	4.6	3.5	4.2	4.3	4.8	3.3	4.6	4.2	4.5	2.8	3.5	3.8	4.5	1.8	4.0
Meadowlark Acres	2.3	3.0	1.0	2.7	2.0	2.3	2.7	3.3	2.3	4.0	2.7	3.3	1.3	1.3	3.0	3.3	1.5	1.5
Moose Can Gully/ Hill View Heights	3.8	4.9	3.0	4.3	4.0	4.6	3.0	3.7	2.0	4.0	4.1	4.5	1.3	3.0	3.3	4.0	1.7	3.0
Mount Jumbo Backbone	3.8	4.8	3.8	4.8	4.4	4.8	4.6	4.8	3.3	4.5	4.8	5.0	2.3	4.7	4.6	4.8	2.0	3.8
Mount Jumbo Saddle	3.8	4.5	3.8	4.5	4.1	4.6	4.8	4.8	3.5	4.8	4.9	4.9	3.8	4.5	4.3	4.8	3.5	5.0
Mount Jumbo South	2.8	4.5	3.0	4.0	3.3	4.6	4.6	5.0	3.4	4.5	4.4	4.8	3.3	4.5	4.4	4.6	2.0	4.5
Mount Sentinel	3.5	4.6	3.8	4.4	3.5	4.6	4.6	4.6	3.8	4.5	4.5	4.7	3.0	4.6	4.3	4.8	2.0	4.0
North Hills (Randolph)	2.9	4.6	3.4	4.4	3.0	4.2	3.4	4.3	2.6	3.9	3.3	4.7	2.9	4.6	3.7	5.0	3.6	4.8
North Hills (Schilling)	2.7	4.1	1.9	3.6	2.9	4.3	1.0	3.0	1.0	4.0	3.3	4.3	1.2	2.0	2.0	3.9	1.3	2.8
North Hills (Sunlight)	3.3	4.6	3.1	4.2	3.3	4.4	2.0	4.4	2.3	4.5	4.0	4.5	1.3	3.8	3.4	4.5	1.0	4.5
Northview	3.3	4.7	3.0	4.7	3.0	4.3	1.0	3.3	1.5	4.3	3.7	5.0	1.0	3.3	1.0	3.0	1.0	1.5

Parcel	Maintain healthy habitat and vegetation types including special and sensitive plants, animals, and habitats		Restore native and disturbed habitat		Maintain healthy wildlife		Provide an appropriate range of recreational activities		Mitigate for recreation user impacts		Maintain the scenic viewshed		Use lands for educational activities		Manage Conservation Lands and adjoining lands cooperatively for connectivity		Interpret (and protect where appropriate) anthropological, historical, geological, and ecological themes	
	Current	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*	*Current*	*Potential*
Bancroft Ponds	3.7	4.7	4.2	4.7	3.7	4.7	3.3	4.3	3.7	4.7	4.0	4.7	4.5	5.0	2.7	4.0	1.5	5.0
Papoose	3.0	4.5	3.0	4.5	3.5	4.5	1.5	2.0	1.5	5.0	3.5	4.0	1.0	2.0	1.0	2.5	1.0	1.0
Powerline Easement	3.4	3.9	3.0	3.7	3.1	3.8	3.5	4.0	2.3	4.3	4.0	4.3	1.0	3.0	4.0	3.5	1.0	3.0
Rattlesnake Trail	4.0	4.4	3.8	4.3	3.9	4.9	4.1	4.3	3.2	4.7	4.4	4.5	1.0	4.0	3.7	4.5	1.5	4.0
Riverside Natural Area	3.7	4.3	2.0	4.3	3.3	3.7	1.3	2.7	1.7	3.0	3.3	4.0	1.3	3.0	1.0	3.5	1.0	1.0
Takima-Kokaski	3.2	4.3	2.0	3.7	2.7	4.0	1.7	2.3	1.7	2.7	3.8	4.0	1.0	1.0	2.0	3.5	1.0	1.0
Tower Street	3.6	4.8	3.0	4.9	4.0	4.6	3.4	4.3	3.4	4.5	4.1	4.6	2.8	4.3	3.8	4.5	2.0	5.0

4. GENERAL ECOLOGY

This chapter catalogues the unique natural resources and general ecology of the MCL system and discusses associated management practices. Conservation of natural resources was one of the primary reasons for acquisition of many of these properties (e.g., Mount Sentinel, Mount Jumbo, the North Hills, Rattlesnake Greenbelt and Tower Street Conservation Area.). Others may possess remnants of native habitats (e.g., Highland, Northview, Ben Hughes Parks) and/or provide roles in ecosystem function (e.g., Bancroft Ponds, Cattail Corner) but due to their small size or location have limited natural resource conservation value. Map 1 in Appendix B (and associated definitions given in Section 3.5) categorizes the overall conservation values on all properties within the system, providing a general idea of management priorities on individual properties.

The Citizen Working Group states,

> As the Conservation Lands Management Plan Citizen Working Group we believe the conservation value of lands are important for people so they may enjoy natural spaces, vegetation, and views.

It is important to note that humans are now, and have historically been, a part of the ecosystem. The challenge we currently face is how to balance our use of MCL with conservation of the natural resources we wish to maintain. Where natural resource values are high, the balance must be tipped toward conservation of those resources. Conversely, where natural resource values are relatively low, a wide range of recreational uses may be appropriate. There are also many circumstances where recreation and education can be provided in such a way as to protect conservation lands with mid to high natural resource values. This will be addressed in more detail in Chapter 5.

Several of the management goals and associated policies developed through public process by the CWG directly relate to the management and improvement of native habitats on MCL. The following goals provided significant direction in the development of this chapter.

- Goal 3: Maintaining healthy habitat and vegetation types including special and sensitive plants, animals, and habitats.
- Goal 5: Restore native and disturbed habitat on MCL.
- Goal 7: Evaluate the results of management strategies on MCL.

Management recommendations and policies given in this chapter consider current and past limitations to successful management of these natural resources. Furthermore, in select cases implementation of these policies will be largely dependent on impact to other resource values and amenities and budgetary constraints.

4.1 SURFICIAL GEOLOGY AND SOILS IN THE MISSOULA VALLEY

Surficial geology and soils are important in this plan because they provide the base on which vegetation and habitat types are developed.

Figure 4-1 Shorelines of Glacial Lake Missoula expressed on Mount Sentinel (Don Hyndman, The University of Montana)

The surficial geology of the Missoula valley is complex. The Missoula valley is part of a structural basin that began to open about 65 million years ago during the early Tertiary crustal movement that created the Rocky Mountains. Precambrian rocks of the Belt Supergroup and a few interspersed Paleozoic sedimentary rocks surround the valley with peaks of 5,000 to 7,000 feet elevation. Repeated events of erosion and sedimentation during the Tertiary period deposited sands, silts, clays, and gravel in alluvial fans, stream terraces, and flood plains in what is commonly referred to as a Tertiary valley fill. Some of these remnant fans and terraces remain as hills within the Bitterroot and Clark Fork valleys. Examples of Tertiary valley fill would be the "South Hills" of Missoula and foot slopes of Mount Jumbo.

Portions of the Tertiary sediments were scoured from the valley during the repeated draining of Glacial Lake Missoula approximately 12,000 to 15,000 years ago, during the Wisconsin age glaciation, and were replaced with layers of sand, gravel, and cobbles deposited during these catastrophic events and more recent alluvium deposited along the river channel and flood plain. The sediments generally become finer to the southwest of the valley as a result of dissipating energy after sediment-carrying water flowed out of Hellgate Canyon and across the broader Missoula valley, depositing coarser sediments first and then gradually allowing deposition of finer sediments.

These Quaternary age sediments from Glacial Lake Missoula overlie the older Tertiary valley fill and include glacial-lacustrine deposits of silt and clay; glacial outwash sand, gravel, and cobbles; and loess deposits associated with Glacial Lake Missoula. Many of the original alluvial fans and terraces of the Tertiary valley fill have been truncated or buried by these Quaternary age deposits. Today, the Bitterroot River, Clark Fork River, Rattlesnake Creek, and other minor tributaries have cut channels through the Tertiary and Quaternary age deposits and deposited more recent alluvial

sands, silts, and clays along present flood plains and stream terraces. The soils derived from these landforms form complex patterns depending on slope, aspect, position on slopes, and parent material (alluvium, colluvium, residuum, or eolian deposits).

The 1975 publication of the Missoula County Soil Survey Area provides detailed soil mapping of Missoula County soils. Appendix A contains additional information about soils on MCL. Maps 2-7 show the Soil Absorbed Runoff Potential, Soil Leaching Potential, Soil Map Units, Soil Solution Runoff Potential, K Factor Soil Erodibility, and Percent Slope, respectively; these maps are available upon request.

4.2 WILDLIFE

Residents of Missoula frequently come into contact with native wildlife. White-tailed deer (*Odocoileus virginianus*) are frequently spotted, particularly along the city's peripheral areas. Hikers using the riverfront trail invariably see osprey (*Pandion haliaetus*). If they spend enough time along the river, residents catch sight of bald eagles (*Haliaeetus leucocephalus*). Hikers using the Rattlesnake Gateway or upland winter ranges like Mount Jumbo or Mount Sentinel see black bears. Dense riparian shrubs along lower Rattlesnake Creek provide birdwatchers opportunities to view warblers (*Vermivora spp.*), song sparrows (*Melospiza melodia*), and catbirds (*Dumetella carolinensis*). During the winter months, elk (*Cervus canadensis*) are visible on Mount Jumbo.

In addition to seeing wildlife on a regular basis, Missoula residents have ample opportunities to learn about native wildlife. The Montana Natural History Center, International Wildlife Film Festival, and other wildlife interpretative organizations provide educational opportunities for people of all ages. Organizations such as the Audubon Society provide field trips, presentations, and slide shows for interested individuals, and schools include information on native wildlife in their curriculum. In addition, the local news media often focuses on wildlife related events heightening the public's awareness. Because of this high level of exposure, Missoula residents are likely more sensitive to wildlife issues than residents from other communities across the country.

Figure 4-2 Great horned owl observed in the Tower Street Conservation Area

Missoula is a rapidly growing, small city in a region teeming with wildlife. When high densities of people are combined with high densities of wildlife, the potential for conflict is large (USDA 1997). The list of issues facing wildlife populations on Missoula city lands is substantial. In the following sections we will

address those issues. This chapter is organized by habitats present on city lands, how they are used by wildlife, and the challenges to be faced in managing those habitats and populations, including identifying plans already in place to address these challenges. Recommendations for addressing these challenges where existing plans are insufficient are provided in Chapter 6.

4.2.1 Habitat Descriptions

MCL provide an abundant variety of habitats and niches for native, introduced, and invasive wildlife species. For management purposes, these habitats are grouped into the following categories:

- Upland winter ranges
- Low-gradient riparian habitats
- Levied rivers
- Standing water
- Woody draws
- Valley bottom prairie habitats

4.2.1.1 Upland Winter Ranges

Wintering Ungulate Habitat Preferences

During harsh winter periods elk and other wild ungulates migrate to low elevation winter ranges (Toweill and Thomas 2002). Winter survival for deer and elk is problematic for the following reasons:

- Forage is less abundant than during the spring, summer, or fall.
- Forage is less nutritious than during the spring, summer, or fall.
- Because of deep snow, substantially more energy must be expended to find food.
- Because of very low winter temperatures, more energy must be expended in the form of fat reserves to stay warm.

Ungulate winter ranges in western Montana typically have the following characteristics (Toweill and Thomas 2002):

- Low elevations (often the foothills directly above valley bottoms)
- South-facing aspects or complexes of generally south-facing aspects
- Gentle to steep slopes or elevated benches.

Maps 8, 9, and 10 in Appendix B show elk, mule deer, and white-tailed deer winter range, respectively.

Lands at low elevations provide better winter range because they generally have less snow than high elevation lands. South-facing slopes or complexes of aspects that are generally south-facing are preferred because the southern exposure allows the sun to periodically melt snow during the winter. Steep slopes are generally preferred over flat lands because the elevated slope angle is more perpendicular to the low winter sun and thus more conducive to snow-melt. This phenomenon can be frequently seen on the steep faces of Mount Jumbo and Mount Sentinel, which become periodically snow-free during the winter. In contrast, snow on the gentler slopes in the North Hills tends to persist for longer periods.

Valley residents often conclude that human habitation has displaced wintering deer and elk from the valley floor to the adjacent foothills. This is probably not the case because the Missoula valley floor is subject to severe cold air inversions that deer and elk avoid. For instance, during extended inversions, elk and mule deer can routinely be seen 1,000–2,000 feet above the valley floor (Henderson pers. comm.) where the warmest air is found. Also, because the valley floor is flat, it is the least perpendicular to the rays of the low winter sun and thus receives less solar energy than the surrounding, steeper hillsides. That said, the extent to which deer and elk may have historically used the valley floor on warmer winter days without inversions can only be speculated. Most certainly, human habitation has impacted the ability of large ungulates to travel across the valley floor to other habitats and developments along the flanks of Mount Jumbo's Saddle area may have decreased overall winter range on Mount Jumbo (Edwards pers. comm.).

Steep, deeply incised drainage bottoms such as the north end of the Rattlesnake Trail are also generally avoided by deer and elk during the winter because they usually contain the coldest air. For that reason, Greenough Park and Rattlesnake Trail parcels, although classified by Montana Department of Fish, Wildlife, and Parks (MFWP) as winter range, are relatively marginal as winter range during the coldest winter months and historically may have served solely as connections between upland winter ranges on Mount Jumbo and the North Hills.

During normal severity winters, mule deer, white-tailed deer, and elk are on the winter range from late November to early May (Toweill and Thomas 2002). During unusually mild winters, the winter ranges within MCL may receive little or no use by ungulates because other upslope lands remain available due to low snow/mild temperatures. Conversely, during years with unusually cold temperatures or deep snow pack, the availability of these lands may determine how many elk, mule deer, and white-tailed deer survive the winter.

MFWP-designated mule deer winter range includes both large and small parcels. Most of the winter range is limited to the large upland tracts of lands such as Mount Jumbo, Mount Sentinel, and the North Hills. Other small, isolated parcels may technically be winter range (i.e., used occasionally) but are of less value for two reasons: they are surrounded by densely developed suburban areas such as the Hemayagan parcel, or they are deeply incised drainage bottoms where cold, winter air precludes much use, such as the Rattlesnake Gateway parcel.

White-tailed deer are thought to be the less able to cope with deep snow than mule deer and elk. During the winter, white-tailed deer often prefer dense, multi-storied tree cover, which intercepts snow and reduces the depth of snow under dense tree stands. White-tailed deer, therefore, are more dependent upon dense tree cover during the winter than other wintering ungulates (Berner et al. 1988). Both mule deer and elk prefer open upland winter ranges, however the presence of stands of trees on these ranges does

provide important thermal and hiding cover throughout the winter (MFWP 2004) It has been hypothesized that fire suppression, which has allowed timber stands to expand and become more dense, may have contributed to the increase and westward expansion of white-tailed deer (Freedman and Habeck 1985).

Most elk have a strong fidelity to the winter range within their home range (Toweill and Thomas 2002) because populations of cows, calves, and young bulls do not mix with other wintering herds. This phenomenon can be seen in the Mount Jumbo and North Hills elk herds. While North Hills elk will use the north end of the North Hills parcel, they do not cross Rattlesnake Creek and mix with the Mount Jumbo herd (Cleveland pers. comm.; Henderson pers. comm.; Weybright 1983). However, recent research has shown that with increasing numbers of elk in the Grant Creek herd, co-mingling with Evaro elk herds is occurring (Cleveland pers. comm.).

Ungulate Populations

MFWP conducts wildlife population trend aerial surveys in the winter and spring. Because elk and mule deer are concentrated on open, low elevation winter ranges, they are easily viewed from the air. MFWP aerial surveys over Missoula's North Hills and Mount Jumbo are to count elk populations primarily, though they also note the presence of mule deer. Mule deer population estimates are, therefore, anecdotal at best (Edwards pers. comm.). However, MFWP population trend data for elk are very accurate. White-tailed population trend data are much less accurate. Population trend data and "hunter harvest data" for white-tailed deer are collected at the hunting district scale. Because the Missoula valley is at the junction of several hunting districts, there is no hunting district specifically limited to the Missoula valley. Moreover, populations of white-tailed deer in the city's valley floor are generally not exposed to hunting or predation, and probably do not parallel population trends at the hunting district scale (Henderson pers. comm.). Thus, while we have accurate data for elk and relatively accurate data for mule deer and in the Missoula vicinity, we can only make educated guesses about the population trends for white-tailed deer.

On large tracts of public and private lands, mule deer, white-tailed deer, and elk populations are regulated via hunting to maintain numbers at levels to ensure ungulate populations are healthy and habitat is of good quality (MFWP 2004; Edwards pers. comm.). One exception is the North Hills elk herd, which has increased substantially since first studied in the early 1980s (Weybright 1983) and has proven difficult to control from a population standpoint. Since Weybright's study, the population has grown from approximately 45 elk, in 1983, to a current wintering population of around 276 (Cleveland pers. comm.). Furthermore, the elk population spends a much longer portion of the year on the winter range than is normal. As part of Cleveland's thesis project on the North Hills elk herd he observed elk on the winter range of both the Grant Creek and North Hills areas from September to June. Cleveland surmises that elk find security from hunting on private lands where no hunting is allowed. On private lands in

more developed areas it is often not safe to utilize hunting as a management tool. This elk population level and non-traditional use patterns have several potential undesirable effects including: (1) over-utilization of native vegetation; (2) difficulty in controlling invasive weeds due to over-utilization of native vegetation; (3) elk damage to private property; (4) human safety concerns associated with habituated elk; and, (5) continued growth of the herd, compounding the negative effects of all the above-mentioned concerns. Elk damage to private property erodes the tolerance of private land owners for having large ungulates on their property. The North Hills Elk Working Group was formed to address this problem. MFWP adopted an adaptive management strategy to better manage the North Hills elk herd. As a result, MFWP implemented early-season and late-season game damage hunts, an early elk rifle season in the Rattlesnake Wilderness and both their outreach and the block management program in the area (Edwards pers. comm.)

4.2.1.2 Low-Gradient Riparian Habitats

Low-gradient, free-flowing rivers and streams are highly dynamic. Major runoff events result in both erosion and deposition, causing low gradient rivers to "meander" periodically. These meander patterns create numerous habitats and niches for wildlife and are generally considered the richest of habitats (Thomas et al. 1979). Habitats provided by stream meanders are described below.

Exposed Vertical Banks

When flooding streams cut through deep soils or gravels, they often leave behind raw, vertical banks. These raw banks provide nesting habitat for bank swallows (*Riparia riparia*) and northern rough-winged swallows (*Stelgidopteryx serripennis*) (Cornell Lab of Ornithology 2009a) and belted kingfishers (*Megaceryle alcyon*) (Cornell Lab of Ornithology 2009b). Bank swallows are colonial nesters and are probably the most sensitive of the seven swallow species occurring in western Montana. They nest exclusively in raw, vertical banks, which are almost always created by flooding. Since these banks eventually slough back to the angle of repose, such nesting habitat quickly becomes unsuitable, and bank swallows are dependent upon the next flooding event for new nest habitat. Belted kingfishers (*Ceryle alcyon*) typically nest in old or abandoned bank swallow nest holes. Raw vertical banks exist in the Tower Street Conservation Area parcel of MCL.

Depositional Gravel Bars

Flooding streams eventually deposit eroded material into newly-formed gravel bars. Depositional gravel bars can occur in all riparian parcels of MCL. While such gravel bars appear desolate from a wildlife habitat standpoint, they provide a nesting niche for various waterfowl including killdeer (*Charadrius vociferus*) (Cornell Lab of Ornithology 2009d) and spotted sandpipers (*Actitis macularia*) (Cornell Lab of Ornithology 2009i). Both species forage upon insects associated with gravel bars, and nest directly upon the gravel in cup-shaped depressions.

Dense Shrubs

Gravel bars quickly regenerate to sandbar willow (*Salix interior*), cottonwood (*Populus spp.*), and other riparian shrubs, as described in Hanson et al. (1995). Such dense shrub communities provide excellent nesting habitat for song sparrows (Cornell Lab of Ornithology 2009g), catbirds (Cornell Lab of Ornithology 2009c), and several species of warblers. Dense shrubs are located in all riparian parcels of MCL.

Mature Cottonwood

Cottonwoods, which regenerate on recent alluvial deposits and are described in Hansen et al. (1995), reach maturity at about 80 years. Cottonwood riparian forests are especially important because they support a higher diversity of breeding birds than most other western habitats, and many species that breed in other habitats forage in cottonwoods (Montana. Audubon Society 2008). They provide excellent habitat for nesting Lewis' woodpeckers (*Melanerpes lewis*) (Cornell Lab of Ornithology 2009e) and pileated woodpeckers (*Dryocopus pileatus*) (McClelland 1977). While pileated woodpeckers also nest in upland ponderosa pine (*Pinus ponderosa*) and western larch (*Larix occidentalis*) communities, Lewis' woodpeckers are limited to mature cottonwoods for nesting. They are an unusual woodpecker because in addition to foraging upon wood-boring insects, they also "flycatch" above the river, and forage upon berries in upland habitats.

Cottonwoods only regenerate in post-flooding conditions. According to the Interior Columbia Basin Ecosystem Management Project, cottonwoods are declining across the West due to flood-control actions (USDA and USDI 2000). Ponderosa pine typically invades cottonwood and will generally replace cottonwood communities in the absence of flooding. Mature cottonwood and associated ponderosa pine also provide nesting habitat for bald eagles and ospreys, although both species also nest in conifers well outside the riparian zone. Beaver are abundant wherever multi-aged cottonwoods are present. Mature cottonwoods are generally limited to the Tower Street Conservation Area parcel in MCL, but also occur in areas along the Rattlesnake Trail, Greenough Park, and other areas near water sources.

Sloughs and Oxbow Lakes

As meandering rivers cut new channels and old channels no longer have low water flows, they become sloughs. When the deposition of flood-deposited gravel bars blocks off sloughs they become "oxbow lakes." Sloughs and oxbow lakes provide nesting and rearing habitat for wood ducks (*Aix sponsa*). Wood ducks nest in mature cottonwood within abandoned pileated woodpeckers' nest holes. Adults and young immediately leave the nest upon hatching, and seek out water where subsequent brood rearing occurs. Sloughs and oxbow lakes are located in the Tower Street Conservation Area parcel of MCL.

Fish Habitat

Both the Clark Fork River and Rattlesnake Creek are important habitat for bull and westslope cutthroat trout (Map 11). Rattlesnake Creek provides a source of cold, high quality water to the Clark Fork River, and high quality in-stream habitat for native fish including westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) and bull trout (*Salvelinus confluentus)* (USDA 1986). It is listed as critical habitat for endangered bull trout and serves an important role for maintaining other native fish species in the lower Clark Fork River (Knotek pers. comm.). Habitat connectivity in the system has been interrupted for decades by the Mountain Water Company's intake dam just upstream from the city boundary. In 1983, after an outbreak of giardiasis, Rattlesnake water ceased to be used as a city water supply. At the time, MFWP had no interest in re-establishing fish passage over the dam to avoid "polluting" potentially pure strain westslope cutthroat trout above the dam with exotic rainbow trout (*Oncorhynchus mykiss*) (Workman pers. comm.). That philosophy has since changed, and the dam and a new fish passage structure are now managed to provide seasonal passage for bull trout. Because bull trout are fall spawners, restoring seasonal passage during the fall precludes passage of most exotic fish. Fish habitat above the dam is generally pristine (USDA 1986). Habitat below the dam, including on MCL parcels, is generally free-flowing and high quality although water quality is adversely impacted by affluent from under-or-poorly designed sewage systems and agricultural and residential runoff. The importance of maintaining appropriate riparian buffers along this creek for the health of the local fishery cannot be understated. Within Greenough Park, biologists have speculated that dams created by humans playing in the creek may further restrict migrating bull trout during late summer. There has been no telemetry or tagging to support this contention, but the risk to reduced bull trout spawning success suggest further analysis might be warranted.

4.2.1.3 Levied Rivers

Rivers or streams that are constrained by levies, represented by lands along the Kim Williams and Riverfront Trails throughout most of town, cannot meander. Consequently, they lack many of the habitats and vegetative communities that are unique to free-flowing rivers (sloughs, raw banks, and oxbow lakes). Levied rivers typically contain riparian shrubs but only in a narrow band within a few feet of the river. Gravel bars may also occur but are usually more limited in scale than within free-flowing rivers. Cottonwood stands may also occur in the short-term, but without bank scouring associated with periodic flooding, they generally will not regenerate or persist as a significant community. Narrow bands of riparian shrubs and mature cottonwoods still support nesting songbirds, raptors, and furbearers, albeit at reduced levels compared to historic conditions. Levied rivers are located in all Clark Fork River parcels except the Tower Street Conservation Area.

4.2.1.4 Standing Water

Wetland communities consist of cattails (*Typha spp.*), beaked sedge (*Carex utriculata*), and other riparian species associated with sloughs and oxbow lakes (Hansen et al. (1995). On MCL, wetland communities exist in the Cattail Corner and Bancroft Ponds parcels. These communities are likely artifacts of past urban development that changed or inhibited natural drainage patterns. Nonetheless, these small, isolated wetlands provide excellent habitat for waterfowl and wildlife viewing opportunities. In addition to ducks, geese, coots and (*Fulica Americana*), such habitats provide nesting and rearing habitat for uncommon species like sora rail (*Porzana carolina)* (Cornell Lab of Ornithology 2009h).

Wetlands provide essential habitat for amphibians. Historically, wetland habitats in the Missoula valley provided habitat for a number of species including Northern leopard frogs (*Rana pipiens*), Columbia spotted frogs (*Rana luteiventris*), and long-toed salamanders (*Ambystoma macrodactylum)*. In the last several decades, leopard frogs have become locally extinct in western Montana as a result of Chytrid fungus (*Batrachochytrium dendrobatidis*) (Maxell pers. comm.; MNHP 2009). Spotted frog populations have been substantially reduced in density and distributed in the valley as a result of exotic, introduced bullfrogs (*Rana catesbeiana*) which are common in sloughs along the Bitterroot and Clark Fork Rivers (Maxell pers. comm.; MNHP 2009). Spotted frogs are still fairly abundant and well distributed on adjacent national forest lands in lakes, wetlands, and low-gradient streams (Maxell 2002). Long-toed salamanders still occur in the valley and can be found near the Rattlesnake Gateway and other mesic, forested lands. Tailed frogs occur in cold water streams including Rattlesnake Creek within the Rattlesnake Gateway and Greenough Park MCL parcels (MNHP 2009).

4.2.1.5 Woody Draws

Woody draws are ephemeral drainages on steep, valley side-slopes.[1] Vegetation is limited to drought resistant shrubs including Douglas hawthorn (*Crataegus douglasii)*, serviceberry (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*), and western snowberry (*Symphoricarpos occidentalis*). Like riparian zones, they represent a tiny percentage of the landscape but provide habitat for many wildlife species. Examples include lazuli buntings (*Passerina amoena*) which nest in low shrubs, long-eared owls (*Asio otus*), northern shrikes (*Lanius excubitor*)[2], and Swainson's hawks (*Butea swainsoni)*. Bears often forage on berries found in this habitat during the fall. Deer and elk also find thermal cover in woody draws during the winter.

[1] These communities are described in Hanson et al. (1995).

[2] Greene (1999) documents severe nest parasitism in buntings (*Passerina spp.*) from brown-headed cowbirds (*Molothrus ater*). Holt (pers. comm.) documents a substantial nesting population of long-eared owls in woody draws, often found nesting on collapsed magpie nests at the tops of hawthorns. Cornell Lab of Ornithology (2009f) identifies hawthorn communities (locally most common in woody draws) as providing nesting and foraging habitat for northern shrikes.

Figure 4-3 Young black bear in woody draw on Mount Jumbo

Because woody draws are linear and usually undeveloped features on the landscape (like riparian zones), they may provide important movement corridors for wildlife. In the Missoula valley, mountain lions (*Puma concolor*), bears and elk have been observed using the Moose Can Gully parcel as a corridor (Henderson pers. comm.). Moose Can Gully/Hillview Heights, Mount Jumbo, Mount Sentinel, and the North Hills parcels contain woody draws.

4.2.1.6 Valley Bottom Prairie Habitat

Non-riparian lands in the valley bottom were historically grasslands and sagebrush/grasslands. These lands provided habitat for species such as meadowlarks and Columbian ground squirrels (*Spermophilus columbianus*) (Hoffmann and Pattie 1968; Knopf 1994). As a community type, this habitat is locally extinct and is currently vegetated with exotic or invasive weeds or other exotic vegetation. The Clark Fork Native Native Prairie, located along the river trail, provides a "museum example" of what the habitat looked like but does not represent enough area to be considered significant as wildlife habitat. MCL parcels located in the central valley that are not riparian have valley bottom prairie habitat.

4.2.2 Wildlife Challenges Facing the City

4.2.2.1 Impact of Human Disturbance, Displacement

In areas where mule deer, white-tailed deer and elk winter, especially during harsh winters, disturbance by non-motorized and motorized human activity and free-ranging dogs can have adverse impacts upon wintering ungulates. Impacts include:

- Displacement of ungulates to less desirable ranges or limitations on the amount of time they can spend foraging on desirable sites (Ward and Cupal 1979).
- Depletion of limited fat reserves from fleeing disturbances can lead to decreased birth rates and weights and a diminished chance of winter survival.
- Accelerated fat depletion due to increased stress, heart rate and metabolic rate even if and/or when ungulates do not flee from disturbance (Cassirer et al. 1992).

Interestingly, Stankowich (2008) concluded that ungulate response was higher to people on foot than within vehicles. The Mount Jumbo Management Plan takes these and other studies into consideration and provides seasonal closures to help avoid disturbances.

4.2.2.2 Avoiding Human/Dog Disturbance to Elk and Mule Deer on Mount Jumbo

Avoiding disturbance to elk on Mount Jumbo during the winter months is important for two reasons: (1) the herd is small but significant, and winter range is clearly limiting to that herd; and (2) having elk that are viewable to Missoula residents and visitors is a unique experience and a value that led to the overwhelming public support for acquiring Mount Jumbo as public land. While the City could strengthen its enforcement of the seasonal closures to people and dogs on Mount Jumbo, actions outlined in the Mount Jumbo Management Plan's Chapter Six is currently sufficient for sustaining elk on Mount Jumbo (Appendix H).

There is, however, one relatively new enforcement issue. An increasing number of recreationists are violating the Mount Jumbo seasonal closure by using the Saddle Road Trail/Woods Gulch Loop prior to its annual opening on May 1st. Collaboration between the City, Missoula Ranger District and MFWP (all of whom own portions of the Loop Trail) is needed to adequately address this problem.

4.2.2.3 Avoiding Transmission of Domestic Sheep Diseases to Wild Sheep in the Lower Blackfoot Bighorn Sheep Population

Bighorn sheep (*Ovis canadensis*) occasionally wander onto Mount Jumbo and Mount Sentinel, and very rarely onto the North Hills. When they make physical contact with domestic sheep or goats there is a risk of transmitting domestic sheep diseases back to wild sheep populations. These diseases are often lethal for wild sheep. As dense infestations of noxious weeds severely reduce the ability of any grassland to support Montana's native wildlife, the City's long-term restoration goals for severely degraded areas using domestic sheep will ultimately help a variety of local wildlife. However, mitigation of potential impacts on wild sheep populations should be an important part of the City's sheep grazing program. The Bighorn Sheep/Domestic Sheep Protocol (MFWP 2010) for the City of Missoula (Appendix C) directs MP&R, MFWP and domestic sheep herders on measures for reducing the potential of domestic/wild sheep interactions. The protocol also outlines measures for responding to possible commingling of domestic & wild sheep. This protocol can be viewed in Appendix C.

The bighorn sheep/domestic sheep protocol for the City of Missoula addresses this issue in sufficient detail. There is no need to modify the current contingency plan.

4.2.2.4 Minimizing the Impacts of Invasive Weeds on Wildlife.

Elk strongly prefer native grasses for winter forage, although they will forage upon shrubs (Toweill and Thomas 2002). Deer (both species) are much more likely to forage upon shrubs, although they will consume grass when available. Baty (1995) found substantial partitioning by species on winter ranges driven by forage preferences. Invasive weeds such as spotted knapweed (*Centaurea maculosa*), leafy spurge (*Euphorbia esula*), and Dalmation toadflax (*Linaria dalmatica*) severely impact

grasslands. In areas where weed infestations are severe, grass production can be reduced from 70% to 90% (USDA 1996). Willard et al. (1988) documented a minor level of foraging upon spotted knapweed by elk in heavily-infested winter ranges. MFWP data indicate that the North Hills/Evaro wintering elk population has been increasing steadily, while data for the Mount Jumbo wintering elk population indicates the herd is holding relatively steady at 40-60 individuals.

Another consequence to wildlife from invasive weeds is that heavily infested knapweed stands reduce the prey base for raptors, coyotes (*Canis latrans*), and red foxes. Pearson and Calloway (2006) and Pearson (2009) found that when bunchgrass communities are infested with knapweed that contain gallflies (*Urophora spp.*), an introduced biological control agent, the population of voles (*Microtus spp.*) is largely replaced by deer mice (*Peromyscus maniculatus*).

Figure 4-4 Leafy spurge and Dalmation toadflax infested rangeland on east side of Mount Jumbo

Pearson found that deer mice learn to forage intensively upon introduced gallfly larvae. Pearson concludes that whereas voles are readily available to raptors, coyotes, and foxes as prey, deer mice are generally not available. Lyon (pers. comm.) describes voles as being "fat, slow, and diurnal" and thus easy prey for daytime predators. Conversely, deer mice are "small, fast, and nocturnal" and thus not readily available to diurnal predators such as red-tailed hawks (*Buteo jamaicensis*) and Swainson's hawks. Ortega (pers. comm.) found "diminished food resources for birds breeding in knapweed-invaded versus native habitat, as well as reduced reproductive success and site fidelity." Ortega (pers. comm.) also suggested the effects found for chipping sparrows probably extend to ground-nesting birds such as meadowlarks (*Sturnella neglecta*) although she didn't specifically test for this. Although Ortega limited her research to knapweed infested rangelands, it is likely that other invasive weeds including Dalmatian toadflax and leafy spurge have similar effects on ground nesting birds.

It is especially important that weed control on MCL takes an integrated approach that focuses on the end-goal of increasing desirable vegetation on site. All weed management should consider effects of prescribed treatments on the resident plant community and develop continuing plans to assure treatments shift the community to a more natural state. Weed management that focuses only on killing weeds and not the plant community as a whole (e.g., many acres treated with only herbicide to control noxious weeds have responded with a high percentage of cheatgrass (*Bromus tectorum*)) will not be sufficient to maintain diverse native wildlife populations. This issue is dealt with in

more detail in subsequent sections on restoration of native plant communities. Maps 13 through 17 in Appendix B show weeds, including spotted knapweed, leafy spurge, and Dalmatian toadflax.

4.2.2.5 Human and Dog Disturbance to Wildlife on Conservation Lands

Much has been published about the effects of dogs, both on-leash and free-ranging, to wildlife. Lenth et al. (2008) found many animals including mule deer, bobcats (*Lynx rufus*), prairie dogs (*Cynomis spp.*) and other small mammals were displaced away from trails that allowed dogs, whereas some animals like red foxes exhibited no displacement. Miller et al. (2001) and Banks and Bryant (2007) documented a substantial loss of songbird nest success in areas that allowed dogs. Miller and Hobbs (2000), however, found that human activity alone had significant adverse impacts on nest success.

Human and dog activity on winter range displaces and/or disturbs wintering ungulates. Overall, areas that allow dogs will be less-suitable for mule deer fawning (Lenth et al. 2008). However, wintering mule deer on Mount Sentinel and white-tailed deer throughout the valley are increasing in numbers. This is likely due to their increasing habituation to humans which allows them to take advantage of forage in urban areas (Edwards and Henderson pers. comm.). The North Hills elk herd as a whole are also tolerant of humans and are exceeding the carrying capacity of their winter range (Edwards and Henderson pers. comm.). Therefore, initiating additional restrictions (beyond the Mount Jumbo closure) to limit public access on MCL upland winter range parcels to limit disturbance to wintering ungulates is not needed at this time.

Letting dogs chase wild game is illegal (Montana Code 87-3-124) and letting dogs harass wildlife should not be tolerated on MCL. During all times of the year, dogs have been documented harassing and killing wildlife on MCL. Such incidents clearly impact individual animal's survival and are also highly offensive from a social standpoint. To address future concerns regarding this issue, expanding enforcement of existing restrictions, educating the public about impacts on wildlife, and monitoring of human and dog-related impacts are needed.

While dogs have been shown to negatively affect some wildlife, human activity alone also impacts wildlife. More research on wildlife and human/dog use of MCL is needed.

4.2.2.6 Human and Dog Disturbance to Nesting Bald Eagles in Low-Gradient Riparian Areas

Nesting bald eagles are rapidly re-occupying western Montana. New nests are being identified at the rate of 3-4 per year in the county (MNHP 2009). While eagles are currently nesting near Kelly Island and just above (former) Milltown Pond (Map 11), there is room for approximately 1–2 more pairs in city-managed lands along the Clark Fork River. When new pairs start nesting activity on city

lands, this will raise the question as to whether additional seasonal restrictions to protect nesting eagles should be initiated. Current direction in the Montana Bald Eagle Management Plan (USDI 1994) and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) suggests that some restrictions would be warranted. Imposing restrictions to protect nesting eagles, however, may be difficult. Many bald eagle nesting pairs in the county exhibit tolerance to human disturbance far above what the Montana Bald Eagle Management Plan suggests is normal. Also, the level of existing disturbances along the Clark Fork River that are outside of city control, such as fishing, floating, homes, and businesses, will make any new restrictions appear in conflict with those established disturbance sources. Potential restrictions should be developed in cooperation with MFWP.

4.2.2.7 Protecting Ground and Shrub-Nesting Songbirds and Other Avian Species of Concern

Upland parcels including Mount Sentinel, the North Hills and Mount Jumbo provide important habitat for ground-nesting and shrub-nesting songbirds like grasshopper sparrows and lazuli buntings (Map 11). Human disturbance, including free-ranging dogs, can substantially reduce nest success. Wildlife viewing activities may exacerbate the problem since birdwatchers are most successful during the nesting season when birds are most easily viewed and may be most sensitive to disturbance.

American redstarts and lazuli buntings frequent areas densely packed with deciduous shrubs (Map 11). Riparian areas along Rattlesnake Creek and woody draws on surrounding hillsides are critical for their success. Preservation and in some areas restoration of these habitats is most important for the success of these birds. Little is known about susceptibility of these species to disturbance.

Both the Swainson's hawk and flammulated owl have been recorded on MCL (Map 11). The Swainson's prefers open grasslands for hunting and nests in a solitary tree. The flammulated owl is a cavity nester that inhabits open pine forests and subsists primarily on insects. The extent to which humans disturb these raptors is unknown but is likely minimal. However, any forest management practices in MCL pine forests should consider the importance of snags for nesting of the flammulated owl.

While restoration of degraded habitats on MCL is most important for maintaining populations of these avian species of concern, little is known about the impacts of recreation on many of these species. Plans for mitigation of negative impacts on these species should be reviewed in consultation with local experts.

4.2.2.8 Maintaining Wildlife Habitat Connectivity across the Missoula Valley

Maintaining wildlife habitat connectivity is an issue that most biologists support unanimously, but it is an issue that has almost no published management direction regarding “when, where, and how” this can be accomplished. Most of the literature focuses on barriers created by highways and the measures necessary to avoid or resolve these obstructions. Focus is also

given to the need to reconnect small, isolated patches of refugia on the urban East coast.

Regarding highways, the City of Missoula County has partnered with MDOT, MFWP, and Missoula County to resolve barriers associated with Interstate 90.

Maintaining habitat connectivity across urban city lands is more difficult to address. While the objective is one that has valid conservation application when applied at a larger scale, there is little science to provide prescriptive management direction for small urban parcels. Species that have clearly disjunct subpopulations (e.g., genetically isolated) that could benefit from increased habitat connectedness may not be the type of wildlife the city wants within its limits. Grizzly bears (*Ursus arctos*), for instance, fit this category (Servheen 1993). For many other large, wide-ranging species like lions, black bears, elk, deer, and virtually all native birds, the distribution data from MFWP and the Montana Natural Heritage Program (MNHP) clearly show no genetic isolation between populations or herd units. Other species are fragmented due to processes beyond human influence. For instance, the genetic isolation of Rocky Mountain and western Oregon/Washington tailed frogs is attributed to changes in post-Pleistocene conditions—a circumstance clearly beyond city control. Although some compelling conclusions have been made, more information is needed on how human-caused barriers and corridors effect wildlife populations. Therefore, it is difficult to prescribe a role for the city in maintaining habitat connectedness.

Woody draws and riparian zones provide travel corridors and may be the most logical places to emphasize habitat connectivity on city lands. Moose Can Gully provides an important woody draw that because of its linear shape and location probably allows animals access from Dean Stone Mountain to the Clark Fork River. Henderson (pers. comm.) has documented elk, bears and lions using this parcel. There may be other opportunities for the city to reconnect isolated lands, such as Kim Williams to Kelly Island, by expanding the width and continuity of protected lands along the river corridor.

4.2.2.9 Minimizing Negative and/or Potentially Dangerous Wildlife Interactions

The majority of the MCL system is within the city limits. However, these lands connect to vast tracts of Federal and State Lands where wildlife are abundant. In many locations, wildlife traverse city Open Space into Missoula neighborhoods. Occasionally, these wildlife encounter humans in a negative and/or potentially dangerous manner. All too frequently, black bears are lethally removed after they become food conditioned to unattended garbage or other human fare. Mountain lions venturing into the city also place humans at risk. While it is rare for coyotes to attack humans, there are abundant reports of coyotes preying on family pets in neighborhoods adjacent to MCL. Conversely, invasive species commonly found in adjacent neighborhoods do reduce habitat for native species. For example, raccoons or fox squirrels reduce nesting success for ground-nesting and other birds on MCL.

Several measures are currently in place to alleviate some of these negative interactions. MFWP's black bear program has reduced problem bear situations and human/bear confrontations in the city. The city's recently revised garbage ordinance, placing more stringent rules on garbage disposal in areas with a history of problem bears, may further reduce problems. MFWP's "living with lions" program provides useful information to residents for avoiding, or more importantly, surviving lion encounters.

One facet of the nuisance wildlife problem that may warrant further research and action is the potential for white-tailed deer to become increasingly more tolerant of humans and abundant in the city. There are several facets to the issue:

- Given the design of MFWP hunting districts and the difficulty associated with inventorying white-tailed deer in urban settings, there is currently no way to accurately assess population trends.
- White-tailed deer in the city are generally not exposed to hunting or predation.[3]
- The behaviors that deer exhibit in the city to humans and dogs clearly show an abnormal level of "comfort" or habituation to people.
- There are no effective birth control or other non-hunting measures for population control currently available.
- Cities nationwide have problems with deer and consistently poor success rates in resolving them.
- Measures to modify white-tailed deer behavior have generally proved unsuccessful. One of the most notable failures involved the O'Hare airport, which tried to scare off deer with randomly located and fired propane-fueled cannons (Belant et al. 1996). After exposure to those cannons, deer only modified behavior for a few days at most and then resumed pre-disturbance behavior.

The city should work with MFWP to appropriately manage Missoula's white-tailed deer population.

4.2.2.10 Fisheries Habitat

Fishery challenges include poor water quality due to increased nutrients from runoff and possible barriers to bull trout migration. Normal spring flood events occurring within non-constricted rivers including major meandering channels are not considered threats to fish habitat.

The city should work to maintain appropriate vegetative buffers in riparian areas to reduce run-off into natural waterways. Naturally deposited coarse woody debris should not be removed. Structures (e.g., human-constructed dams) that impede the natural flow of a waterway should be removed. Partnering with MFWP and Missoula Conservation District to

[3] Sport hunting is typically an effective means of controlling white-tailed deer populations (Leopold 1933). Hunting within cities, including bow-hunting, is difficult because of real or perceived risks to human life. When bow-hunting is limited to small isolated parcels, injured animals often die away from the parcel in which hunting is allowed leading to social conflicts with the non-hunting portion of the public. Furthermore, when hunting is limited to small, isolated parcels, surrounded by lands closed to hunting, deer (and virtually all other ungulates) quickly learn which parcels to avoid (Burcham et al. 1999). Thus, hunting, while well-intended as a means to control urban deer populations, often does not occur on a large enough scale to be an effective population control tool.

educate the public on responsible recreation in important trout fisheries is recommended.

4.3 VEGETATION

The diverse vegetation found on MCL contributes to the unique character of these landscapes. Plant communities are the backbone of all habitats. Local native plant communities provide food and cover for animals, play essential roles in nutrient cycles, and offer a variety of recreational opportunities for Missoula's active population.

The importance of healthy, diverse, native plant communities to the preservation of local Montana habitats cannot be understated. In general, the more diverse any plant community the more wildlife it can support. Shaped by climate and natural phenomenon our local habitats have evolved unique assemblages of plants and animals. Natural disturbances (e.g., fire, floods) in many cases continue to be necessary to maintain the vigor of our vegetation. Impacts from intensive recreational use, invasive species and short-sighted management practices are all threats to the integrity of our local native plant communities. If native plant diversity is lost from a site, it is both challenging and costly to replace.

Humans are also a part of our local habitats. For thousands of years before European influence Native Americans in our area actively managed native plant communities. Prescribed burning and the harvesting of root crops (e.g., bitterroot, camas, and biscuitroot) were widespread throughout our area. Early American settlers brought the axe, plow, domestic livestock and a host of non-native plants, all which drastically altered native plant communities in the Missoula valley. Today, vegetation on MCL shows evidence of past influences and retains remnants of intact native vegetation. Missoula Conservation Lands are frequently used by native plant enthusiasts, students, and researchers from the University of Montana to learn about our local plant communities.

Figure 4-5 Arrowleaf balsamroot, an important component of native grasslands in our area.

4.4 VEGETATIVE COVER ON CONSERVATION LANDS

In order to appreciate the current condition of vegetation it is important to understand the landscape as it was prior to European influence. The historic landscape is referred to as the historic range of variation (HRV). Analysis of the soil on a site is one way to approximate historic vegetative cover types. Soils develop specific characteristics over thousands of years; because they are closely tied to vegetation, they offer a window into the vegetation type that historically covered an area. However, using soil types to determine historic vegetation cover

has limitations. In some areas, human disturbance has so altered the soil that its classification no longer reflects the vegetation that grew on it historically.

The current condition of vegetation on MCL Lands is easy to describe qualitatively but somewhat difficult to quantify. Comparisons between the HRV derived from soil data, remotely sensed vegetative cover estimates, and on-the-ground mapping allows us to accurately depict broad changes in vegetation over time and to set future restoration goals.

Datasets that cover MCL in their entirety are limited to remotely sensed data sources, which can be inaccurate due to coarse resolution. The U.S. Department of Interior's LANDFIRE Rapid Refresh Cover Type layer portrays all of MCL via satellite interpreted images (LANDFIRE 2009). Table 4-1 compares current vegetation cover types to historic cover types on MCL. Current conditions are from LANDFIRE's Rapid Refresh layer called Existing Vegetation Type (LANDFIRE 2009). Historic conditions were determined by analyzing soil data from the Missoula County Area Soil Survey of 1994 with the Soil Data Viewer (NRCS 2009), which converted it to an ecological site classification.

From 2004-2008 the Missoula County Weed District (MCWD) and MP&R mapped the ecological condition of grasslands across 88% of MCL, including adjacent lands on Mount Sentinel. The health of these grasslands was determined as the percentage of native versus non-native plants on site with: "Pristine Grassland" as containing less than 20% non-natives; "Grassland Native-Dominant" with 50-80% native species; "Grassland Non-Native-Dominant" with 50-80% non-native species; and "Inundated" with 80-100% non-native species.

Table 4-2 and Map 20 presents the results of MCWD and MP&R ground-based vegetation mapping project.

Table 4-1 Comparison of Current to Historic Cover Types on Missoula Conservation Lands

Cover Type	Current Acres	Historic Acres
Water	20	19
Developed	43	0
Barren	11	0
Agriculture	9	0
Forested/Woodland	768	433
Rangeland	2,562	2,977
Riparian	180	164
Total	**3,593**	**3,593**

Table 4-2 Current Health of Native Grasslands on Select Missoula Conservation Lands

Name	Vegetation Type	Acres	%
Mount Jumbo	Pristine Grasslands	154.05	11.9%
	Grassland – Native Plants Dominant	383.93	29.7%
	Grassland – Non-Native Weeds Dominant	480.73	37.2%
	Inundated – (75-100% non-native weeds)	274.82	21.2%
Mount Jumbo Total		**1,293.53**	**100%**
Mount Sentinel	Pristine Grasslands	57.80	11.7%
	Grassland – Native Plants Dominant	116.09	23.6%
	Grassland – Non-Native Weeds Dominant	155.10	31.6%
	Inundated – (75-100% non-native weeds)	163.00	33.1%
Mount Sentinel Total		**491.99**	**100%**
North Hills Open Space	Pristine Grasslands	22.33	2.5%
	Grassland – Native Plants Dominant	360.47	39.8%
	Grassland – Non-Native Weeds Dominant	418.25	46.2%
	Inundated – (75-100% non-native weeds)	104.46	11.5%
North Hills Total		**905.51**	**100.0%**

Some vegetation cover types on MCL have changed over the last fifteen years, as evidenced by the difference in current and historic acreages (Table 4-1). Those cover types with the largest differences are the forested and rangeland types. The following sections describe the current and historic condition of the dominant vegetation cover types on MCL.

4.4.1 Rangeland

Rangeland cover types dominate MCL (Figure 4-6). Historically, they covered 82.9% of present day MCL. Currently, rangeland cover types comprise 71.3% of MCL representing an 11.6% reduction in acreage, a loss of 415 acres (Table 4-1). This significant departure from historic rangeland levels is due to the introduction of non-native species, fire suppression, and conifer encroachment. Rangeland habitat types are shown in Map 19 (Appendix B). The rangeland species list by Mueggler and Stewart (1980) which is used to determine rangeland cover types is included in Appendix D.

Figure 4-6 Rangeland in the South Hills

Table 4-3 presents the LANDFIRE classification of MCL that were historically categorized as rangeland. Notice that LANDFIRE currently classifies 59.4% of the historic rangeland types as introduced upland vegetation which reflects the extent of the current noxious weed invasion. This classification is supported by MCWD/MP&R's ground-based mapping which catalogued 50% (1,594 acres) of city lands on Mount Jumbo, Mount Sentinel and the North Hills as grasslands with more than 50% cover of invasive non-native vegetation.

These data also shed light on the conifer encroachment issue, estimating that almost 10% of the historic rangeland types have been replaced with forested types (Table 4-3, Figure 4-7).

Table 4-3 Current Cover Types on Conservation Lands Historically designated as Rangeland (USDI 2009)

Existing Cover Type	Acres	%
Introduced Upland Vegetation-Perennial Grassland and Forbland	1,768.9	59.4%
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	194.6	6.5%
Inter-Mountain Basins Big Sagebrush Steppe	161.0	5.4%
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	149.9	5.0%
Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	123.6	4.2%
Inter-Mountain Basins Montane Sagebrush Steppe	89.4	3.0%
Inter-Mountain Basins Big Sagebrush Shrubland	80.1	2.7%
Artemisia tridentata ssp. vaseyana Shrubland Alliance	15.8	0.5%
Forested Types	287.7	9.7%
Rocky Mountain Montane Riparian Systems	26.3	0.9%
Developed	33.9	1.1%
Agriculture	4.0	0.1%
Barren	0.2	0.0%
Other	42.0	1.4%
Total Historic Rangeland	**2,977.1**	**100.0%**

4.4.2 Riparian

Riparian Riparian cover types comprise 5% of MCL. These areas are primarily tied to the Clark Fork River and Rattlesnake Creek, but there are some small riparian areas in other MCL parcels where the presence of ephemeral streams and seeps produce many of the characteristics and species habitats of a riparian area; examples include Moose Can Gully, Takima-Kokaski, and select areas on Mount Jumbo, the North Hills, Northview, Hemayegan Parks, Bancroft ponds, and Cattail Corner. Even though these types comprise a small portion of Conservation Lands, they are the most biodiverse in regards to flora and fauna, and they receive some of the most concentrated recreational uses.

Major habitat and community types include black cottonwood (*Populus balsamifera*)/red-osier dogwood (*Cornus sericea*) habitat type, black cottonwood/western snowberry habitat type, and sandbar willow community type. These types are shown in Map 19 (Appendix B). Current riparian types were classified according to Hansen et al. (1995).

Like rangeland cover types, riparian cover types have been altered by fire exclusion and the invasion of non-native species. In the absence of fire suppression, these areas would have seen periodic fires similar to the high frequency fire regimes of the adjacent rangelands.

Riparian habitats are also impacted by river manipulations designed to control flooding. The Clark Fork River has been significantly altered by levees and other modifications to the floodplain, especially in Missoula (Figure 4-8).

Historically, the riparian areas along the Clark Fork River through Missoula were more expansive. Flood control levees and urban expansion on the Clark Fork River, and to a lesser degree on Rattlesnake Creek, have worked to confine historic riparian areas. However, the historic riparian acres likely were underestimated due to extensive human disturbance to soils in the Missoula urban areas prior to the 1994 soil survey.

Figure 4-7 Conifer encroachment of historic rangeland on the west flank of Mount Jumbo.

Figure 4-8 Levee along Clark Fork River

4.4.3 Forested

Historically, most of MCL had few conifers and were dominated by grassland. Frequent low-intensity wildland fires maintained the grass and shrub vegetation and kept conifer encroachment to a minimum. Fire killed regenerating conifer seedlings, and only those conifers with bark thick enough to withstand the low intensity fires survived. In contrast, fire top-killed aspen groves allowing them to resprout and develop into vigorous clones with little conifer competition. Historically, wildland fire was frequent and of low intensity with a return interval averaging five to 20 years on MCL (Missoula Parks and Recreation 1999). Wildland fire occurred on average every seven years from 1557 to 1918 on the dry slopes of Pattee Canyon (Lolo National Forest 2009). These wildland fires were caused by both frequent lightning and Native American ignitions (Arno and Fiedler 2005). Fire suppression began nearly 100 years ago. As a result, the grassland acreage present early in the last century has been succeeded by varying degrees by conifers.

Conifer encroachment continues today with periodic episodes of successful regeneration. In the absence of fire, a few trees can facilitate the stand regeneration by providing a seed source and environment in which seedlings can establish and mature. This results in a mosaic pattern of mixed conifer size classes that are easily seen within the parks and in aerial photographs. Interesting also are the lines of successful conifer regeneration along the ancient Glacial Lake Missoula shoreline terraces (wave-cut benches) that are visible as long horizontal lines of trees along the hills surrounding Missoula. The continued invasion of conifers into the open grasslands with resulting increases in tree density elevates competitive stress and can make trees more susceptible to insects, disease, and wildland fire.

Figure 4-9 Conifer dominated forest along Rattlesnake Greenbelt

Many Missoula Conservation Lands are now conifer-vegetated parks dominated by ponderosa pine and Douglas-fir (*Pseudotsuga menziesii*). Theses stands are multi-aged with many overly dense young trees and a few older trees, often remnants from past logging. Conifer dominated areas are found on, but not limited to, the Rattlesnake Greenbelt, Upper Mount Sentinel, Mount Jumbo Backbone and Saddle, Highland Park, and Moose Can Gully. Forested habitat types, shown on Map 19 (Appendix B), are from *Forest Habitat Types of Montana* (Pfister et al. 1977).

Forested bottomlands also have varying densities of black cottonwood (*Populus trichocarpa*), aspen (*Populus tremuloides*) stands, and several non-native trees such as Norway maple (*Acer platanoides*), European mountain ash (*Sorbus aucuparia*), common buckthorn (*Rhamnus cathartica*), golden willow (*Salix alba var. vitelina*), Siberian elm (*Ulmus pumila*), the occasional Russian olive (*Elaeagnus angustifolia*), and orchard apple (*Malus domestica*).

MCL on low-elevation slopes have varying densities of ponderosa pine with chokecherry, serviceberry, Douglas hawthorn, and elderberry (*Sambucus spp.*). Upper-slope and north-slope parks have varying densities of Douglas-fir with some mix of ponderosa pine and shrub species including ninebark (*Physocarpus spp.*).

Non-native forbs exist within all forested areas. Most widespread are spotted knapweed, leafy spurge, sulphur cinquefoil (*Potentilla recta*), Dalmatian toadflax, Houndstongue (*Cynoglossum officinale*) annual bromes (*B. tectorum & japonicas*) and mustard species (*Sisymbrium spp.*).

4.4.4 Plant Species of Concern

Missoula County is home to a great number of species of concern. Table 4-4 lists three plants and one lichen identified by the MNHP as species of concern located on MCL. Missoula Phlox, a culturally significant species of concern, is shown in Figure 4-10. Map 12, Appendix B, shows the plant species of concern located in the Missoula valley.

Table 4-4 Species of Concern in the Missoula Valley

Scientific Name	Common Name
Camissonia andina	Obscure Evening-Primrose
Phlox kelseyi var. missoulensis	Missoula Phlox
Rotala ramosior	Toothcup
Arctoparmelia subcentrifugia	Ring Lichen

Figure 4-10 Missoula Phlox on the North Hills

4.5 RISKS TO CONSERVATION LANDS

4.5.1 Invasive Species and Noxious Weeds

The abundance and variety of non-native vegetation poses a real threat to MCL. These species lower the ecological condition, diversity of plants and animals, and ground cover of MCL (Figure 4-11). Some introduced species, most notably the annual bromes (cheatgrass and Japanese brome), have been shown to alter fuels and fire behavior in other regions of the country, increasing the fire risk in forested and rangeland sites.

The most widespread non-native species on MCL include spotted knapweed, leafy spurge, sulphur cinquefoil, Dalmatian toadflax, common tansy (*Tanacetum vulgare*), cheatgrass, invasive pasture grasses (e.g., smooth brome, Kentucky/Canada bluegrass, and orchard grass) and annual mustard species. There are also many new invaders that are now becoming established on MCL. New invaders recognized on Montana's noxious weed list include: Japanese knotweed (*Polygonum cuspidatum*), whitetop (*Cardaria draba*), perennial pepperweed (*Lepidium latifolium*), St. John's wort (*Hypericum perforatum*), yellow-flag iris (*Iris pseudacorus*), yellow toadflax (*Linaria vulgaris*) and dyer's woad (*isatis tinctoria*). Several non-native plants that are not listed on the State's noxious weed list but are established and expanding their distribution on MCL include: Norway maple (*Acer platanoides*), European mountain ash (*Sorbus aucuparia*), white bryonia (*Bryonia alba*), common buckthorn (*Rhamnus cathartica*), golden willow (*Salix alba var. vitelina*), Siberian elm (*Ulmus pumila*), Russian olive (*Elaeagnus angustifolia*), moth mullein (*Verbascum blattaria* L.), Common teasel (*Dipsacus fullonum* L.), ornamental Caragana (*Caragana spp.*) and common lilac (*Syringa vulgaris*). These unlisted plants should be considered as new invaders and managed accordingly.

While management of all non-native invasives on Missoula Conservations Lands should continue, it is vital that MP&R aggressively control all new invaders. For many of these new invaders, local eradication is still a possibility and aggressive controls now will likely save significant resources in the future if these plants were allowed to expand their current distribution.

The increasing abundance of cheatgrass (including Japanese brome) within grasslands on MCL complicates weed management due to its aggressive nature and difficulty to control. Cheatgrass quickly takes advantage of

disturbances to prevent native plants from recolonizing a site.

Figure 4-11 Loss of native plant diversity on Missoula's North Hills from 1973 (top photo) to 2003 (bottom photo) following invasion by non-native plants

Adoption of adaptive, holistic management strategies that control cheatgrass and promote diverse native plant communities are highly recommended. As few lands managers or researchers have been able to successfully restore natives to solid stands of cheatgrass, successful management of this grass will likely take multiple tools (e.g., herbicides, mowing, prescribed burning, revegetation) and be highly site dependent. Minimizing disturbance from management activities, immediately reseeding disturbance when it occurs, and managing cheatgrass along trails/trailheads and other locations of human activity would help reduce the spread of this invasive grass.

Careful analysis of native and non-native vegetation on site, prior to herbicide treatment of noxious weeds, would help reduce the creation of cheatgrass monocultures. Herbicide treatments of areas inundated with noxious weeds and few native grasses often create cheatgrass monocultures once weeds are removed; this is clearly evident following control of areas severely degraded by leafy spurge and Dalmation toadflax which require high amounts of herbicide to kill. Vegetation management in these inundated areas should involve a complete restoration plan for the site which addresses weed control, cheatgrass suppression, and subsequent native plant revegetation.

Using large natural and/or man-made disturbances like fire to further ecological goals will be essential for managing cheatgrass, and other invasive weeds, on the landscape scale. Any of these cheatgrass control measures undertaken by the MP&R should be monitored for success to help guide future management.

4.5.2 Wildland Fire

Historically, human- and lightning-caused fires frequented MCL. The recent removal of fires from the natural ecosystem have had profound effects on MCL. A century of fire suppression

coupled with western Montana's arid climate and trends toward hotter and drier conditions may increase the risk of severe fires.

Figure 4-12 Mount Sentinel fire 2008

A fire regime is the frequency, predictability, intensity, and seasonality of fire in a particular ecosystem. Table 4-5 presents the fire regime for MCL. These groups characterize the presumed historical fire regimes within landscapes based on interactions between vegetation dynamics, fire spread, fire effects, and spatial context (Hann et al. 2003).

Based on these groupings, the majority of both the rangeland and forested cover types on MCL had historic fire return intervals of less than 35 years.

Fire regime condition class (FRCC) is the degree to which a landscape has departed from its natural fire regime (Hann et al. 2003). Departures from natural fire regimes can be caused by changes in one or more of the following ecological components:

- Vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern)
- Fuel composition
- Fire frequency, severity, and pattern
- Other associated disturbances (e.g., insect and disease mortality, grazing, and drought) (Hann et al. 2003).

Table 4-6 presents the definitions of the three FRCC classes.

GIS was used to spatially analyze the FRCC data and cross-reference FRCC classes with rangeland and forested land cover types; the two most prevalent cover types on MCL. The results of this analysis are displayed in Figure 4-13. Due to fire suppression, FRCC 2 and 3 dominate the forested and rangeland cover types on MCL. The driving forces behind this departure from natural fire regimes are fire suppression (many areas have missed multiple burn cycles), conifer encroachment, and the onslaught of non-native species.

Table 4-5 Fire Regimes on Missoula Conservation Lands

Fire Regime	Forested Acres	Rangeland Acres
≤ 35 Year Fire Return Interval, Low and Mixed Severity	210	785
≤ 35 Year Fire Return Interval, Replacement Severity	17	931
35–200 Year Fire Return Interval, Low and Mixed Severity	193	701
35–200 Year Fire Return Interval, Replacement Severity	13	561
> 200 Year Fire Return Interval, Any Severity	0	0

Table 4-6 FRCC Descriptions (Hann et al. 2003)

FRCC Class	Description
1	Low degree of departure from historic conditions (0–33% departure from average reference conditions)
2	Moderate degree of departure from historic conditions (34–66% departure from average reference conditions)
3	High degree of departure from historic conditions (67–100% departure from average reference conditions)

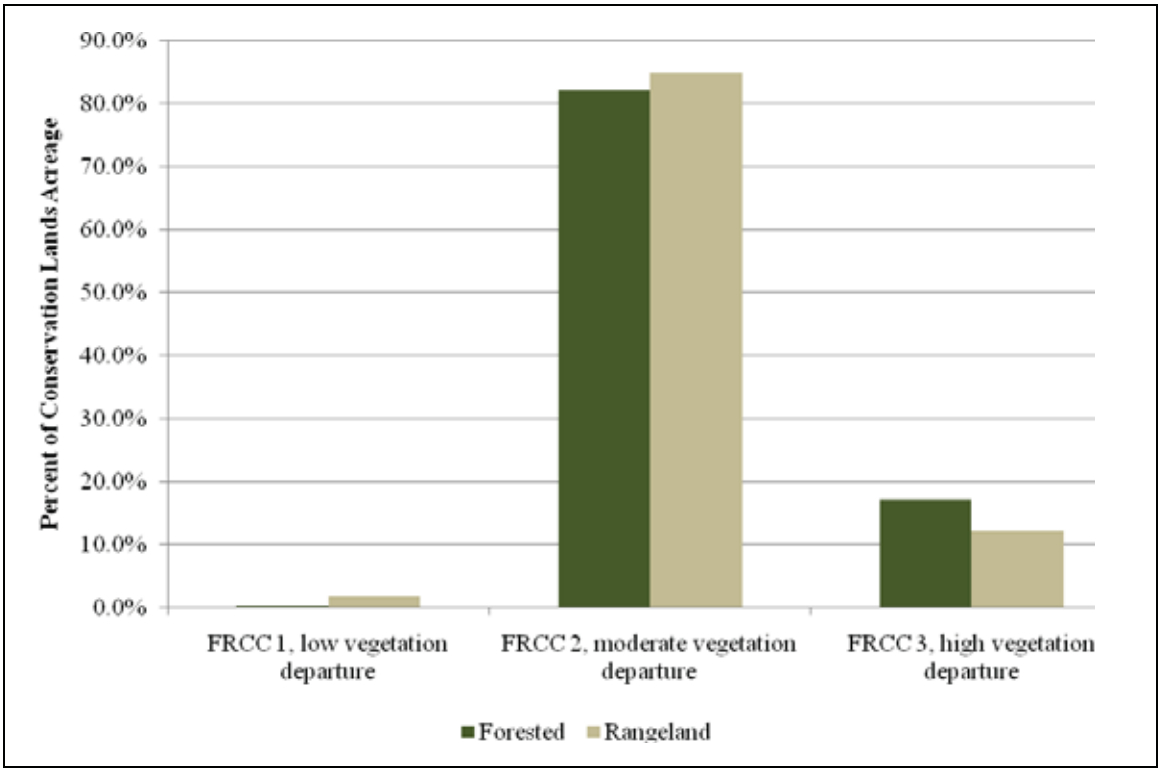


Figure 4-13 FRCC for forested and rangeland cover types on Missoula Conservation Lands

In forested areas, stands have skipped at least one burn cycle and have an overabundance of ladder fuels. As tree density increases so do live and dead fuels, increasing the risk of high-severity wildfire.

For rangeland, fire suppression has changed the species composition to less fire-tolerant and non-native species. As grasslands propagate and cure every growing season, they leave large amounts of ignitable fuel on the landscape. An increase in low-moisture, early-maturing species such as cheatgrass increases grassland flammability by adding a significant amount of fine fuels on the landscape at the height of fire season. Additionally, many of the trees on MCL grow over continuous fuel-loaded grassland, compounding the risk of fast moving high severity wildfires. The lower, nearly flat parks are at moderate fire risk due to a slower rate of spread and quick response time from fire departments. However, parkland on slopes greater than 15–20% are at high risk due to the ability of fires to move quickly up-slope; less available moisture; the abundance of surface and aerial fuels; and the lack of easy access for fire fighters.

As nearly all of MCL lie within the wildland-urban interface (WUI), as defined by Missoula's Community Wildfire Protection Plan, the City should consider the effects of wildfire on adjacent private property. With an ever-increasing number of homes constructed along the borders of MCL, it will become important to work cooperatively with adjacent landowners on fuel mitigation actions and education. Assessing fuel loads, forest/grassland restoration needs and wildfire risks within the WUI across all MCL will be critical for identifying management priorities and implementing prescribed thinning and/or burning treatments.

4.5.3 Bark Beetles

Mountain pine beetle (*Dendroctonus ponderosae*) and pine engraver beetle (*Ips spp*.) are the most common tree-killing bark beetles currently on MCL. Both are native species that play a natural role in forested ecosystems and specifically attack pines. Another bark beetle, the Douglas-fir beetle (*Dendroctonus pseudotsugae*), is present at endemic levels. However, Douglas-fir beetles preferentially attack mature trees and the MCL contain primarily young trees of this species.

Mountain pine beetles communicate via chemical messages, called pheromones, to mass attack trees. Verbenone is a commercially-available synthesized chemical that mimics the pheromone produced by mountain pine beetle and has been shown to repel attacking beetles (Gibson pers. comm.; Gibson et al. 2009; USDA 2009). Small pouches of this pheromone are placed on individual trees or in a grid pattern throughout larger forested areas where beetle protection is desired. Verbenone is more effective when infested trees are removed from the stand and less than 20% of the remaining trees are infested (Gannon pers. comm.).

Figure 4-14 Ponderosa pine infested with mountain. pine beetle, as evidenced by numerous pitch-tubes.

Pine beetle is responsible for most of the recent ponderosa pine mortality on MCL. Most mortality is occurring in small groups of ponderosa pine, measuring 5–10 inches diameter at breast height (DBH), yet some larger trees over 24 inches DBH are being infested and killed as well. Many of these trees are in young, overstocked stands that were historically grassland ecosystems and now are growing under stressed conditions. Recent drought conditions of the last decade perpetuate the poor growing conditions and make the trees less resilient to beetle attacks. Trees affected by bark beetle infestations are shown in Figure 4-14 and Figure 4-15.

Figure 4-15 Pine beetle ponderosa pine mortality of differing age classes

Bark beetle mortality has been a problem on MCL for several years, however, as of mid-August 2009, there were apparently fewer trees infested in 2009 than in 2008. Two factors may be the cause: (1) less successful brood production from the smaller infested trees or (2) adult beetles from the broods had yet to fly and attack trees, as mid-July through August is the normal flight period (Gibson pers. comm.). The general trend of the beetle infestation is not known at this time. However, until drought conditions subside and stand conditions improve, mortality will continue as natural processes work to reduce the dense numbers of conifers.

Natural agents affecting bark beetle populations are woodpeckers, predatory insects such as clerid beetles and parasitic wasps, and cold winters. These agents are less effective at controlling populations at outbreak levels. Generally, bark beetle outbreaks simply subside when beetles run out of suitable host trees. In

recent years, the Parks Department has successfully removed beetle-attacked trees from small areas of Highland Park, Rattlesnake Greenbelt and the Mount Jumbo Saddle area. It is highly recommended that MP&R aggressively manage known infestations of bark beetles across MCL.

4.5.4 Other Common Agents Causing Tree Crown Loss or Mortality

Needle disease (*Elytroderma deformans*) in ponderosa pine is characterized by dead needles at the new end of branches and some brooming and killing of branches. This native disease rarely kills pole to mature-sized trees in the area.

Western gall rust (*Endocronartium harknessii*) causes round to oval galls to develop on ponderosa pine branches and sometimes main stems. Over time, this can cause branch kill, main stem kill, and mechanical weakening of the tree (hip cankers).

Western spruce budworm (*Choristoneura occidentalis*) and the less common Douglas-fir tussock moth (*Orgyia pseudotsugata*) are sporadic defoliators of Douglas-fir in the Missoula area. However, these generally do not kill a large number of trees and no local outbreaks are currently active.

Certain herbicides can also cause tree branch and terminal deformation and tree mortality. Severity of damage is dependent on type of herbicide and rate of application.

5. RECREATION

5.1 BACKGROUND AND BENEFITS

Missoula's Conservation Lands provide significant recreation opportunities for residents and tourists. These lands are also critical to Missoula's vibrant economy (see Appendix E). Missoula's unique blend of forest, grassland, and riparian areas plus easy access to these treasures stimulates support among Missoulians for future acquisition and management of Open Space. City-owned conservation lands are critical parts in a much larger local network of recreational opportunities. The majority of MCL are adjacent to USFS, MFWP, and/or private lands with access allowed, and provide easy access to these lands for users. Most MCL have a long history, dating before public acquisition, of recreation use.

To fully appreciate the importance of recreation and education on MCL it is important to understand how and why recreation affects our quality of life. Through recreation, humans gain profound benefits in physical, mental, intellectual, social, and spiritual health. Recreation on natural open spaces connects us with nature and builds a sense of stewardship and connectedness to a place. A multitude of influential Americans like Walt Whitman, John Muir, Theodore Roosevelt, Aldo Leopold, and Henry David Thoreau have sought the solitude of the natural environment to discover and explore their social and personal identities.

Recently, multiple studies have shown the importance that nature-based activities and an active lifestyle have on individual health and quality of life. Richard Louv in his book "Last Child in the Woods" (Louv 2005) compiled compelling evidence that showed children who engage in outdoor unstructured play are likely to develop higher IQs, solve problems creatively, suffer less from ADD and ADHD and are more likely to become our future land stewards. Currently, 20% of adults in Montana are obese; if the trend continues, children born today are likely to be the first generation to live a shorter average lifespan than their parents (American Heart Assoc. 2009; Center for Disease Control 2009). It's well known that recreation can significantly improve physical health, however, mental health is also greatly improved by recreation (Hau-ho et al. 2003; Lautenschlager et al. 2004). As a majority of costs related to sickness and disease come from preventable illnesses (U.S. Dept. of Health and Human Services 2002), having no-cost, easily accessible places (like public open space and parks) for the public to recreate in likely helps more than just the individual.

Recreation is good for our society as a whole. Families who recreate together report greater stability and satisfaction (Canadian Parks Council). Recreation programs also build leadership and enhance self esteem, especially for youth from disadvantaged backgrounds (Bembry 1998). "Low crime and safe streets….and access to greenery and open space" are cited as elements crucial for a satisfactory life and for community economic development (Blaha 2009; Zieper 2000). Additional economic benefits of open space and parks are found in Appendix E.

Missoula's Conservation Lands are critical for the physical, mental, social and economic health of Missoula largely due to the outdoor recreational opportunities they provide. The challenge for land managers is to provide recreation opportunities that increase quality of life and economic stability for Missoula, while at the same time preserving the natural elements that make conservation lands desirable. Through responsible recreation, education, and stewardship, Missoula can achieve this desired balance and preserve these valuable assets for future generations.

5.2 RECREATION GOALS AND MANAGEMENT POLICIES

Each of the following goals are from Chapter 3 Overall Management and are found in Section 3.4 Recommended Goals and Policies. Only the goals that apply to recreation are addressed here. These goals and associated policies should be considered in the context of all other goals and criteria as is appropriate for each parcel or area and in the context of management priorities outlined in the Open Space and Master Parks Plans. Additionally, refer to Section 3.5, Conservation Lands Categories, for specific management priorities on any given parcel. As with all management strategies, adequate funding and resources will be necessary for full implementation.

5.2.1 Recreation Goals 1&2: Provide an Appropriate Range of Recreational Activities and Mitigate for User Impacts.

All recreational activities should be evaluated for impacts. For this reason providing an appropriate range of recreation activities, and managing those activities to reduce user impacts are closely related and will be addressed together.

Activities currently taking place on MCL include hiking, running, paragliding, hang-gliding, fishing, bow-hunting, biking, horseback riding, birding, nature study, volunteerism, dog walking, photography and much more (see Appendix G for a recreational inventory of MCL). In order to provide positive, healthy recreation opportunities for users on MCL, the land and natural ecosystems must be preserved. Further, conflicts among users must be minimal. With the sheer numbers of users and the variety of recreation pursuits, a proactive and assertive management approach is critical. The following outlines a number of tools to assist in maintaining a healthy natural ecosystem, responsible recreation, and a reduction of user conflicts.

Figure 5-1 Hikers along the Kim Williams trail

Trails:

Trails connect users to virtually all recreation opportunities; they are a very important component of the Missoula Conservation Lands system. Well designed trails, located away from protected and sensitive habitats are critical to preserving natural resources on MCL. By locating trails appropriately, providing a sufficient number, and maintaining the quality of trails, recreation use can be maximized while the negative impacts of human use can be minimized.

Trails throughout the system should:

- Be designed, built, and maintained per standards developed to provide desirable surfaces, widths, access for intended trail users, and erosion control. These standards are listed in Table 5-1.
- Be designed, built and located to minimize disturbance to native flora and fauna.
- Be repaired, rebuilt or closed if they do not meet aforementioned guidelines.
- Be completely rehabilitated to natural conditions if closed.
- Be designated by use (e.g., Pedestrian, Public non-motorized, Dogs on- or off-leash) based on objective criteria including but not limited to historic use, trail condition, grade, width, user conflict, impacts to native flora and fauna, impacts to adjacent trails/lands, enforcement capability, and priority goals for any given parcel. All trails should be signed accordingly in-the-field. Map 21 (Appendix B) shows current use designations on all current MCL trails.
- Avoid areas with threatened or sensitive habitat. If current trails negatively impact such areas they should be closed, rerouted or use should be restricted.
- Be signed by name with distances to provide direction for users and reduce "cutting" of trails.
- Be multi-modal when practical. If multi-modal, post appropriate signage on-site to notify the public.
- Connect with other trails within the City Parks and Open Space System and to those managed by adjacent land owners. When possible, management, as it pertains to use, closures and maintenance, of any trail that crosses property boundaries should be cooperative between landowners.
- Should be provided in such a way to interpret historical, cultural, geological, archaeological, and other important features of Missoula's Conservation Lands.

The trail guidelines in Table 5-1 were developed from standards outlined in the U.S. Forest Service criteria for class 4 trails (Forest Service 2005), U.S. National Parks (Fogg 1975), the International Biking Association, Felton et al. (2004) and Flink et al. (1993).

Table 5-1 Trail Guidelines

Designed Use	Hiker	Bike	Equestrian
Tread Width	18"–48"	24"–48"	48"–96"
Target Grade Range	Desirable 1–10% Max 20%	Max 15%	Max 10%
Target Cross-slope Range	3–7% Max 10%	3–7% Max 10%	5% Max 10%
Clearing Width	12"–18" outside of tread edge	36"–72" outside of tread edge	36"–72" outside of tread edge
Clearing Height	8'	8'	10–12'

Designed Use	Hiker	Bike	Equestrian
Minimum Turn Radius	4’	8’-12'	10’-12’
Surface Type	Native or imported materials	Native or imported materials	Native or imported materials
Surface Obstacles	Smooth with few obstacles. Occasional protrusions 2−3”		

Trails, much like natural waterways, are not static. Trails change over time depending on use and weather. The Parks Department should maintain accurate inventories of their trail system. Modifications of a trail's location, condition, and possibly use will occur as the system changes. As challenges present themselves, MP&R should remain both objective and flexible. Involvement of advisory committees, the Park Board, local experts and the general public in hard decisions will likely be necessary as changes need to occur.

A significant amount of user impacts along trails occurs during times when trails are icy or muddy. Users who are not prepared for conditions on the trail often walk off trail to avoid ice and mud. This leads to trail widening, braiding, and significantly impacts adjacent vegetation and soils. Additionally, some users enjoy walking two or three abreast for conversation. While this is appropriate on wider trails and roads, on single track trails this practice tramples vegetation and unnecessarily widens trails. There is a need for education on trail use etiquette and appropriate signage to reduce trail users impacts. Appropriate educational campaigns aimed at raising awareness among users about causes of trail widening and braiding is recommended.

Trailheads:

Trailheads are the “front door” for any recreational area. Trailheads are the primary interface between land managers and the public. Among other functions, a well designed frequently maintained trailhead can help reduce user impacts. They are often the site of multiple amenities including signage, kiosks, maps, parking, restrooms, and even play and picnic features. Trailheads should be welcoming, informative, and promote stewardship. In order to provide the user with an enjoyable experience, trailheads should possess necessary amenities, be appropriately sized, and be well maintained.

In total there are 63 trailheads and access points in the MCL system. Many of these were inherited by the MP&R when properties were purchased and on-site improvements have occurred sporadically over the years. To achieve continuity between trailheads across the MCL system, infrastructure at each of the following categories of trailheads should be developed as follows:

- Primary trailhead (6 total)
  Located in areas that have a number of trails or are primary origination points of trail systems and have adequate space to accommodate vehicles. Should have an informational kiosk with rules and regulations, educational information, trail maps, parking for 8-10 vehicles, bike rack, access gate, trashcan, mutt-mitts and, possibly, sanitary and picnic facilities.

- Secondary trailhead (27 total)
  Located in areas that provide access to trail systems where less developed character is

desired and have adequate space for several vehicles. Include information sign and map, parking for 2-8 vehicles, bike rack, access gate, trashcan and mutt-mitts.

- Local access point (30 total)
  Located where primarily local residents access a trail. No parking is provided in these areas. Include information sign, access gate, and depending on the site, a bike rack, and mutt-mitts.

It will be important for MP&R to maintain accurate inventories of trailhead use. If use changes over time, it may be necessary to revise services, signage and/or access at individual trailheads.

Facilities:
Facilities such as parking lots, restrooms, play areas, sledding hills, bike racks, picnic areas, and outdoor classrooms add significantly to the recreation opportunities and potential for education and stewardship programming. Some facilities also assist in addressing increased use due to population growth. Criteria for development and capital improvements should be developed with the following considerations:

- Infrastructure development should be minimized on MCL (see conservation lands categories definitions in chapter 3.5).
- Improvements should serve a particular purpose and goals specific to the area or the trailhead, based on potential impacts to the environment versus benefits to the users and the environment.
- Education facilities should be designed to enhance stewardship of the lands and minimize impacts of field learning.
- Health and sanitation must be considered for all MCL trailheads, therefore garbage receptacles and restroom facilities may become essential at some sites.

Maps:
Accurate, easy to use maps of MCL and trails are essential to developing knowledgeable users. Maps are communication tools that assist users in choosing routes and understanding rules and regulations. Additionally, quality maps enhance the user's experience and their ability to recreate responsibly. Successful land management requires quality, accurate, user-friendly maps be available to the public around town, at primary and secondary trailheads, and on the Web. While several locally available paper maps of MCL exist, few up-to-date maps exist at trailheads and little is available on the Web.

Signage:
Accurate, universal, easy to understand signage on trails and at trailheads communicate important messages to users. All MCL should have a level of signage including, but not limited to, parcel name, trailhead names, trail names, rules and regulations for the area, interpretive information, seasonal and temporary closures, directions, and emergency contact information.

Over-signage should be avoided whenever possible to maintain viewshed. The Conservation Lands Program should inventory all signs across the system, and work to standardize all signage. A prototype for signage at trails and trailheads, as well as other important MCL areas, should be developed. Information on new signs should be concise and to the point.

Education and Outreach:

Successful public land management must include opportunities to engage users and potential users as stewards of the land. Partnerships with local resources like the Montana Natural History Center, public schools, the University of Montana, and others is essential to create rewarding educational opportunities for the public. Users who understand the history, culture, ecology, and management of MCL are much more likely to respect the land, abide by regulations, and provide support for future acquisition and management of MCL. The CLP should include direct outreach and education as well as develop partnerships with the public, private, commercial, and non-profit sectors who share common conservation-minded goals. Guided and interpretive hikes, in-class presentations, signage, interpretive kiosks, media stories, and volunteer events are some of the options available to enhance education and outreach.

Stewardship and Volunteerism:

The management of MCL provides many opportunities for citizens to volunteer their time, expertise and labor; giving back to the community. The MP&R should encourage well-managed volunteer stewardship projects on MCL. A well developed volunteer program is an excellent form of both recreation and stewardship. A program to encourage volunteerism should be developed within MP&R. A successful volunteer stewardship program should include options for all ages and interest groups to engage in short- and long-term volunteerism. Short-term special events such as nationally recognized volunteer days (e.g., National Trails Day, National Public Lands Day, Earth Day, etc.) or long-term stewardship of an area through "adopt-a-trail or parcel" programs, would be successful components of a volunteer program.

Special Events:

The desire to host large races, walks, demonstrations, orienteering or other special events on public open space is growing. It is very important for MP&R to weigh the benefits versus the impacts of such events on MCL before allowing them to occur. The following guidelines should be considered when permitting events on Conservation Lands:

- Each event needs to be individually permitted through a process, similar to those used by other public lands agencies. The current MP&R "interim permit" for conservation lands special events (see Appendix F) is a good start but needs to be reevaluated following adoption of this plan.
- Charge a sufficient fee to cover all direct costs and easily identified indirect costs incurred in allowing the event.
- Require reservation and deposit fees to cover costs of restoration if event causes damage.
- Charge an additional surcharge or fee and dedicate this fee to special projects on Conservation Lands.
- Limit and restrict the events based on the specific type of event, time, season, numbers, anticipated pre-event use (practice), hazards and risks.
- Route events on those trails that are well constructed and will not be negatively impacted by additional use surrounding such events.
- Restrict the total number of events or user days per year (or season) and per trail to minimize

cumulative environmental impacts and user conflict.

- All events must remain on-trail and provide a parking/transportation plan, sanitation plan, and resource protection plan as part of the application process.

- Events should not be permitted during closures or during times of year when habitats are most sensitive.

Regulation and Enforcement:
Unfortunately, quality design, excellent trails and trailheads, top-notch education and programming is not enough to successfully mitigate user impacts on MCL. Ordinances, rules, and regulations to manage human use and activity must be developed. Once rules are established they will require at least minimal enforcement by trained enforcement officers. Enforcement must include fines, sentences or community service commensurate with the offense. It should be noted that a vast majority of users prefer at least minimal levels of enforcement. Enforcement assures users and neighbors a sense of fairness, safety, and lawfulness. It also demonstrates the importance of the regulations in reducing conflicts and preserving the place. As the majority of MCL are inaccessible by vehicle, little actual enforcement of park rules and regulations occur. The Parks Department should pursue creation of a part-time enforcement officer/park ranger to patrol MCL.

Evaluation, Assessment, Adaption:
All recreational and educational events should be evaluated for impacts to the conservation values and established uses. Levels of recreational use should be periodically monitored to track use trends across the system and monitor for impacts to conservation values.

The Parks Department shall maintain the ability to close trails and individual parcels to any use if it is creating or has the potential to damage natural and/or cultural resources. In instances where user conflicts are high, the Parks Department shall evaluate appropriate solutions; depending on available resources, this may entail reducing the use level.

In addition, the Parks Department should conduct and encourage research, monitoring and surveying as important tools to determine successes and strategies for adaptive change.

Mitigation Goals and Tools:
As with most behaviors, prevention, education, and enforcement are the best tools. However, mitigation is sometimes required. Following is a list of tools that might be used to effectively mitigate past or future issues on MCL.

- Close and restore unauthorized trails immediately.

- Aggressively manage for weeds at trailheads and along trails to reduce spread.

- Immediately remove unauthorized structures such as camps, bike ramps, and hunting stands to name a few.

While motorized vehicles are critical for the maintenance of Conservation Lands, land managers shall work to minimize maintenance vehicle access to all properties when possible. Driving off-road is highly discouraged except when necessary to maintain the property. Any

extensive maintenance projects, where vehicular use will be concentrated in an area for an extended period, should include a restoration plan.

5.2.2 Recreation Goal 3: Use Lands for Educational Activities

The use of MCL for outdoor educational activities is highly encouraged. Through classes, field trips and research, stewardship grows within our community and we gain important knowledge for land management. The CLP should adopt and implement the following priorities as possible:

- Develop a volunteer program including recruitment, orientation, training, supervision, tracking and recognition. Consider hiring a trained volunteer coordinator to develop and manage the program and to coordinate the program with MP&R's successful teen work-reation program and other volunteer programs across the city. Open the volunteer program to all ages, service clubs, student groups, businesses and interest groups.
- Involve the public in restoration efforts, closures, and policy development as a means to increase education about management activities.
- Encourage outdoor classroom and experiential education and recreation.
- Use all media resources and the Web to communicate management activities, education, and recreation opportunities and to promote the individual, community, environmental, and economic benefits of Missoula's Conservation Lands.
- Communicate management activities through field trips, classes and presentations.
- Encourage educational research on lands where and when appropriate and when benefits for land management policy or adaptation are likely.

Figure 5-2 Educational group on Missoula Conservation Lands

5.2.3 Recreation Goal 4: Manage Conservation Lands and Adjoining Lands Cooperatively for Connectivity

Maintain, enhance, and encourage landscape connectivity between Conservation Lands, other park lands, and other pertinent landscapes in order to enhance conservation and recreational use values. If opportunities exist for increasing connectivity between parcels, and increased connectivity is ecologically and socially acceptable, pursue the opportunity.

It is critical to maintain collaborative working relationships with neighboring landowners. Strive for mutually beneficial agreements that promote the management goals outlined in this plan. For example, look for opportunities to improve wildlife passage by removing boundary fencing or replacing it with wildlife-friendly

fencing on private or other publicly owned lands.

5.2.4 Recreation Goal 5: Interpret and Protect Important Anthropological, Historical and Ecological Themes

Protection of cultural and ecological resources should include public education about the resource's value. Actively seek opportunities to partner with other entities to increase interpretative educational opportunities, where appropriate, throughout the system.

Maintain an inventory of important anthropological, historical, and ecological resources. Use this inventory to determine the need for interpretation and protection of appropriate resources.

Increase interpretative signage at major trailheads where opportunities exist (e.g., Waterworks Hill, Cherry Street, Pattee Canyon gasworks, and Tower Street Conservation Area). Maintain and, if needed, update interpretative signage already in place across the system (e.g., Greenough Park's Bolle bird loop, the Lincoln Hills trailhead kiosk and *Trail to the Buffalo* brochure, Bancroft Ponds kiosk, Cattail Corner interpretative panels).

The Missoula valley viewshed combines natural and cultural elements establishing a sense of place for people who live in and visit the valley. Natural elements (although somewhat modified in recent years) include moderately steep grassland slopes with woody draws and scattered conifers. Three major rivers and many creeks flow through the valley. Most notable are the Clark Fork, Bitterroot, and Blackfoot Rivers.

Residents and visitors also value the cultural enclaves within the valley. These include the historic Fort Missoula Military Complex, the Moon-Randolph Homestead, globally rare plant communities on the North Hills, and isolated more recent cultural elements such as the "L" on Mount Jumbo, the "M" on Mount Sentinel, and the peace sign on Waterworks Hill (recently reestablished from its original ridgeline tower location, downhill onto land owned by the Jeanette Rankin Peace Center).

All and all, MCL provide much of the backdrop that visually distinguish Missoula from other communities and should be managed as important aesthetic assets.

6. IMPLEMENTATION STRATEGIES

A summary of all action items are included below. Many are general suggestions and may need to be modified to fit specific situations. Development of these implementation strategies was guided by the CLMP Working Group's (CWG) goals and policies (Section 3.4). General themes from all CWG goals and policies are addressed throughout this chapter with specific goals addressed in the recreation section (Section 6.5). Information about necessary funding for these projects, an important component of CWG's Goal 8, is provided in Sections 6.7- 6.9.

6.1 GENERAL MANAGEMENT

The Missoula Parks & Recreation Department should assure that their management structure is efficient and streamlined.

Currently, MP&R and the Park Board are advised by three separate citizen advisory groups (Figure 1-2). The number of special focus or specific parcel-based advisory groups for MCL should be reduced to maximize use of staff resources and advisory group involvement. The City should strive for comprehensive management of MCL as a system. Input from advisory groups will be more effective if the group has a comprehensive understanding of the MCL system (versus a parcel-specific viewpoint). Creation of a single MCL advisory group is recommended in lieu of the three advisory groups that currently exist.

A forum of adjacent large landowners and organizations on adjacent properties (e.g., FVLT, SOS/RLT, USFS, MFWP, Missoula County, and private landowners) should meet annually to collaborate on management practices.

General maintenance should remain adaptive. While the criteria and goals outlined in this plan provide a framework for maintenance, the CLP should expand its ability to monitor the effects of management activities and allow findings to improve maintenance standards.

The Conservation Lands Manager should work closely with the Open Space Advisory Committee to evaluate future acquisitions before purchase.

Parks Department personnel should be expanded over time to include the following staff positions:

- A Parks Ranger or police officer who enforces rules and educates the public about responsible recreational use.
- A Volunteer Coordinator.
- A Research Specialist who would conduct research and monitoring on the Conservation Lands.
- A Grant Writer who would work on grants for all Parks Department programs.
- Add additional seasonal labor staff, approximately 3 FTE, to adequately address management and maintenance of current MCL.
- Add adequate budget, at approximately $120/ac. (2009 figures see section 6.8) for management

and maintenance of current and future open spaces.

6.2 SOILS

Avoid applying pesticides that are prone to leaching in areas with water tables at shallow depths (less than 10–15 feet) or where soils have a high leaching potential.

On soils with erosive characteristics, design trails at grades sufficient to minimize erosion and incorporate erosion controls into construction. If possible, avoid trail construction on highly erosive soils.

Work to minimize sheep trailing on highly erosive soils.

6.3 WILDLIFE

6.3.1 Mount Jumbo Seasonal Restrictions

No change in current management is recommended. The Mount Jumbo Management Plan is still fully appropriate as it pertains to seasonal restrictions on Mount Jumbo. The City should periodically revisit the enforcement compliance and cost issue to determine if changes are needed. Additionally, the City and/or MFWP should continue to initiate media coverage of the need to comply with elk winter restrictions, provide the public with education about winter restrictions, enforce winter restrictions, and monitor results of the winter restrictions.

6.3.2 Bighorn Sheep/Domestic Sheep Protocol for the City of Missoula

Follow existing protocol, developed with MFWP, for bighorn sheep/domestic sheep in the City of Missoula.

6.3.3 Mule Deer on Mount Sentinel

Additional actions to protect mule deer are not recommended at this time. The City should ask MFWP and/or the City's wildlife subcommittee to periodically evaluate the situation and make recommendations as needed.

6.3.4 Elk in the North Hills

Cooperate with MFWP, the National Wildlife Federation, and the Missoula Ranger District as needed to control the North Hills elk population and limit the process of habituation.

6.3.5 Habitat Connectivity

Improve connectivity between the Line/Rimel/Hayden conservation easement and Moose Can Gully as the City and MFWP deem appropriate.

6.3.6 Minimizing Potentially Dangerous Wildlife Interactions

Increase the usage of bear resistant trash cans at trailheads within bear conflict zones and/or develop appropriate bear management plans to comply with Missoula's recently adopted garbage ordinance.

The Parks Department should continue supporting MFWP's education program aimed at decreasing the food-conditioning of bears.

Because of the history of human-lion confrontations in Missoula County, MP&R should continue support of MFWP's "living with lions" program and lion control actions.

The Parks Department should periodically re-evaluate with MFWP opportunities for bow-hunting on MCL for elk, mule deer and white-tailed deer.

6.3.7 Reducing Impacts on Wildlife

Restrictions due to wildlife conflict on Missoula Conservation Lands are a controversial issue. Relevant factors include habituation of mule & whitetail deer, and elk, and impacts of humans and dogs on other species.

Mule deer populations on Mount Sentinel, city white-tailed deer populations, and North Hills elk populations seem to be stable and increasing. Given these data, additional restrictions to public access on city-owned winter range (beyond the Mount Jumbo closure) are not necessary at this time.

We recommend the following measures to reduce the impact upon avian species of concern:

- Initiate a volunteer working group including Audubon, MFWP, Avian Science Center, and other interested citizens to identify those parcels most valuable to nesting birds and most at risk from human disturbance and explore appropriate restrictions if applicable.
- Have the working group develop a public education program to inform the public on appropriate behaviors to be used in critical nesting habitat during nesting periods. The working group should explore multiple venues including mass media for making the information available.

As discussed in section 4.2.2.5, dogs, and humans to a lesser extent, both can negatively impact wildlife populations. Expanding enforcement of existing restrictions, increasing public education about the impacts on wildlife and monitoring dog and human–related impacts are needed.

As both the Missoula Conservation Lands system and use of the system grows it is highly recommended that trail design and location considers impacts on wildlife. A well designed system may limit the need for future restrictions. The Audubon Society guidelines of recommended buffers for wildlife are presented in Table 6-1 (Ellis and Richard 2008) and provide a good reference for minimizing impacts on wildlife.

Table 6-1 Recommended Buffers for Wildlife (Ellis and Richard)

Wildlife	Desired Width
Bald eagle	1,320 feet
Nesting heron, cavity nesting ducks	600 feet
Pileated woodpecker	450 feet
Beaver, dabbling ducks, mink	300 feet
Bobcat, red fox, fisher, otter, muskrat	330 feet
Amphibians and reptiles	100–330 feet
Belted kingfisher	100–200 feet
Songbirds (dependent upon species)	50–660 feet

In cottonwood bottomlands and pine forests, if public safety is not threatened, large dead standing snags should be left undisturbed to provide nesting sites for cavity nesters like the Lewis' woodpecker and the flammulated owl.

6.3.8 Fisheries Habitat

MP&R should ask MFWP to further assess the impact of human-constructed dams in Rattlesnake Creek on migrating bull trout including providing evidence from radioed fish that exhibit proof of restricted movement as such data are available. If human-constructed dams are restricting bull trout migrations MP&R should support efforts to reduce these dams.

Restoration of appropriate riparian vegetative buffers (minimum of 25 feet from high water mark) along all parcels of MCL that border Rattlesnake Creek and the Clark Fork River will enhance habitat and reduce run-off into the waterway.

6.4 VEGETATION

6.4.1 Treatments to Improve Forest Health and to Reduce Wildfire Risk

6.4.1.1 Tree Thinning and Pruning

Thinning should be done in all conifer dominated forests on MCL to reduce ladder fuels and inter-specific competition, to promote larger, fire resistant trees, and to address wildfire threats along the WUI. Where applicable, trees that remain should be left in even clumps versus a uniform stand. This type of tree thinning would simulate natural wildfires and restore the historic appearance of open forests and grassland. All slash should be burned, chipped or removed from site.

Thinning of trees larger than eight inches DBH could involve timber harvest and sale which would off-set the cost of thinning. Ground-based, low-impact equipment should be used on gentle ground, but on steeper slopes helicopter removal of trees may be the only option.

Ponderosa pine slash should not be created during the winter and early spring without immediate follow-up treatment. The slash must be removed from the site, chipped, and/or piled and burned to avoid infestation by the pine engraver beetle and brood flight to attack adjacent green trees.

Quaking aspen clones are mostly declining, being overtopped and out-competed by conifers. Conifer removal from within and around these clones would maintain or enhance aspen vigor and promote aspen regeneration.

Pruning can greatly reduce the likelihood of a grass fire (surface fire) spreading into the crowns of the conifers (crown fire). Pruning is especially important in parks where homes and other developments, are immediately upslope of densely forested areas, such as Highland Park and where adjacent homes would be subjected to a shower of fire embers from crown fires.

Not all trees need to be pruned. Trees should be selected for pruning based on crown-fire

potential, distance from structures, and desirability.

Pruning should be done at variable heights for aesthetics to avoids a uniform 'browse' line appearance. While some trees may still burn during a grass fire, strategically pruned trees could prevent an intense continuous crown fire from developing.

6.4.1.2 Bark Beetle Management

Recently attacked green trees containing developing beetle larvae should be felled and disposed of prior to adult beetles taking flight (DNRC 2009; Gibson pers. comm.). This removes a large number of beetles that would otherwise take flight and attack mostly adjacent green trees.

Previously attacked, red, dead trees generally no longer contain beetles but should be removed to reduce fire danger, with the exception of select larger diameter trees that may offer habitat for animals.

Verbenone packets should be utilized to temporarily protect high-value individual and stands of trees. However, without altering the existing stand conditions (unnaturally dense trees), re-treatment must occur every spring prior to beetle flight and be continued for as long as beetles are in an area.

Spraying individual or groups of trees with insecticides (e.g., carbaryl or pyrethroids) prior to beetle flight effectively prevents most beetle attacks. This is an effective treatment where a few highly desirable trees are selected for protection.

6.4.1.3 Legacy Trees

High-value, old-growth, and culturally significant trees should be protected as legacy trees for future generations. Survival of legacy trees can be increased by thinning and removing ladder fuels from around selected trees.

Figure 6-1 Dense fire prone forest on Missoula Conservation Land

This would include raking existing duff mounds. Duff mounds are the fuel, mostly needles and bark that have accumulated for decades around the base of a tree (Harrington 2007; Hood 2009). Duff mound removal around legacy trees would

decrease the chance of root collar killing during a grass fire.

Given the high stocking rates within conifer-dominated forests on MCL, most trees will die in the event of a wildfire. As forests are managed to restore more natural conditions, treatments aimed at allowing individuals or groups of individuals to survive would allow some trees to mature into future legacy trees.

6.4.1.4 Funding

As the Parks Department can currently only address beetle kill, thinning and wildfire risk where liability is an issue, they must develop funding sources to adequately address forest health. The Parks Department currently manages approximately 445 acres of conifer forest that are in need of thinning. The cost estimate for this large project is shown in Table 6-2.

Table 6-2 Forest Health Cost Table

Acres	Cost	Total Cost
445	$1,500/acre	$667,500

6.4.2 Restoration and Vegetation Management

6.4.2.1 Restoration Priorities

Prioritization of restoration needs is greatly facilitated by comprehensive inventories and planning. The Conservation Lands Program, with assistance from the Missoula County Weed District, has already made significant strides towards accessing the health of native grasslands on Mount Jumbo, Mount Sentinel and the North Hills (Table 4-3 & Map 20, Appendix B). This effort should be expanded to include grasslands on all conservation lands and other habitat types.

Given current budgetary constraints, restoration of native grasslands should prioritize areas where a significant component of the native plant community is still intact. Areas designated in Table 4-3 as "Pristine" and "Native Dominant" will require less resources to restore (Table 6-3) and management actions will likely be more successful.

Long-term comprehensive restoration plans for grasslands designated in Table 4-3 as "Weed Dominant" and "Inundated" should be developed. Progress in these areas will likely take decades and require an on-going commitment of resources (Table 6-3). Plans should remain adaptive to incorporate new findings.

Table 6-3 A Conservative Estimate of Grassland Restoration Costs Across a Five Year Period Assuming Best Case Scenarios.

Vegetation Class	Acres	Year 1 Cost per Acre	Year 2 Cost per Acre	Year 3 Cost per Acre	Year 4 Cost per Acre	Year 5 Cost per Acre	Total Cost
Pristine	338.49	$80.00	$80.00	$40.00	$24.00	$14.40	$80,696.02
Native Dominant	957.66	$110.00	$110.00	$55.00	$33.00	$19.80	$313,920.95

Vegetation Class	Acres	Year 1 Cost per Acre	Year 2 Cost per Acre	Year 3 Cost per Acre	Year 4 Cost per Acre	Year 5 Cost per Acre	Total Cost
Weed Dominant	1072.91	$200.00	$200.00	$150.00	$90.00	$54.00	$744,599.54
Inundated	594.39	$330.00	$330.00	$247.50	$185.60	$139.20	$732,466.80
Total	2963.45	$543,152.50	$543,152.50	$374,258.93	$246,607.22	$164,12.15	$1,871,683.30

Fire is an important component of native Montana habitats. Where applicable the City should incorporate fire as a tool to help in the restoration and maintenance of natural habitats.

Conifer encroachment into native grasslands should be aggressively managed.

Riparian areas along the Clark Fork River and Rattlesnake Creek are very important for wildlife habitat and ecosystem function and should be managed accordingly. Native vegetation buffers, a minimum of 25 feet in width, adjacent to these waterways should be restored where they are absent.

Cottonwood forested bottom lands are threatened across much of the West. Regeneration of these forests depends greatly on seasonal flooding. On properties like the Tower Street Conservation Area, management activities should not hinder the natural flow of the Clark Fork River. In Greenough Park, where cottonwood forests are severely impacted by invasive Norway maples, maple removals and subsequent restoration of native forests should be a priority for management of this park.

Missoula is home to a number of restoration oriented non-profits, student groups and clubs. A fair portion of Missoulians are both nature-oriented and civically engaged. The CLP should take full advantage of these local resources and actively engage the public in restoration activities.

Restoration of any natural system can be difficult and results may be highly site-specific. The CLP should develop a research & monitoring program to ensure efficient management of natural systems.

6.4.3 Vegetation Management

Protection of pristine and/or mostly intact native plant communities should be the foremost vegetation management priority.

Weed management should be holistic and site-specific. Narrow-minded goals of simply killing weeds are not sufficient to actively restore native plant diversity on a site. Weed management must consider the end-goal of protecting and promoting native plant diversity.

Manage for weeds using an integrated approach including revegetation (considering passive vs. active restoration), herbicides, erosion controls, fire, monitoring, hand pulling, grazing, biocontrols, mowing, community involvement and education, and/or the ability to use natural phenomenon to your advantage (e.g., weed control after a fire, reseeding during wet years, etc.).

Control and possible eradication of new invaders (examples listed in 4.6.1) should take priority over general control of widespread weeds.

Non-native, invasive plants that are not listed on the State's noxious weed list should be actively controlled on conservation lands defined as "Park Preserves" (Map 1, Appendix B). On "Public Natural Areas" and "Urban Parklands with Special Resources Present" (Map 1, Appendix B) management of unlisted non-native plants should be left to the discretion of the Conservation Lands Manager and based on the management goals for that particular parcel.

Active management plans, including monitoring, to address cheatgrass infestations on MCL should be developed. Collaboration on projects designed to restore cheatgrass infested rangeland should be pursued.

As many of these vegetation management tools commonly come up against community critique (e.g., fire, herbicides, grazing and biocontrols) and monetary deficiencies (monitoring, education, large-scale active restoration projects) the Parks Department should increase public education and seek funding accordingly.

6.5 RECREATION

6.5.1 Provide an Appropriate Range of Recreational Activities and Mitigate for User Impacts

Trails:

Design, build and maintain trails according to guidelines listed in Table 5-1. An inventory of current new trail construction and trails requiring rehabilitation/reroutes with associated costs is listed in Section 6.9.

Develop criteria matrix and protocol for trail design, location, recreational use, interpretation, etc., as outlined in Chapter 5.

Develop educational programs to address trail widening, braiding, and off-trail recreational impacts.

Name and sign trails.

Encourage public adoption of trail maintenance.

Trailheads:

Develop and implement prototype signage, interpretive kiosks and amenities for each trailhead type.

Maintain an inventory of trailheads based on designation (primary, secondary, local access) and modify amenities as necessary. Upgrades needed at current trailheads are addressed in Section 6.9.

New access points should be considered on MCL that lack public access and/or can sustain a higher level of use.

Facilities:

Provide improvements based on potential impacts to the environment versus benefits to the user.

Maps:

Design maps as primary communication tools for users and post at trailheads, on the Web, and in print.

Signage:

Develop prototype for trails and trailheads, as well as other city-owned conservation areas.

Install signage as resources allow with goal of installing signage before land is accessible to public.

Education and Outreach:

Encourage and promote education programs and activities that achieve or reinforce the goals of the CLP as outlined in this plan

Stewardship and Volunteerism:

Develop programs to encourage volunteerism and stewardship.

Special Events:

Develop a permitting process and criteria for events on MCL that adheres to the goals and policies of the CLP and this plan.

Regulation and Enforcement:

Pass ordinances that support the Conservation Lands Program and the goals and policies of the Conservation Lands Management Plan.

Secure budget for adequate and qualified enforcement officials.

Evaluation, Assessment, Adaption:

Conduct and encourage research, monitoring and surveys as important tools to determine successes and strategies for adaptive change.

Mitigation Goals and Tools:

Close and restore unauthorized trails immediately.

Aggressively manage for weed control at trailheads and along trails to reduce spread.

Immediately remove unauthorized structures from MCL.

6.5.2 Use Lands for Educational Activities

Involve the public in restoration efforts, closures and policy development as a means to increase education about management activities.

Encourage outdoor classroom and experiential education and recreation. Current MCL which may be able to support more developed nature-based education facilities include: Bancroft Ponds, Tower Street Conservation Area, and when developed, the Knife River JTL site east of McCauley Butte.

Increase media presence as it relates to stewardship, recreation and benefits of conservation lands.

6.5.3 Manage Conservation Lands and Adjoining Lands Cooperatively for Connectivity

Prioritize cooperative management of conservation lands. Cultivate collaborative working relationships with neighboring landowners.

Where and when possible connect lands of conservation values.

6.5.4 Interpret and Protect Important Anthropological, Historical and Ecological Themes

Add interpretive trails and signage to conservation lands.

6.6 PUBLIC HEALTH AND SAFETY

6.6.1 Dogs

The Conservation Land Manager, in consultation with specialists, should impose restrictions on dogs and/or humans to avoid wildlife conflict, damage to sensitive areas, or user conflicts.

Public education including signage and active outreach should be implemented regarding dog and/or human use of MCL.

The mutt-mitt stations and lend-a-leash program should be extended to include additional areas with dog conflict.

6.6.2 Bears

The Parks Department should add bear resistant trash cans to the system where they are needed (six at Mount Jumbo trailheads, three at North Hills trailheads, three along Rattlesnake Trail, one each at the Mount Sentinel and Tower Street Conservation Area trailheads, and one on the Kim Williams Trail) to become compliant with the current Missoula garbage ordinance.

6.7 REVIEW OF MISSOULA'S CONSERVATION LANDS PROGRAM BUDGET

MP&R's Conservation Lands Program FY2010 budget, without weed lot maintenance (biannual mowing of small parcels and road right-of-way around the city), is $248,670. As MP&R manages 3,592 acres, the CLP has approximately $69/acre for management. This figure is significantly smaller than all peer cities surveyed (Table 6.4).

Table 6-4 shows Missoula's peer cities' annual management budgets per acre for conservation land, or equivalent types of land, management.

Table 6-4 Peer-City Budget Comparison

City	Population	Acres	Cost/Acre
Boulder, Colorado	94,171	39,258	$253
Eugene, Oregon	150,104	2,814	$612
Fort Collins, Colorado	136,506	33,000	$160
Helena, Montana	29,351	>2,140	$129
Missoula, Montana	68,202	3,592	$69
Portland, Oregon	557,706	>7,000	$250

6.8 NECESSARY BUDGET FOR MISSOULA'S CONSERVATION LANDS PROGRAM

Missoula, Montana; Helena, Montana; and Fort Collins, Colorado have the smallest budgets per acre of conservation lands or equivalent lands. The average of their management expenditures (including Missoula) is approximately $120 per acre. To effectively meet the goals and objectives stated in this plan and to maintain a healthy conservation lands system, the City of Missoula needs to increase funding of these lands. A budget of $120 per acre (2009$) is recommended to provide consistent, ongoing maintenance of MCL. This figure does not include any capital improvement projects, additional necessary or replacement equipment, or any significant restoration projects. Given current budgetary constraints on the City of Missoula and the fact that MP&R is not an emergency service so does not receive priority

funding, it is highly recommended that MP&R pursue supplemental funding strategies.

Development of a park maintenance district to adequately fund routine maintenance, management, and the implementation of this management plan should be pursued. Additionally, or in the interim, creation of a grant writing position to increase the ability of MP&R to pursue additional outside funding is recommended.

6.9 ADDITIONAL CAPITAL IMPROVEMENT PRIORITY PROJECTS AND MAJOR RESTORATION PROJECTS

In addition to the budget for ongoing maintenance, the CLP is in need of funds for several priority projects immediately necessary to address growth and habitat protection. These projects were described in Sections 6.3-6.5 and include:

- Rehabilitation and/or reroute of 9.78 miles of trail inventoried by MP&R due to poor design and/or impacts on natural resources.
- Construction of 1.69 miles of new trail (Map 21; Appendix B) to maintain connectivity, increase recreational opportunities and preclude establishment of user created trails.
- Purchase and installation of 15 bear resistant trash cans in known bear conflict zones.
- Upgrades to existing trailheads, signage and maps.

These priority projects are immediately needed to address deficiencies across the system due to a historic lack of funding for these lands. All cost estimates for these projects were calculated based on actual 2009 expenditures and are provided in Table 6-5.

Aside from the priority projects, two large-scale, long-term habitat restoration projects needed on MCL include extensive grassland restoration and forest health. Both of these projects will include a significant commitment of time and resources in the short-term (next 5-10 years) with continual maintenance beyond that. However, the longer these projects are delayed the larger the problems will become and the more they will cost to repair. A rough cost estimate for these projects were shown in Table 6-2 and Table 6-3.

Table 6-5 Additional Project Costs Based on Actual 2009 Figures.

Project	Cost	Units	Total Cost
Primary trailhead upgrade	$15,000	4.00	$60,000
Secondary trailhead upgrade	$470	27.00	$12,690
Secondary trailhead map design	$1,500	1.00	$1,500
Local trailhead upgrade	$200	10.00	$2,000
Bear resistant trash cans	$695	15.00	$10,425
Bear resistant trash can labor	$6,008	1.00	$6,008
Trail rehabilitation and reroutes	$4,591	9.78	$44,900
Trail construction	$6,712	1.69	$11,343
Total			**$148,866**

7. REFERENCES

Arno, Stephen F. and Carl E. Fiedler. 2005. *Mimicking nature's fire: Restoring fire-prone forests in the west.* Washington, D.C.: Island Press.

American Stroke Association and American Heart Association. 2009. A Nation at Risk, http://strokeassociation.org/downloadable/heart/1114880987205NationAtRisk.pdf. (accessed 2010)

Banks, Peter B. and Jessica V. Bryant. 2007. Four-legged friend or foe? Dog walking displaces native birds from natural areas. *Biology Letters* 3, 611—13.

Baty, G. R. 1995. Resource partitioning and browse use by sympatric elk, mule deer, and white-tailed deer on a winter range in western Montana. Thesis. University of Montana.

BEA. (U.S. Bureau of Economic Analysis). 2009. *Local Area Personal Income, Table CA30*. www.bea.gov. (accessed .

Belant, J. L., T. W. Seamans, and C. P. Dwyer. 1996. Evaluation of propane exploders as white-tailed deer deterrents. *Crop Protection* 15, no. 6 575–8.

Bembry, Reco. 1998. A Youth Development Strategy: Principles to Practice in Re-creation for the 21st Century . *Journal of Park and Recreation Administration*, 17(2), 15-34.

Berner, K. L., C. E. Fiedler, and D. H. Pletscher. 1988. *White-tailed deer winter habitat use in western Montana second-growth forest*. Research Report No. 2. Missoula, MT: Montana Forest and Conservation Experiment Station. September.

Blaha, Kathy. 2009. How Urban Parks Could Become a National Priority by Vice President for National Programs and Director of the Green Cities Initiative, Trust for Public Land, Federal Affairs Office, Washington D.C. http://www.pps.org/topics/forreview/blaha1 (accessed 2009).

Burcham, Milo, W. Daniel Edge, and C. Les Marcum. 1999. Elk use of private land refuges. *Wildlife Society Bulletin* 27, no. 3 833–9.

Canadian Parks Council. 2005. Health by Nature. http://www.interenvironment.org/cipa/Healthy%20by%20Nature.pdf (accessed 2010)

Cassirer, E. F., D. J. Freddy, and E. D. Ables. 1992. Elk response to disturbance by cross-country skiers in Yellowstone National Park. *Wildlife Society Bulletin* 20, 375–81.

Centers for Disease Control and Prevention: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5536a1.htm. (accessed 2010)

Cleveland, Shawn. August 2009 & March 2010. [Personal communication]. Masters Student. University of Montana, Wildlife Biology Program. Missoula, Montana.

Cornell Lab of Ornithology. 2009a. *All about birds: Bank swallow*. http://www.allaboutbirds.org. (accessed August, 2009a).

———. 2009b. *All about birds: Belted kingfisher*. http://www.allaboutbirds.org. (accessed August, 2009b).

———. 2009c. *All about birds: Gray catbird*. http://www.allaboutbirds.org. (accessed August, 2009c).

———. 2009d. *All about birds: Killdeer*. http://www.allaboutbirds.org. (accessed August, 2009d).

———. 2009e. *All about birds: Lewis woodpecker*. http://www.allaboutbirds.org. (accessed August, 2009e).

———. 2009f. *All about birds: Northern shrike*. http://www.allaboutbirds.org. (accessed August, 2009f).

———. 2009g. *All about birds: Song sparrow*. http://www.allaboutbirds.org. (accessed August, 2009g).

———. 2009h. *All about birds: Sora*. http://www.allaboutbirds.org. (accessed August, 2009h).

———. 2009i. *All about birds: Spotted sandpiper*. http://www.allaboutbirds.org. (accessed August, 2009i).

Crompton, John L., Lisa L. Love, and Thomas A. More. 1997. An empirical study of the role of recreation, parks and open space in companies' (re)location decisions. *Journal of Park and Recreation Administration* 15, no. 1 (Spring 1997): 37-58.

DNRC. 2009. Mountain Pine Beetle. http://dnrc.mt.gov/forestry/Assistance/Pests/mtnpinebeetle.asp. (accessed .

EDAW. 2004. *Master parks and recreation plan for the greater Missoula area*. May.

Edwards, Vickie. 2010. [Personal communication]. Wildlife Biologist: Montana Fish Wildlife and Parks. Missoula, Montana. February.

Ellis, Janet H. and Jim Richard. 2008. *A planning guide for protecting Montana's wetlands and riparian areas*. Bozeman, Montana: Montana Watercourse.

Fausold, Charles J. and Robert J. Lilieholm. 1996. The economic value of open space. *Land Lines* 8, no. 5 (September):

Felton et al. Elizabeth Train, eds. 2004. *Trail solutions: IMBA's guide to building sweet single track.* Johnson Printing.

Flink, C. et al. K.L.Ryan, eds. 1993. *Trails for the twenty-first century: Planning design and management manual for multi-use trails.* Island Press.

Fogg, G. E. 1975. *Park planning guidelines*. National Society for Park Resources, National Recreation and Park Associaiton.

Forest Service. 2005. *National trail management classes*. FSH 2309.18. January 31.

Freedman, June D. and James R. Habeck. 1985. Fire, logging, and white-tailed deer interrelationships in the Swan Valley, northwestern Montana. Paper presented at Fire's effects on wildlife habitat symposium, ed. Lotan, James E. and James K. Brown, 23–35. Missoula, MT, March 21, 1984. General Technical Report INT-186. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Gannon, Amy. 2009. [Personal communication]. Pest Management Program Manager. DNRC. Helena, Montana. December.

Gibson, Ken. 2009. [Personal communication]. Forest Entomologist. USDA Forest Service, Northern Region.

Gibson, Ken, Sandy Kegley, and Barbara Bentz. 2009. *Mountain pine beetle, forest insect and disease leaflet 2*. Portland, Oregon: USDA Forest Service, Pacific Northern Region.

Greene, Erick. 1999. Demographic consequences of brown-headed cowbird parasitization in lazuli buntings. *Studies in Avian Biology* 18, 144–52.

Hann, Wendel, Doug Havalina, Ayn Shlisky, Bev Schwab, Mark Kaib, and Nate Benson. 2003. *Interagency and The Nature Conservancy fire regime condition class*. USDA Forest Service, US Department of the Interior, The Nature Conservancy, and Systems for Environmental Management. http://www.frcc.gov. (accessed .

Hansen, Paul L., Robert D. Pfister, Keith Boggs, Bradley J. Cook, John Joy, and Dan K. Hinckley. 1995. *Classification and management of Montana's riparian and wetland sites*. No. 54. Missoula, MT: University of Montana, School of Forestry, Montana Forest and Conservation Experiment Station. May.

Harrington, Mick. 2007. *Benefits of treating old-growth stands*. Bitterroot Ecosystem Management Research Project. Missoula, Montana.

Headwaters Economics. 2009a. *Profile for Missoula County, Montana*. www.headwaterseconomics.org. (accessed .

———. 2009b. *Profile for Montana*. www.headwaterseconomics.org. (accessed .

Henderson, Robert. 2009. [Personal communication]. Wildlife Biologist: Retired. Montana Fish Wildlife and Parks. Missoula, Montana. August.

Hoffmann, Robert S. and Donald L. Pattie. 1968. *A guide to Montana mammals: identification, habitat, distribution, and abundance.* Missoula, Montana: University of Montana.

Holt, Denver. 1988. [Personal communication]. Director of the Owl Research Institute. The Owl Research Institute. Charlo, Montana.

Hood, Sharon. 2009. Prescribed burning and big trees. Can we do it without killing the trees? *Fire Science Brief* no. 31 (January):

Hua-ho, Ching, Laura Payne, Elisabeth Orsega-Smith, and Geoffrey Godbey. 2003. Parks, recreation and public health: parks and recreation improve the physical and mental health of our nation-Research Update. *Parks and Recreation*. http://findarticles.com/p/articles/mi_m1145/is_4_38/ai_100960607/?tag=content;col1

Kiker, Clyde F. and Alan W. Hodges. 2002. Economic benefits of natural land conservation: Case study of Northeast Florida. Gainesville, Florida. December 30.

Knopf, Fritz L. 1994. Avian assemblages on altered grasslands. *Studies in Avian Biology* 15, 247–57.

LANDFIRE. 2009. LANDFIRE Rapid Refresh Cover Type. U.S. Department of Interior, Geological Survey. October 2009. www.landfire.gov.

Lautenschlager, Nicola T., Osvaldo P Almeida**,** Leon Flicker and Aleksandar Janca. 2004.Can physical activity improve the mental health of older adults? *Annals of General Hospital Psychiatry*, **3:**12doi:10.1186/1475-2832-3-12

Lenth, Benjamin E., Richard L. Knight, and Mark E. Brennan. 2008. The effects of dogs on wildlife communities. *Natural Areas Journal* 28, no. 3 218–27.

Leopold, Aldo. 1933. *Game management.* Madison, Wisconsin: The University of Wisconsin Press.

Lolo National Forest. 2009. Fire scars. http://www.fs.fed.us/r1/lolo/resources-natural/wildlife/after-fire/main/ponderosa.W3.html. (accessed 2009) .

Louv, Richard.2005. *Last Child in the Woods.* New York, New York. Workman Publishing Co.

Lyon, L. Jack. 1996. [Personal communication]. Station Director. U. S. forest Service, Forest Science Laboratory. Missoula, Montana.

Maxell, Bryce A. 2002. Database file of herpetological observations from 2001.

———. 2000. [Personal communication]. Zoologist. University of Montana. Missoula, Montana.

McClelland, B. Riley. 1977. Relationships between hole-nesting birds, forest snags, and decay in western larch—douglas-fir forests of the northern Rocky Mountains. Ph.D. dissertation. University of Montana, Missoula, MT.

MFWP. 2000. Bighorn sheep/domestic sheep protocol for the City of Missoula. Missoula, Montana. July 18, 2000.

MFWP. 2004. Montana statewide Elk Management Plan, Helena Montana

Miller, James R. and N. Thompson Hobbs. 2000. Recreation trails, human activity, and nest predation in lowland riparian areas. *Landscape and Urban Planning* 50, no. 4 (August): 227—36.

Miller, S. G., R. L. Knight, and C. K. Miller. 2001. Wildlife responses to pedestrians and dogs. *Wildlife Society Bulletin* 2, no. 1 124—32.

Missoula County. 2002. *Lolo regional plan*. Missoula County Office of Planning and Grants. Missoula, MT: April. ftp://www.co.missoula.mt.us/opgftp/Documents/LRCounty/LoloRegionalPlan/LoloRegionalPlanLP.htm. (accessed 2009) .

Missoula Parks and Recreation. 1995. *Missoula urban area open space plan*. Missoula, Montana.

———. 1999. *Mount Jumbo management plan*. Mount Jumbo Stewardship Subcommittee; Citizens Advisory Committee on Open Space. June.

———. 2009a. Conservation Lands Management Plan Process, Citizen Working Group, Meeting 3. Missoula, Montana. June 3, 2009.

———. 2009b. *Public Opinion Survey*.

MNHP. 2009. *Database*. http://mtnhp.org. (accessed .

Mueggler, W. F. and W. L. Stewart. 1980. *Grassland and shrubland habitat types of western Montana*. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. General Technical Report INT–66.

NRCS. 1994. *Soil survey of Missoula County area*. October.

———. 2009. Soil data viewer. http://soildataviewer.nrcs.usda.gov/ (accessed .

Pearson, Dean E. 2009. Invasive plant architecture alters trophic interactions by changing predator abundance and behavior. *Oecologia* 159, 549–58.

Pearson, Dean E. and Ragan M. Callaway. 2006. Biological control agents elevate hantavirus by subsidizing deer mouse populations. *Ecology Letters* 9, no. 4 443–50.

Pfister, Robert D., Bernard L. Kovalchik, Stephen F. Arno, and Richard C. Presby. 1977. *Forest habitat types of Montana*. General Technical Report. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Rosenberger, Randall S. and John B. Loomis. 2001. *Benefit transfer of outdoor recreation use values*. A technical docment supporting the Forest Service Strategic Plan (2000 update). Fort Collins, CO: United States Department of Agriculture, Forest Service.

Servheen, C. 1993. *Grizzly bear recovery plan*. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service.

Stankowich, Theodore. 2008. Ungulate flight responses to human disturbance: A review and meta-analysis. *Biological Conservation* 141, 2159–73.

Thomas, Jack Ward, C. Maser, and J. E. Rodierk. 1979. *Wildlife habitats in managed rangelands—The Great Basin of southeastern Oregon: Riparian zones*. U. S. Department of Agriculture, Forest Service. General Technical Report PNW-80.

Toweill, Dale E. and Jack Ward Thomas. 2002. *North American elk: Ecology and management.* Washington, DC: Smithsonian Institution Press.

U.S.Bureau of Labor Statistics. 2009. Databases and tables of statistics by subject. www.bls.gov. (accessed March, 2009).

U.S.Census Bureau. 2002. *2000 United States Census*. 2002. http://www.census.gov/. (accessed .

USDA. 1986. *The Lolo National Forest plan*. Forest Service. February.

———. Forest Service. 1996. *Mormon Ridge winter range restoration: Final environmental impact statement*. Lolo National Forest, Missoula Ranger District. Missoula, Montana.

———. 1997. *Managing wildlife damage: The mission of APHIS' Wildlife Services Program*. U.S. Department of Agriculture, Animal and Plant Health Inspection Service. Miscellaneous Publication No. 1543. Riverdale, MD: October.

———.**Forest Service**. 2009. *Direct control of mountain pine beetle*. http://www.fs.fed.us/r1/helena/resources/insects_diseases/MPB_control_techniques.pdf. (accessed 2009) .

USDA and USDI. 2000. *Interior Columbia Basin final environmental impact statement*. Interior Columbia Basin Ecosystem Management Project. Boise, Idaho.

U.S. Department of Health and Human Services. 2002. *Physical Activity Fundamental To Preventing Disease*. http://aspe.hhs.gov/health/reports/physicalactivity/

USDI. Bureau of Reclamation. 1994. *Montana bald eagle management plan*. July.

USDI National Park Service. 1995. *Economic impacts of protecting rivers, trails, and greenway corridors.* 4 vols..

Valliant, Morgan. 2009. [Personal communication]. Conservation Lands Manager. Missoula Parks and Recreation Department. Missoula, Montana.

Ward, A. L. and J. J. Cupal. 1979. Telemetered heart rate of three elk as affected by activity and human disturbance. Dispersal recreation and natural resource management, 47–56. Utah State University, Logan, Utah.

Weybright, Darrel L. 1983. Impacts of cattle grazing and subdivisions on Grant Creek ungulates. Thesis. University of Montana.

Willard, E. Earl, Donald Bedunah, C. Les Marcum, and Gloria Mooers. 1988. *Environmental factors affecting spotted knapweed*. Biennial Report 1987-1988. Missoula, Montana: University of Montana, School of Forestry, Montana Forest and Conservation Experiment Station.

Wonder Land. 2008. *Farviews Pattee Canyon parks study*.

Workman, Dennis. 1982. [Personal communication]. Fisheries Biologist. MFWP, Region 2.

Zieper, Matthew, Margaret, Kelly C.H. 2000. Financing for the Future: The Economic Benefits of Parks and Open Space.: *Government Finance Review.* http://www.allbusiness.com/finance-insurance/707707-1.html (accessed 2010)

APPENDIX A. SOIL MAP UNIT LEGEND AND BRIEF DESCRIPTIONS

Table shows the Soil Map Unit Legend for soils within MCL. Soil maps and interpretive groupings were developed from the Soil Survey of Missoula County Area, Montana (NRCS 1994). The following table also includes the soil map units found within the boundaries of the MCL. Soil units 34, 44, and 72 could perform as agricultural soils if irrigated. Brief soil map unit descriptions are also provided in this Appendix. Map 2, Map 3, Map 4, Map 5, Map 6, and Map 7 in Appendix B show the Soil Absorbed Runoff Potential, Soil Leaching Potential, Soil Map Units, Soil Solution Runoff Potential, K Factor Soil Erodibility, and Percent Slope, respectively; these maps are available upon request.

In Table several soil map units are mapped and described only to the Suborder (map unit 73 - Orthents) or Great Group (map unit 136 - Xerofluvents) level. This is occasionally done because the soil properties are so variable that unique or "typical" soil characteristics cannot be mapped or delineated as a single polygon. This also implies that unique soil interpretations cannot be developed for these soil map units at the scale at which these soils were mapped. In the example of the Soil Survey of Missoula County Area, Montana, mapping was completed on photos at a scale of 1:24,000 or approximately 2.64 inches per mile.

Table A-1 Soil Map Unit Legend

Map Symbol	Map Unit Name
7	Argixerolls-Haploxerolls complex, 0 to 4% slopes
8	Argixerolls-Haploxerolls complex, 4 to 15% slopes
9	Argixerolls-Haploxerolls complex, 15 to 30% slopes
10	Argixerolls-Haploxerolls complex, 30 to 60% slopes
16	Bigarm gravelly loam, 0 to 4% slopes
17	Bigarm gravelly loam, 4 to 15% slopes
18	Bigarm gravelly loam, 15 to 30% slopes
19	Bigarm gravelly loam, 30 to 60% slopes
20	Bigarm-Rock outcrop complex, 30 to 60% slopes
23	Bignell gravelly loam, 8 to 30% slopes
25	Bignell, warm-Winkler complex, 30 to 60% slopes
34	Desmet loam, 0 to 2% slopes
44	Grantsdale loam, 0 to 2% slopes
73	Orthents, 0 to 4% slopes
72	Moise, 0 to 2% slopes
88	Pits, gravel
89	Repp very gravelly loam, 30 to 60% slopes
93	Riverwash
105	Totelake gravelly loam, 2 to 8% slopes

Map Symbol	Map Unit Name
114	Urban Land
131	Winkler very gravelly sandy loam, 30 to 60% slopes
133	Winkler gravelly loam, cool, 30 to 60% slopes
135	Winkler, cool-Rock outcrop complex, 50 to 80% slopes
136	Xerofluvents, 0 to 2% slopes
138	Water

7, Argixerolls-Haploxerolls complex, 0 to 4% slopes

This map unit is composed of soils mapped at a higher taxonomic level, the Great Group level. The reasoning for this is soils within this map unit are highly variable but have some common attributes. Argixerolls and Haploxerolls are very deep (greater than 60 inches) and well drained. Both soil types have a dark surface layer about 8 inches thick. Surface textures vary from loam to very gravelly loam. Typically, the Argixerolls would occur on gentler slopes and the Haploxerolls on steeper slopes. The slopes for this map unit range from 0 to 4%, with inclusions of soils on steeper slopes. Also included are soils with cobbly surface layers and soils that are poorly drained.

8, Argixerolls-Haploxerolls complex, 4 to 15% slopes

This map unit is similar in composition to the previous map unit, 7. The major difference is the slope range for this map unit. These soils occur on slopes ranging from 4 to 15%. Also included are soils on steeper slopes and soils with cobbly surface layers.

9, Argixerolls-Haploxerolls complex, 15 to 30% slopes

This map unit is similar in composition to the map unit, 7. The major difference between the two is the slope range. These soils occur on slopes ranging from 15 to 30%. Also included are soils on less steep slopes and soils with cobbly surface layers.

10, Argixerolls-Haploxerolls complex, 30 to 60% slopes

This map unit is similar in composition to the map unit, 7. The major difference is in the slope range. These soils occur on slopes ranging from 30 to 60%. Also included are soils on less steep slopes and soils with cobbly surface layers.

17, Bigarm gravelly loam, 4 to 15% slopes

This soil map unit contains about 85% Bigarm soils. These soils formed in gravelly alluvium on alluvial fans and stream terraces. Typically, the Bigarm soil has a gravelly loam surface layer about 11 inches thick. The subsurface layer is very gravelly loam about 4 inches thick. The subsoil is very gravelly loam about 25 inches thick. The substratum to a depth of 60 inches is extremely gravelly loamy sand. The Bigarm soil is very deep and somewhat excessively drained. Included are soils with gravelly sandy loam surface and soils with clayey surface and underlying material.

18, Bigarm gravelly loam, 15 to 30% slopes

This soil map unit contains about 85% Bigarm soils. These soils formed in gravelly colluvium derived from glacial outwash on fans and terraces. Typically, this Bigarm soil has a gravelly loam surface layer about 11 inches thick. The subsurface layer is very gravelly loam about 4 inches thick. The subsoil is very gravelly loam about 25 inches thick. The substratum to a depth of 60 inches is extremely gravelly loamy sand. The Bigarm soil is very deep and somewhat excessively drained. Included are soils with gravelly sandy loam surface and soils with clayey surface and underlying material.

19, Bigarm gravelly, 30 to 60% slopes

This soil map unit contains about 85% Bigarm soils. These soils formed in gravelly colluvium derived from glacial outwash on fans and terraces. Typically, this Bigarm soil has a gravelly loam surface layer about 8 inches thick. The subsurface layer is very gravelly loam about 4 inches thick. The subsoil is very gravelly loam about 20 inches thick. The substratum to a depth of 60 inches is extremely gravelly loamy sand. The Bigarm soil is very deep and somewhat excessively drained. Included are soils with gravelly sandy loam surface and soils with clayey surface and underlying material.

20, Bigarm-Rock outcrop complex, 30 to 60% slopes

This soil complex contains about 75% Bigarm soils on side slopes in mountains and 15% areas of rock outcrop. Typically, this Bigarm soil has a gravelly loam surface layer about 8 inches thick. The subsurface layer is very gravelly loam about 4 inches thick. The subsoil is very gravelly loam about 20 inches thick. The substratum to a depth of 60 inches is extremely gravelly loamy sand. The Bigarm soil is very deep and somewhat excessively drained. Included are soils with a gravelly sandy loam surface layer.

23, Bignell gravelly loam, 8 to 30% slopes

This soil map unit contains about 85% Bignell soils. These soils formed in Tertiary alluvium on hills. Typically, the Bignell soil has a forest litter layer about 2 inches thick. The surface layer is gravelly loam 11 inches thick. The subsurface layer is very gravelly loam about 4 inches thick and the substratum is very gravelly clay to a depth of 60 inches. The Bignell soil is very deep and well drained.

25, Bignell, warm-Winkler complex, 30 to 60% slopes

This soil complex contains about 55% Bignell soils and 30% Winkler soils on side slopes in mountains. The Bignell soils formed in Tertiary alluvium. Typically, the Bignell soil has a forest litter layer about 2 inches thick. The surface layer is gravelly loam 11 inches thick. The subsurface layer is very gravelly loam about 4 inches thick and the substratum is very gravelly clay to a depth of 60 inches. The Bignell soil is very deep and well drained.

The Winkler soils formed in colluviums derived from argillite and/or quartzite. Typically, the Winkler soil has a forest litter layer about 2 inches thick. The surface layer is very gravelly sandy loam about 8 inches thick. The subsurface layer is very gravelly sandy loam about 17 inches thick. The subsoil is extremely gravelly sandy loam about 17 inches thick. The substratum is extremely gravelly sandy loam to a depth of 60 inches. The Winkler soil is very deep and somewhat excessively drained.

34, Desmet loam, 0 to 2% slopes

This soil map unit contains about 85% Desmet soils. The Desmet soils formed in alluvium on stream terraces. The Desmet soil has a loam surface layer about 7 inches thick and a loam subsurface layer about 8 inches thick. The subsoil layer is loam about 9 inches thick and the substratum layer is very fine sandy loam to a depth of 60 inches. The Desmet soil is very deep and well drained.

44, Grantsdale loam, 0 to 2% slopes

This soil map unit contains about 85% Grantsdale soils. The Grantsdale soils formed in loamy alluvium over sand and gravel on stream terraces. Typically, the Grantsdale soil has a loam surface layer about 9 inches thick. The subsoil is loam about 23 inches thick and the substratum is very gravelly loamy sand to a depth of 60 inches. The Grantsdale soil is very deep and well drained.

72, Moiese gravelly loam, 0 to 2% slopes

This soil map unit contains about 85% Moiese soils. The Moiese soil formed in loamy alluvium over sand and gravel on stream terraces and alluvial fans. Typically, the Moiese soil has a gravelly loam surface layer about 9 inches thick. The subsoil is very gravelly sandy loam about 12 inches thick. The substratum is extremely gravelly sand to a depth of 60 inches. The Moiese soil is very deep and excessively drained.

73, Orthents, 0 to 4% slopes

This map unit is composed of soils mapped at a higher taxonomic level, the Sub Order level. The reasoning for this is soils within this map unit are highly variable, but have some common attributes. Orthents consist of very deep, well drained to excessively drained soils that formed in alluvium. These soils are on stream terraces.

88, Pits, gravel

This soil map unit consists of disturbed areas, primarily open excavations from which soil material and gravel have been removed.

89, Repp very gravelly loam, 30 to 60% slopes

This soil map unit contains Repp soils. The Repp soil formed in colluviums derived from argillite and/or limestone. They occur on side slopes in mountains. Typically, the Repp soil has a forest litter layer about 1 inch thick. The surface layer is very gravelly loam about 13 inches thick. The subsoil is very gravelly loam about 12 inches thick. The substratum is extremely gravelly loam to a depth of 60 inches.

93, Riverwash

This map unit contains areas of sandy, silty, clayey, or gravelly alluvium that are frequently flooded and support little or no permanent vegetation.

105, Totelake gravelly loam, 2 to 8% slopes

This soil map unit contains Totelake soils. The Totelake soil formed in sandy and gravelly alluvium on stream terraces. Typically, the Totelake soil has a forest litter layer about 1 inch thick. The surface layer is gravelly loam about 7 inches thick. The subsoil is very gravelly sandy loam about 15 inches thick. The substratum is extremely gravelly loamy sand to a depth of 60 inches.

114, Urban land

This miscellaneous land area contains soil that is covered by asphalt, concrete, or buildings and in which the exposed soil is highly disturbed.

131, Winkler very gravelly sandy loam, 30 to 60% slopes

This soil map unit contains 85% Winkler soils. The Winkler soil formed in colluviums derived from argillite and/or quartzite on side slopes in mountains. Typically, the Winkler soil has a forest litter layer about 2 inches thick. The surface layer is very gravelly sandy loam about 8 inches thick. The subsurface layer is very gravelly sandy loam about 17 inches thick. The subsoil is extremely gravelly sandy loam about 17 inches thick. The substratum is extremely gravelly sandy loam to a depth of 60 inches. The Winkler soil is very deep and somewhat excessively drained.

133, Winkler gravelly loam, cool, 30 to 60% slopes

This soil map unit contains 85% Winkler soils. The Winkler soil formed in colluviums derived from argillite and/or quartzite on side slopes in mountains. Typically, the Winkler soil has a forest litter layer about 2 inches thick. The surface layer is gravelly loam about 8 inches thick. The subsurface layer is very gravelly sandy loam about 17 inches thick. The subsoil is extremely gravelly sandy loam about 17 inches thick. The substratum is extremely gravelly sandy loam to a depth of 60 inches. The Winkler soil is very deep and somewhat excessively drained.

135, Winkler, cool-Rock outcrop complex, 50 to 80% slopes

This soil complex contains about 55% Winkler soils on side slopes in mountains and 25% areas of Rock outcrop. Typically, the Winkler soil has a forest litter layer about 2 inches thick. The surface layer is gravelly loam about 8 inches thick. The subsurface layer is very gravelly sandy loam about 17 inches thick. The subsoil is extremely gravelly sandy loam about 17 inches thick. The substratum is extremely gravelly sandy loam to a depth of 60 inches. The Winkler soil is very deep and somewhat excessively drained.

136, Xerofluvents, 0 to 2% slopes

This map unit is composed of soils mapped at a higher taxonomic level, the Great Group level. The reasoning for this is soils within this map unit are highly variable, but have some common attributes. Xerofluvents consists of very deep, somewhat poorly drained to well drained soils that formed in

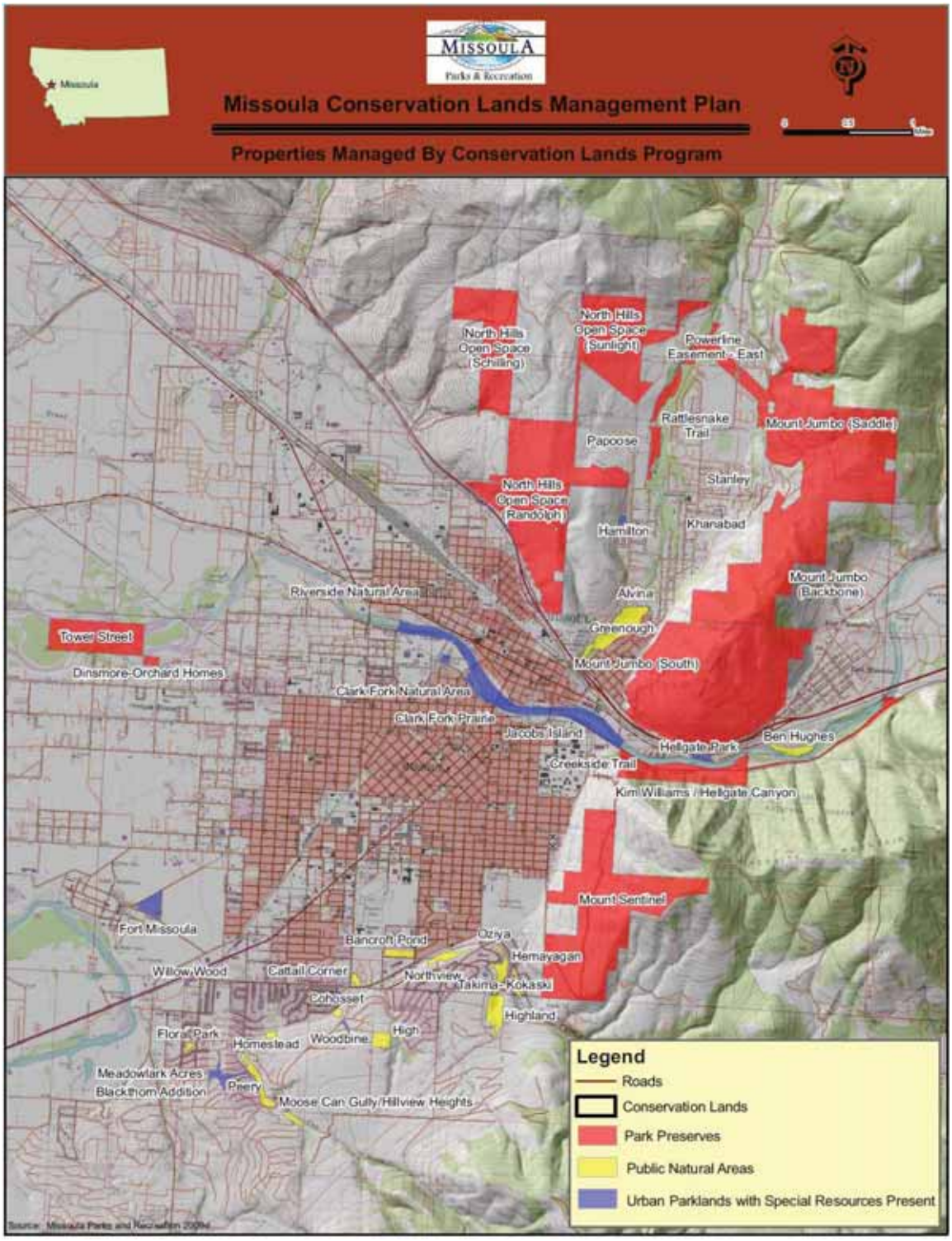
alluvium. These soils are on flood plains. The surface texture varies from loamy very fine sand to loam. The subsurface texture varies from loam to extremely gravelly sand.

138—Water

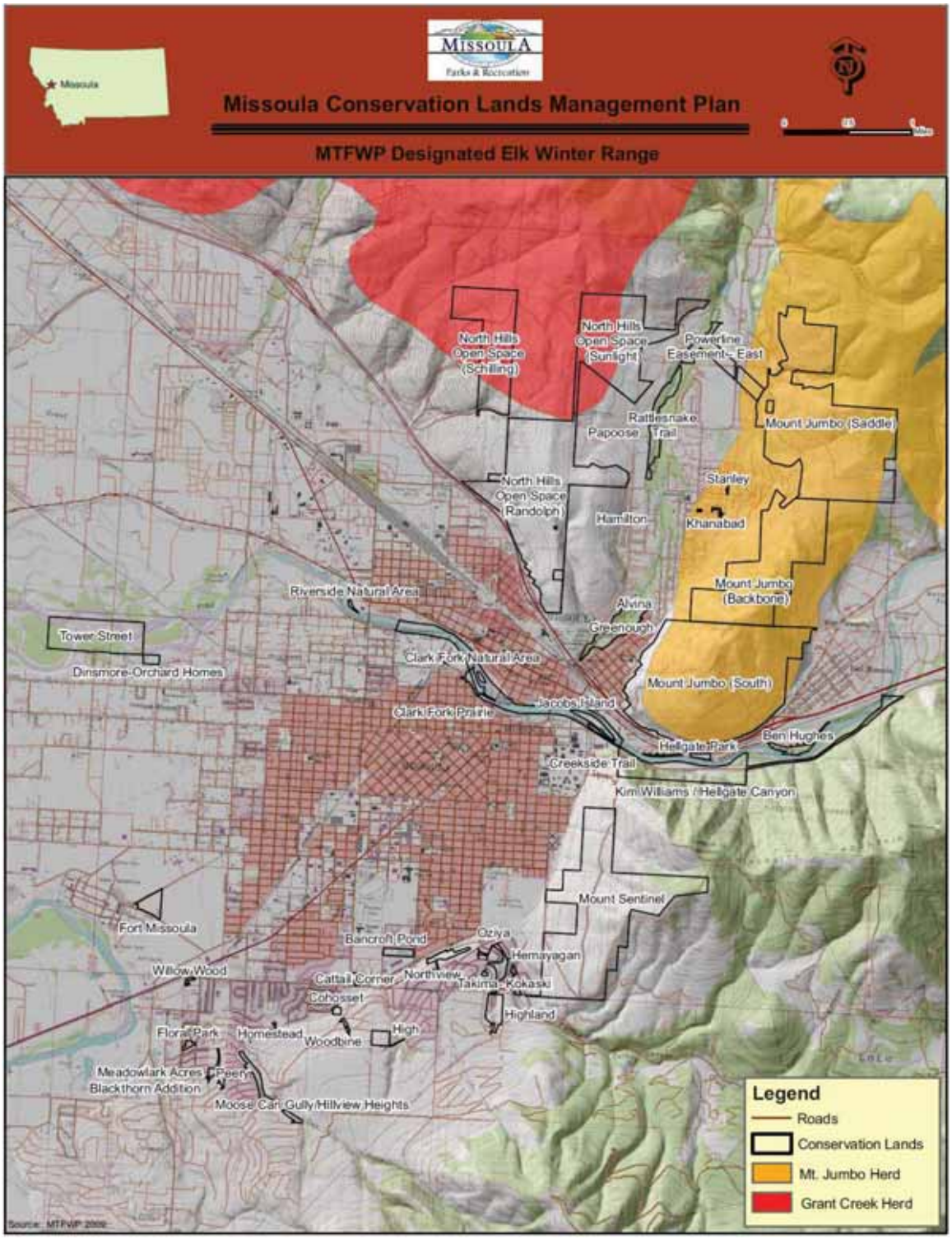
APPENDIX B. MAPS

1. Properties Managed by the Conservation Lands Program
2. Soil Absorbed Runoff Potential (available upon request)
3. Soil Leaching Potential (available upon request)
4. Soil Map Units (available upon request)
5. Soil Solution Runoff Potential (available upon request)
6. K Factor Whole Soil Erodibility (available upon request)
7. Percent Slope (available upon request)
8. MFWP Designated Elk Winter Range
9. MFWP Designated Mule Deer Winter Range
10. MFWP Designated Whitetailed Deer Winter Range
11. Bird and Fish Species of Concern
12. Plant Species of Concern
13. Spotted Knapweed Infestations (available upon request)
14. Leafy Spurge Infestations (available upon request)
15. Dalmatian Toadflax Infestations (available upon request)
16. Sulfur Cinquefoil Infestations (available upon request)
17. Cheatgrass Infestations (available upon request)
18. Mueggler and Stewart Grassland Habitat Types
19. Current Forest and Riparian Habitat Types
20. Native Grassland Health Indicators
21. Recreational Trail Use
22. Ownership

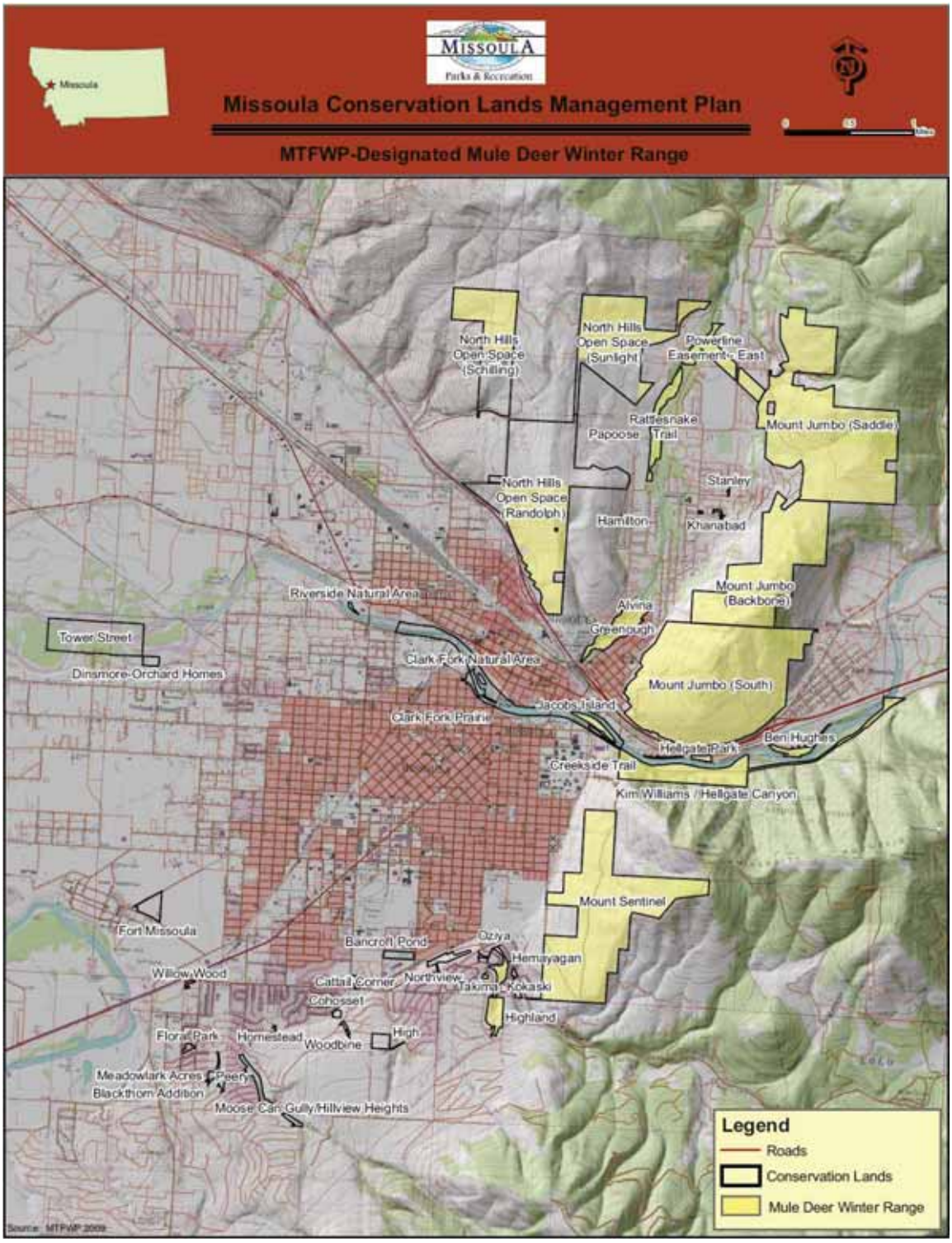
Map 1: Properties managed by the Conservation Land Program



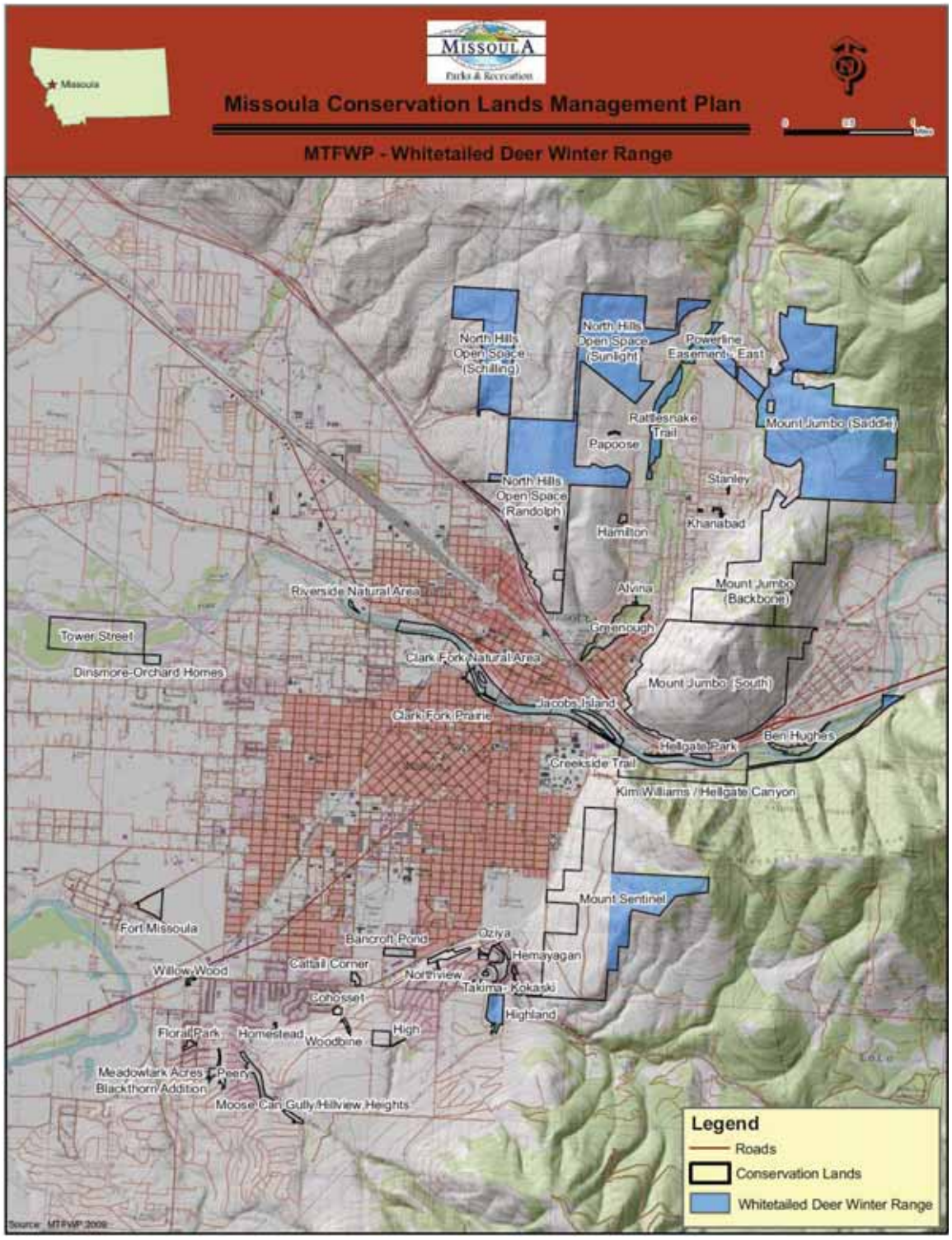
Map 8: MFWP Designated Elk Winter Range



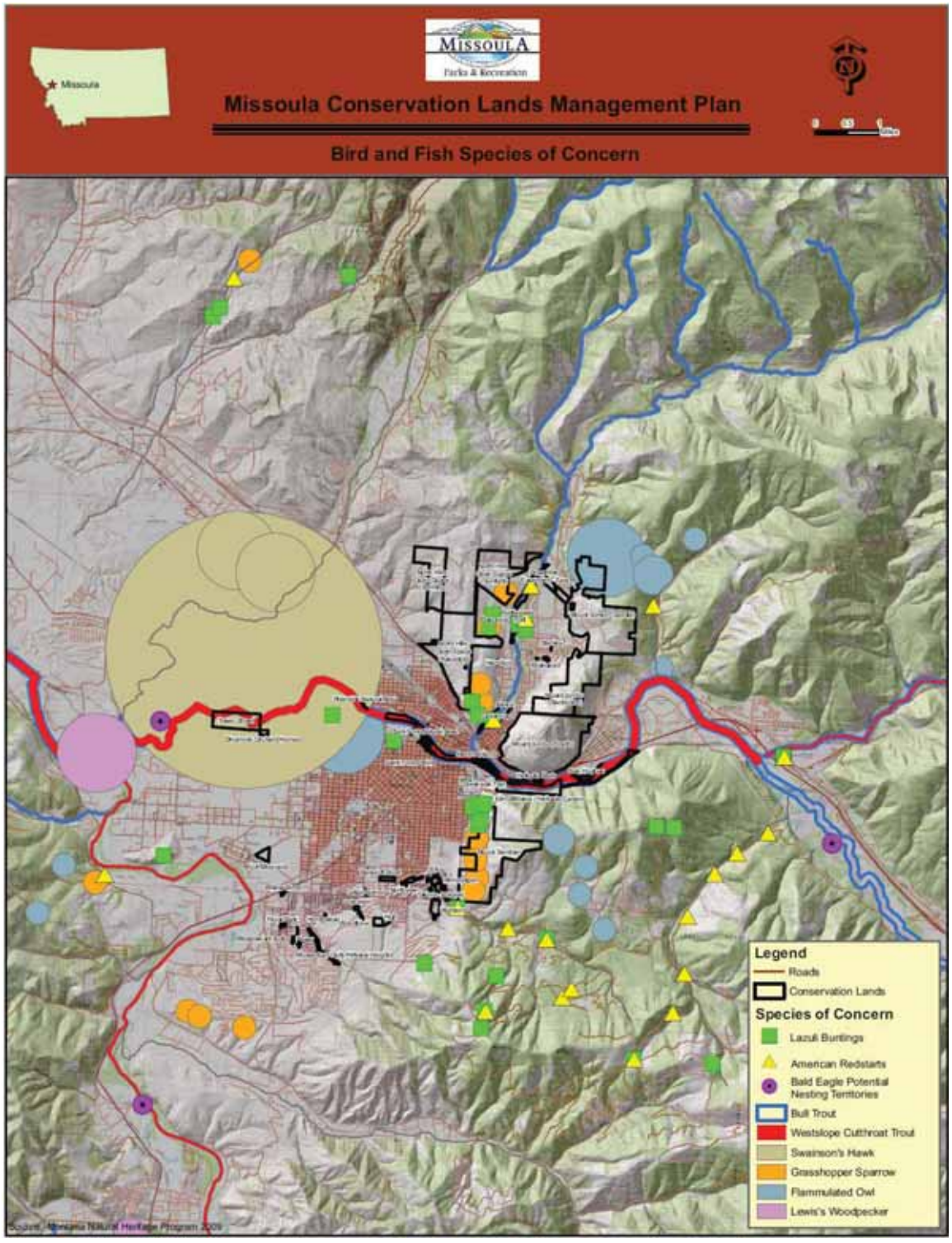
Map 9: MTFWP Designated Mule Deer Winter Range



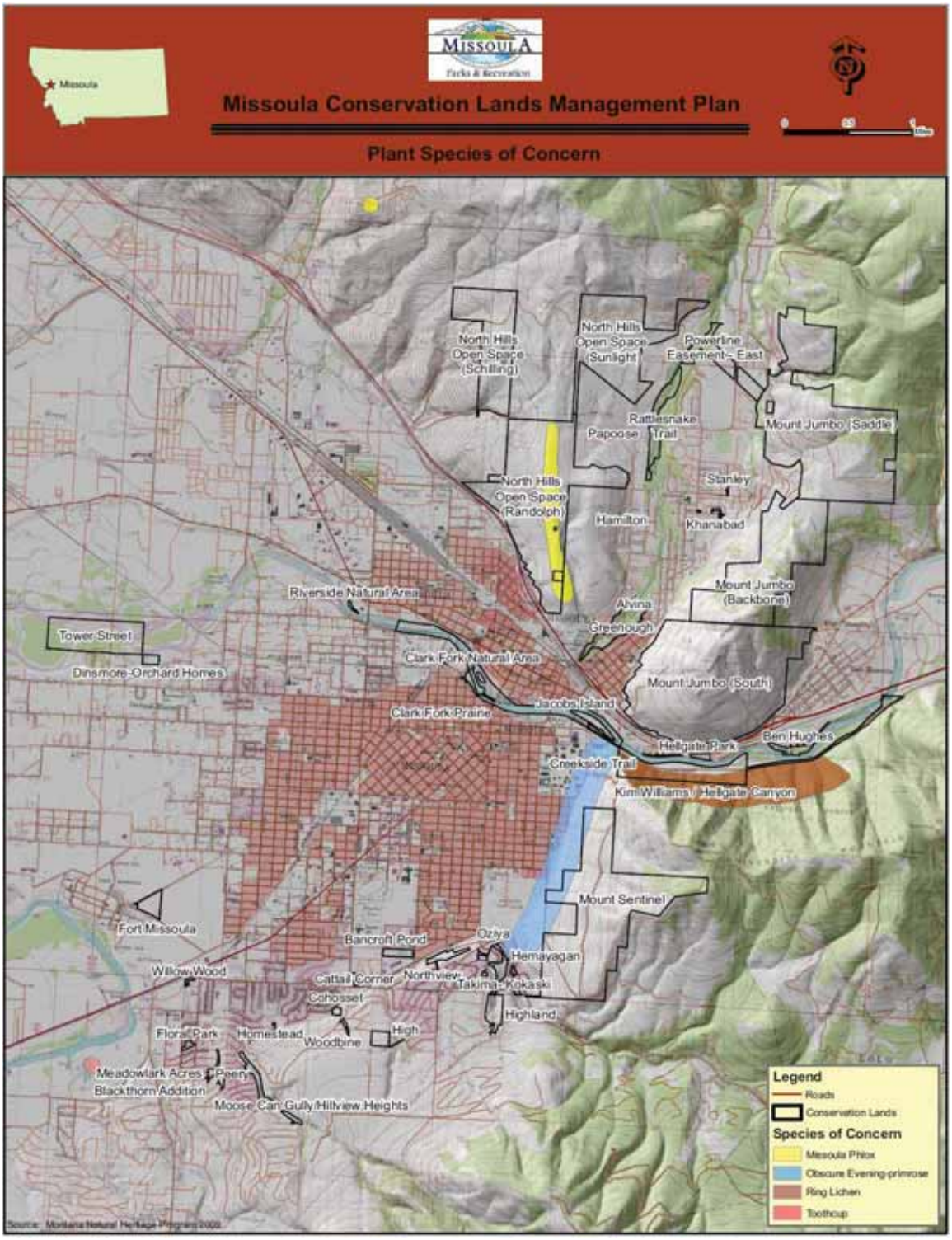
Map 10: MTFWP White-Tailed Deer Winter Range



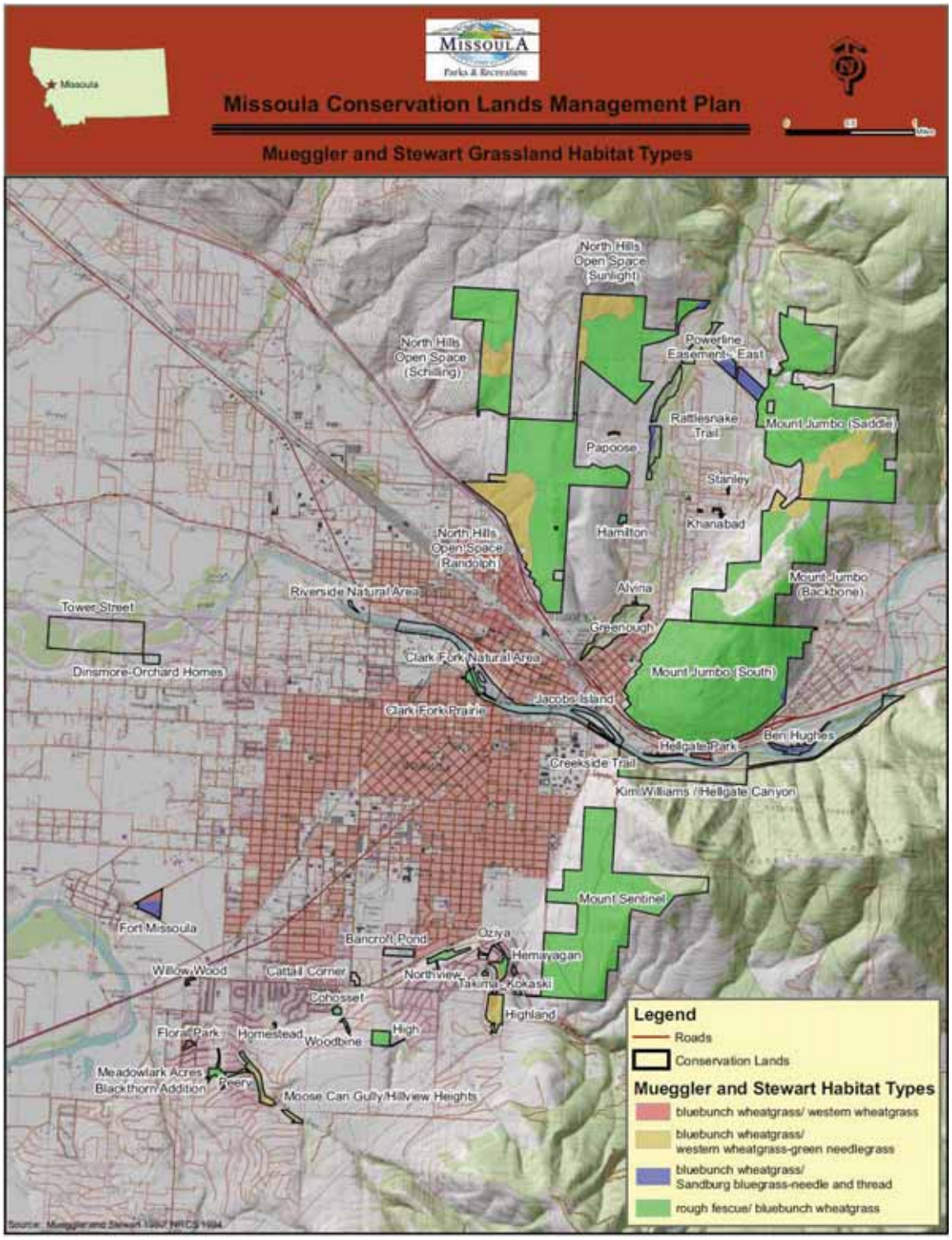
Map 11: Bird and Fish Species of Concern



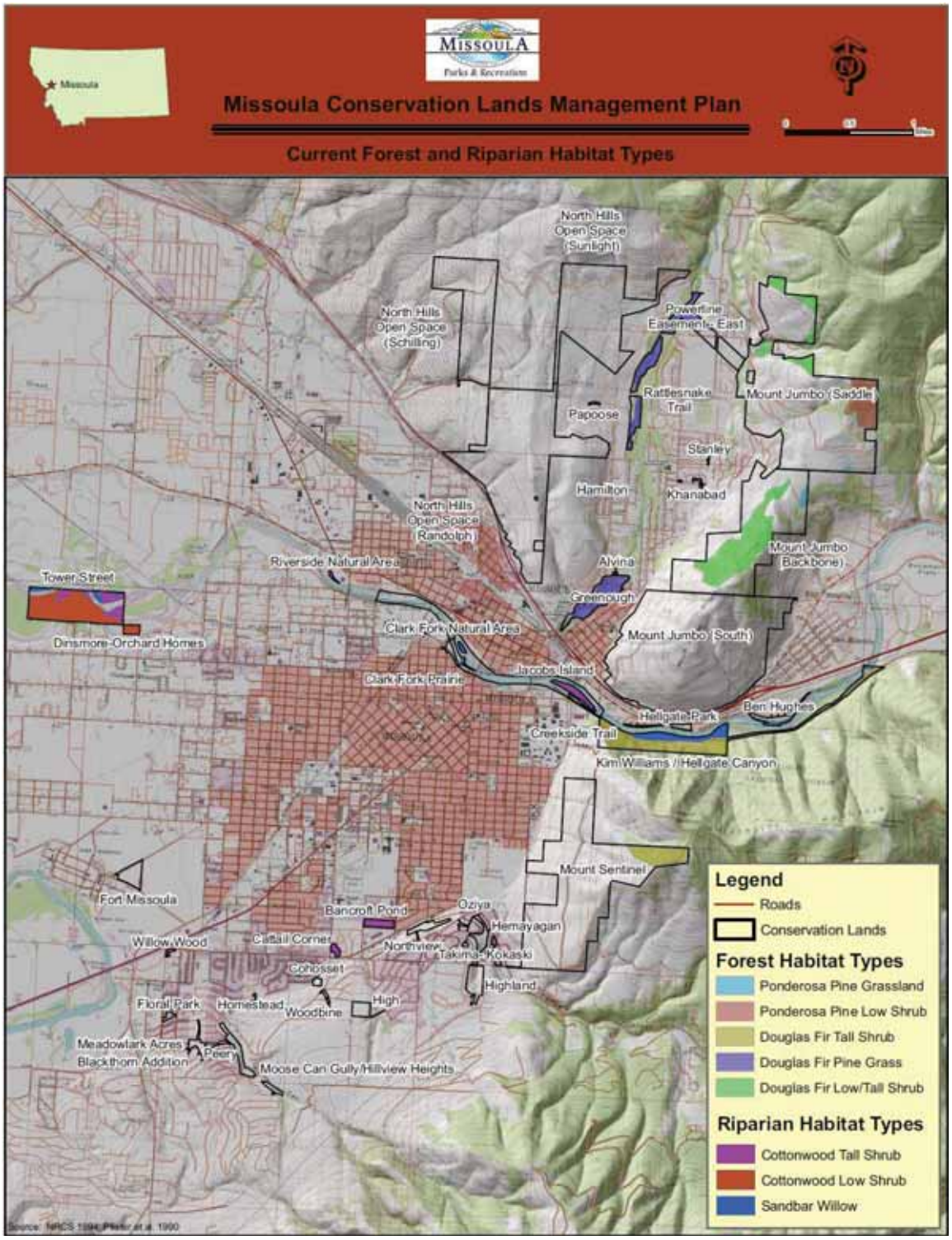
Map 12: Plant Species of Concern



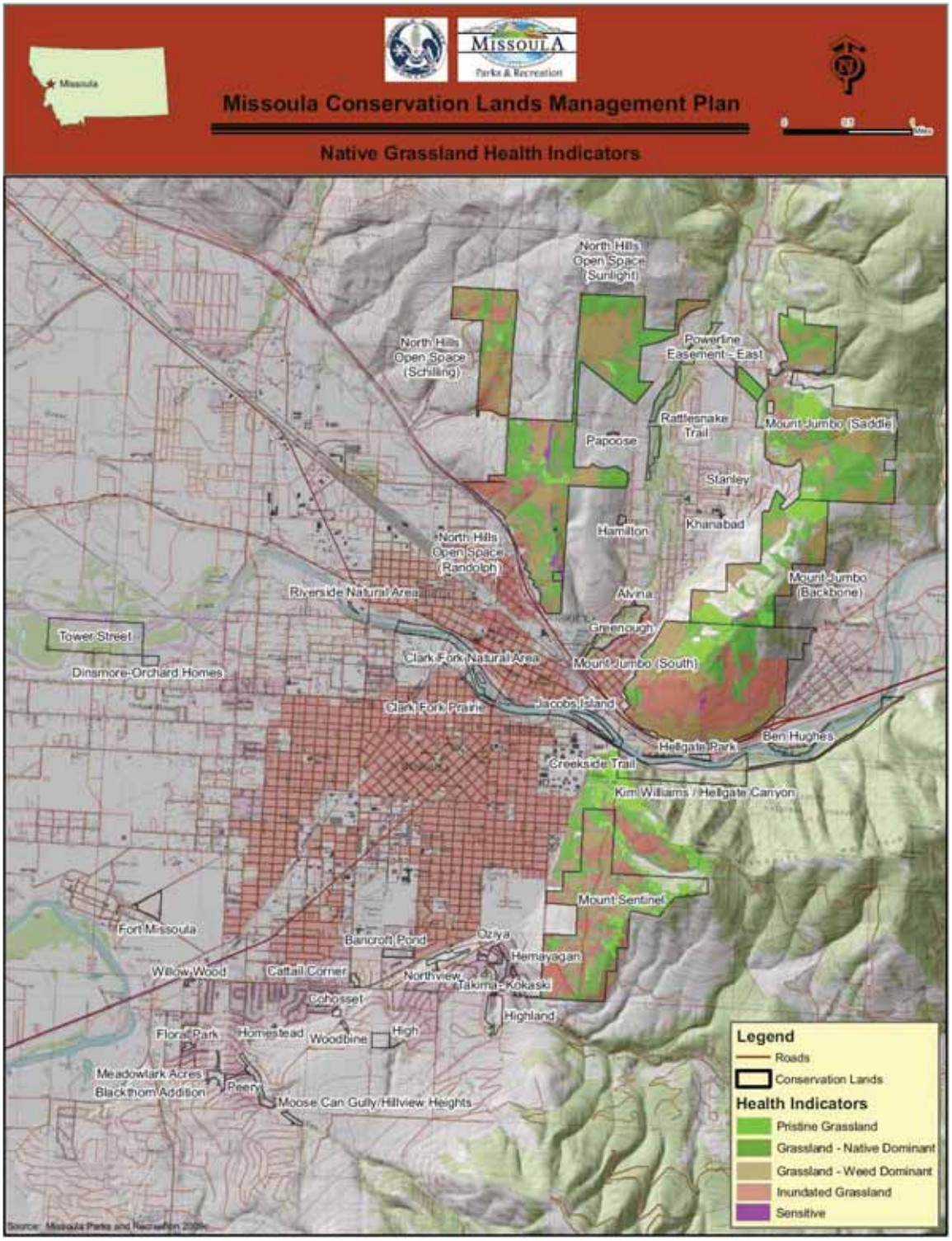
Map 18: Mueggler and Stewart Grassland Habitat Types



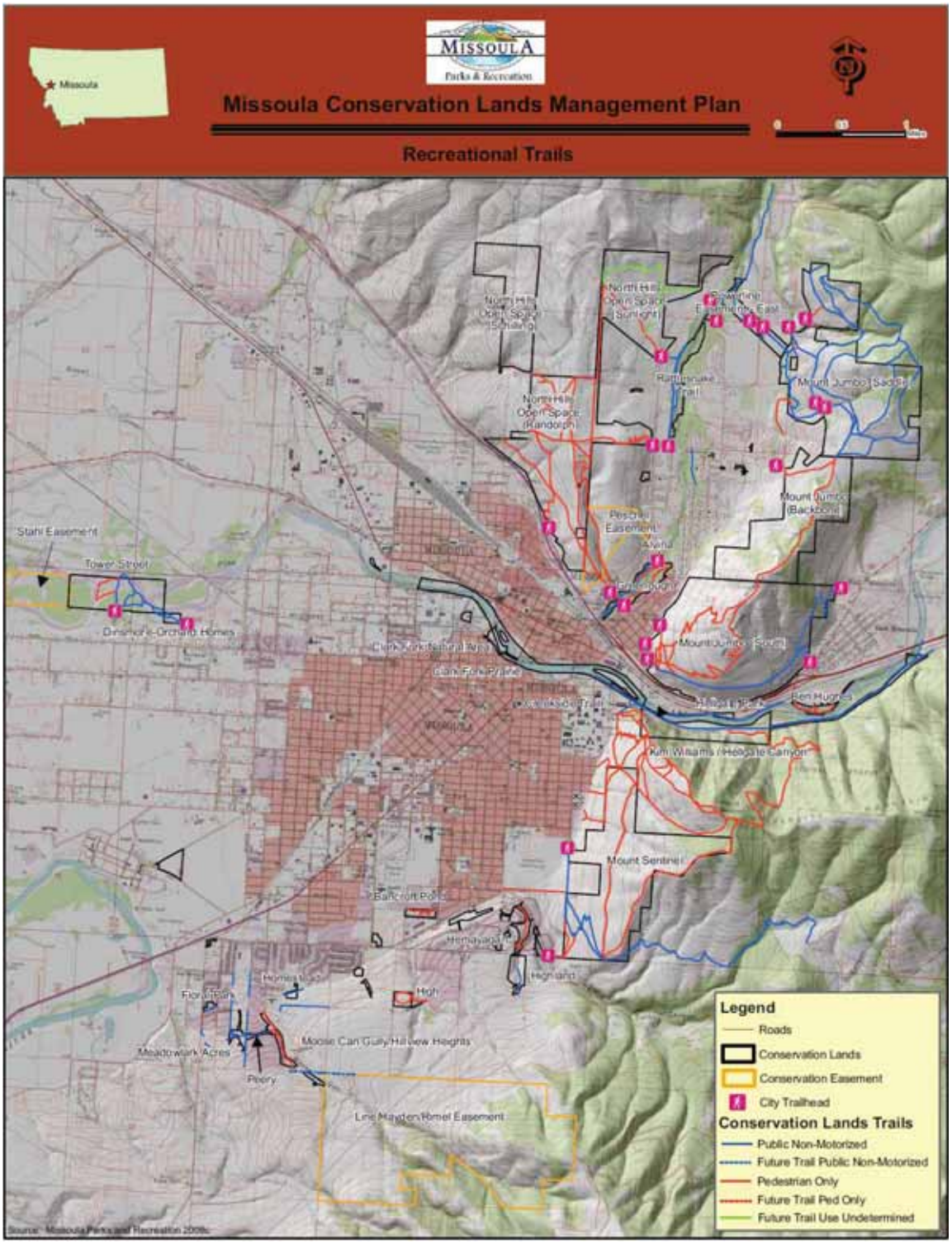
Map 19: Current Forest and Riparian Habitat Types



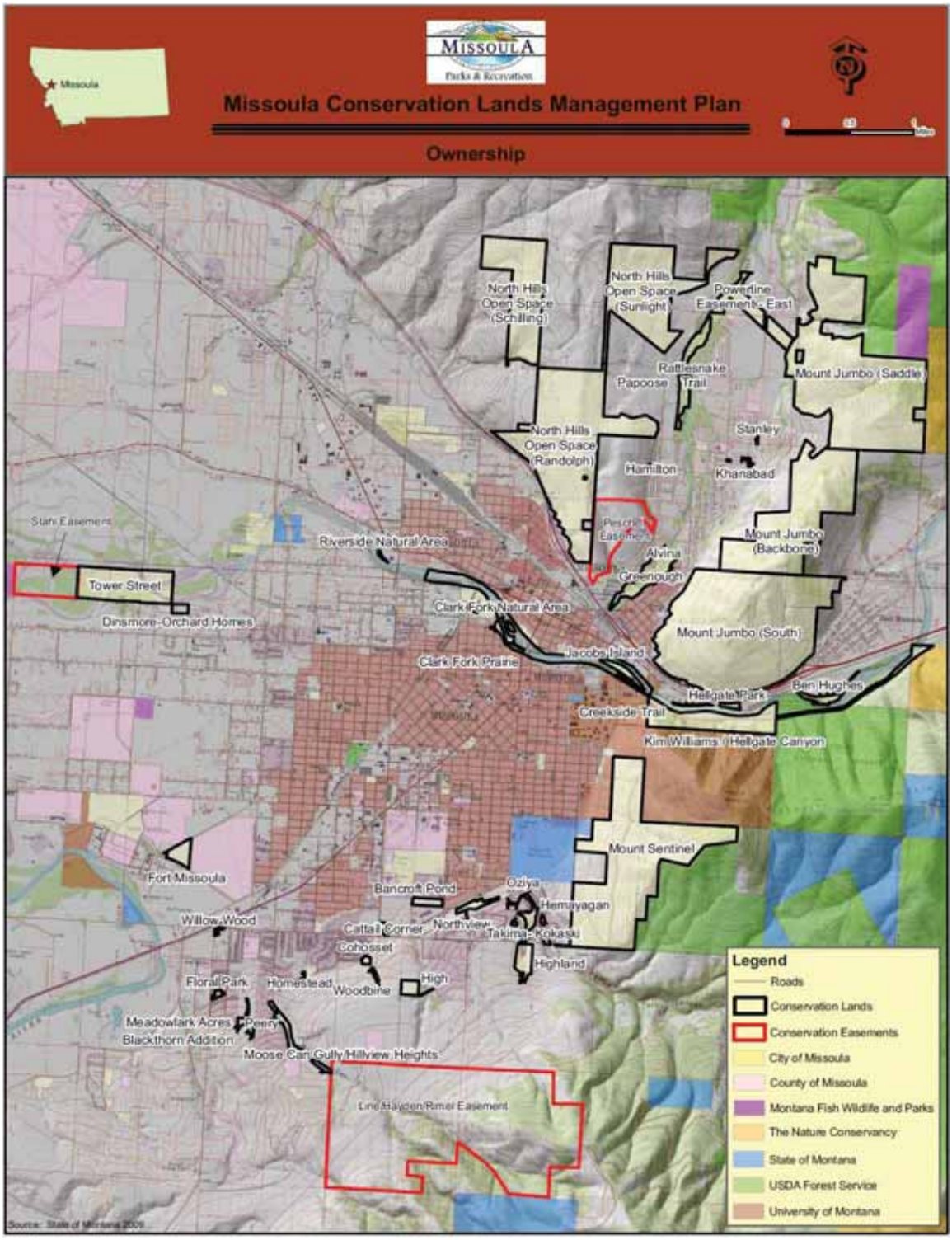
Map 20: Native Grassland Health Indicators



Map 21: Recreational Trail Use



Map 22: Ownership



APPENDIX C: BIGHORN SHEEP AND DOMESTIC SHEEP INTERACTION PROTOCOL

Bighorn Sheep and Domestic Sheep Interactions -Agreement and Protocol Montana Fish, Wildlife and Parks and the City of Missoula, Parks and Recreation

In June of 2000, Montana Fish, Wildlife and Parks (MFWP) and the University of Montana implemented an informal agreement and protocol to limit potential interactions between domestic and wild sheep on City of Missoula open space lands. At that time, vegetation management on City open space was contracted to the University of Montana, and domestic sheep grazing was one of the tools used to control leafy spurge. In 2005, the City of Missoula's Parks and Recreation department (CMPR) inherited this agreement when it took over the domestic sheep grazing program from the University of Montana. Since then, MFWP and the CMPR have successfully cooperated to limit possible interactions of domestic and wild sheep on Open Space lands. This document is an update to the 2000 agreement and protocol, and it is in accordance with the Montana Bighorn Sheep Conservation Strategy (MFWP, 2009).

Other Background Information

Rocky mountain bighorn sheep are native to western Montana, with established populations in Bonner and Rock Creek that are in close proximity to Missoula. Unfortunately, wild sheep are susceptible to many diseases and parasites (MFWP, 2009). While most diseases and parasites do not cause severe morbidity or mortality by themselves, in combination, they can result in reduced reproductive potential and death (MFWP, 2009). Certain strains of pneumonia-causing bacteria commonly found in domestic sheep and goats are transmissible and deadly to wild sheep. While domestics maintain effective immunities to some of those strains, bighorns do not.

An extensive history of catastrophic bighorn die-offs exists for the western states and Canadian provinces. Most recently in Montana, die-offs have occurred in the East Fork of the Bitterroot, Bonner, and Lower and Upper Rock Creek. While not all bighorn sheep epizootic disease events can be attributed to contact with domestic sheep and goats, and transmission of disease agents from domestics to wild sheep is not completely understood, it is widely recognized by those that deal with animal health (wild and domestic) that when domestic sheep and wild sheep intermingle, wild sheep can die in significant numbers (MFWP, 2009). Dispersal, migratory, and exploratory behaviors of individual bighorn sheep, as well as the gregarious nature of both wild and domestic sheep may exacerbate the potential for disease and parasite introductions and transmission between species. When wandering bighorns comingle with domestics, as occurred in June 2000 on the saddle of Mount Jumbo, MFWP must remove and kill the roaming bighorn(s) before they leave and possibly transmit lethal bacteria to other wild sheep.

The City of Missoula's Parks and Recreation department utilizes a number of tools to control invasive plants and restore native habitats on City Open Space. Domestic sheep grazing is a low-cost biological control for leafy spurge and Dalmatian toadflax. The City currently uses sheep to graze spurge and toadflax infestations on steep terrain on Mt. Jumbo and Waterworks Hill where few other weed control options are available. As dense infestations of noxious weeds severely reduce the ability of any grassland to support Montana's native wildlife, the City's long-term restoration goals for these severely degraded grasslands will ultimately help a variety of local wildlife.

Although Jumbo, Sentinel and Waterworks Hill are not within bighorn sheep spring and summer ranges, wild sheep have been seen occasionally in these areas over the past 15 years. Most often, those sightings occurred from May – July and primarily involved dispersing subadult rams looking for other sheep and new habitats to colonize. With the recent die-offs though, in the Bonner and Rock Creek populations, the probability of bighorns dispersing to Missoula's open space lands should lessen. Nonetheless, it is important to proactively establish an updated response protocol to limit the potential of domestic and wild sheep commingling. In order to maintain effective separation between bighorn sheep and domestic animals used for noxious weed control, MFWP and the CMPR commit to implementing the following preventative measures.

PROTOCOL LIMITING THE POTENTIAL OF BIGHORN SHEEP AND DOMESTIC SHEEP COMMINGLING

1) CMPR staff will train herders to recognize bighorn sheep and to describe circumstances of any sightings.
2) CMPR will provide or require herders to have trained herding dogs, permanent night sheep-holding facilities guarded by herding dogs, and training for controlling domestic sheep.
3) CMPR will limit or exclude grazing in the Jumbo saddle area in May – July. This area is closest to the Bonner bighorn population; therefore, limiting and/or excluding domestic sheep grazing from this area during months when bighorns are most apt to wander will greatly reduce the potential for contact.
4) CMPR and MFWP, where appropriate, will use public education (i.e. signs at trailheads, personal contact with recreationists, and newspaper articles) to inform the citizenry of the risks (both from the lack of weed control and wild/domestic sheep interactions).
5) CMPR and MFWP will ask recreationists to report immediately sightings of wild sheep in the vicinities of Jumbo, Sentinel and Waterworks Hill.
6) MFWP will continue to participate on general advisory committees for CMPR to

provide updated information on bighorn sheep populations.

7) CMPR will provide or require herders to have cell phones. Observations of bighorns need to be reported to the Missoula Conservation Lands Manager and to Montana Fish, Wildlife and Parks as soon as possible (see protocol below for response to possible or known commingling of domestic and wild sheep).
8) MFWP will notify CMPR's conservation lands manager if sightings of bighorn sheep are reported on any city-owned open space during the grazing season (mid-May through August).
9) If bighorn sheep sightings become consistently common on Jumbo, Sentinel, and/or Waterworks Hill (suggesting a natural range expansion), CMPR will re-evaluate its domestic sheep grazing program.
10) CMPR and MFWP will evaluate this agreement and protocol every five years, or as needed in response to new information or changing circumstances.

MFWP realizes that even under the best circumstances, there is some risk of interaction between wild and domestic sheep. If possible or known commingling between the species occurs, CMPR and MFWP will implement the following protocol.

PROTOCOL FOR RESPONSE TO POSSIBLE OR KNOWN COMMINGLING OF BIGHORN SHEEP AND DOMESTIC SHEEP

1) Herders will contact the Missoula Conservation Lands Manager and the MFWP Missoula
2) Wildlife Biologist (see below for contact information) to report any sightings of bighorn sheep.
3) If it is confirmed or questionable that bighorns have made contact with domestics, MFWP will lethally remove the bighorn(s). The repercussions of a large die-off far outweigh those from killing a couple in a preventive action.
4) Herders and the livestock owner(s) should be prepared to remove domestic sheep from the site as soon as bighorns are sighted in the area.
5) If bighorns have not made contact with domestics, and the wild sheep are > ¼ mile from the domestics, MFWP will haze the wild sheep from the area.
6) If the above (#4) occurs, the herder will promptly remove any domestic sheep from the area. 6) CMPR will consider implementing a temporary emergency closure for MFWP to accomplish either number two or four described above.
7) There may be situations where extenuating circumstances may dictate different actions from those listed above. In those situations, MFWP and CMPR will work cooperatively to create an action plan.

Contacts

1) Vickie Edwards, Montana Fish, Wildlife and Parks, Missoula Wildlife Biologist
   Office: (406) 542-5515; Cell:_____; Home:_____

2) Morgan Valliant, City of Missoula, Missoula Conservation Lands Manager
   Office: (406) 552-6263; Cell:_____; Home:_____

3) 1-800-Tip-Mont (1-800-841-6668) The dispatcher will contact the nearest on-duty game warden.

Literature Cited: MFWP, 2009. Montana Bighorn Sheep Conservation Strategy, August, 2009. Montana Fish, Wildlife and Parks, Wildlife Division, Helena, Montana. Pp. 311.

APPENDIX D. RANGELAND SPECIES LIST

Table 7-1 Species List (Mueggler and Stewart 1980)

Species		
Shrubs	**Graminoids**	**Forbs**
Medium shrubs	*Agropyron caninum*	*Achillea millefolium*
Rosa arkanana	*Agropyron dasystachyum*	*Agoseris glauca*
Tetradymia canescens	*Agropyron smithii*	*Allium Cernum*
Low shrubs	*Agropyron spicatum*	*Anaphalis margaritacea*
Artemisia campestris	*Bouteloua gracilis*	*Androsace septentrionalis*
Artemisia dracunculus	*Bromus carinatus*	*Anemone cylidrica*
Artemisia frigida	*Bromus Japonicus*	*Anemone drummondii*
Gutierrezia sarothrae	*Bromus mollis*	*Anemone multifida*
	Bromus tectorum	*Anemone patens*
	Calamagrostis montanensis	*Antennaria anaphaloides*
	Carex filifolia	*Antennaria parvifolia*
	Carex obtusata	*Antennaria rosea*
	Carex petasata	*Arabidopsis thaliana*
	Carex pennsylvanica	*Arenaria congesta*
	Carex rupestris	*Arnica fulgens*
	Carex scirpoidea	*Arnica sororia*
	Carex stenophylla	*Artemisia ludoviciana*
	Danthonia parryi	*Aster falcatus*
	Danthonia unispicata	*Aster integrifolius*
	Festuca idahoensis	*Astragalus miser*
	Festuca scabrella	*Astragalus striatus*
	Helictotrichon hookeri	*Balsamorhiza incana*
	Koeleria cristata	*Balsamorhiza sagittata*
	Muhlenbergia cuspidate	*Besseya wyomingensis*
	Poa cusickii	*Campanula rotundifolia*
	Poa pratensis	*Castelleja lutescens*
	Poa sandbergii	*Cerastium arvense*
	Stipa comata	*Chrysopsis villosa*
	Stipa spartea	*Comandra umbellata*
	Stipa viridula	*Erigeron caespitosus*
		Erigeron compositus
		Erigeron corymbosus
		Erigeron speciosus
		Erigeron subtrinervis

Species		
Shrubs	**Graminoids**	**Forbs**
		Eriogonum umbellatum
		Gaillardia aristata
		Galium boreale
		Gaura coccinea
		Gentiana affinis
		Geranium viscosissimum
		Geum triflorum
		Heuchera spp.
		Hieracium albertinum
		Hymenoxys acaulis
		Liatris punctata
		Lithospermum ruderale
		Lomatium triternatum
		Lupinus sericeus
		Orthocarpus tenuifolius
		Oxytropis campestris
		Oxytropis deflexa
		Oxytropis lagopus
		Oxytropis sericea
		Oxytropis viscida
		Penstemon procerus
		Petalostemon purpureum
		Phlox albamarginata
		Phlox hoodii
		Potentilla arguta
		Potentilla gracilis
		Potentilla hippeana
		Senecio canus
		Solidago missouriensis
		Taraxacum officinale
		Thermopsis rhombifolia
		Tragopogon dubius
		Vicia Americana
		Zigadenus venenosus

APPENDIX E. ECONOMIC BENEFIT OF CONSERVATION LANDS

Maximizing the Economic Benefits of the Primary Uses of Conservation Lands

Conservation Lands provide recreational opportunities and environmental protection, both public goods. Public goods are non-excludable, and thus provide benefit to all. The recreation use of these lands can result in the negative effects of crowding and overuse. This can cause degradation to the land, which then diminishes further economic benefits. Management of Conservation Lands should aim to minimize this effect while still providing maximum benefit.

The environmental economic benefits of Conservation Lands can be measured through the natural resources that they provide and the cost savings to the city of not having to utilize alternative methods to meet environmental compliance. Fausult and Lilieholm (1996) write of the monetary benefits of open space lands.

> Open space possesses natural system value when it provides direct benefits to human society through such processes as ground water storage, climate moderation, flood control, storm water prevention, and air and water pollution abatement. It is possible to assign a monetary value to such benefits by calculating the cost of the damages that would result if the benefits were not provided, or if public expenditure were required to build infrastructure to replace the functions of the natural system.

Recreational enjoyment by users of Conservation Lands is the most visible economic benefit. While consumers of these benefits are not required to pay at the time of use, it is possible to assign economic values to these activities by studying people's willingness to pay for them. Rosenberger and Loomis (2001) compiled recreational studies from 1967 to 1998 to determine consumer surplus values (or net economic value) per activity day. These numbers were then converted to 2000 dollars (Kiker and Hodges 2002). The results are presented in the following table.

Mean Net Economic Values per Recreation Day for Various Outdoor Activities

Activity	Mean Value
Camping	$33.33
Picnicking	$38.72
Swimming	$23.15
Sightseeing	$39.40
Non-motorized Boating	$67.60
Hiking	$40.22
Bicycling	$49.75
Big Game Hunting	$47.40
Small Game Hunting	$39.20
Migratory Waterfowl Hunting	$34.71
Fishing	$39.41
Other Recreational Activities	$44.56

The value of a day of these various outdoor activities will be higher if the land on which they take place is in a more pristine condition and lower if the land is in poor condition.

The Multiplier Effect of Conservation Lands: Secondary Benefits that Create Additional Revenue for Local Businesses and Government

Well-managed Conservation Lands generate additional expenditures in local businesses and

increase property tax revenues to the city. While there is an estimated value to be placed on the recreational use of these lands, there is also a true dollar amount that is spent in order to participate in the activity. This dollar amount is usually spent in the local economy in the form of equipment and guide services sought by local residents and the additional lodging and food services sought by tourists. Also, these amenities attract small businesses and new residents to the local community and increase property values.

Direct expenditures for recreational activities range from $60 for low-end bird watching equipment to $4,575 for high-end rafting equipment (USDI National Park Service 1995). To illustrate the effect of these expenditures, suppose that during a month 1,000 people purchased equipment for use in open space and that each person spent on average $2,000. The direct spending on the local economy would be $2,000,000 for the month. These direct expenditures also have indirect effects on the retail supply of the goods and services and on the manufacturing of the recreational goods. Many of the indirect effects can be realized by the local economy.

Company start-ups, expansions, and relocations are widely viewed as direct and effective means of enhancing a community's economic development through expanding its existing tax base. High-technology, research and development businesses, and smokeless industries are attractive because they infuse money into the economy without the adverse effects such as pollution often associated with traditional manufacturing industries. These businesses may be characterized as "footloose" because they are likely to be less constrained and more flexible in their choice of location than traditional manufacturing firms. Their success is dependent on the caliber of their workforce as their principle assets area ideas and skilled workers rather than capital items and low-wage workers. Today many such skilled workers choose their jobs based on quality of life. In a study of 174 businesses that had relocated to Colorado in the previous five years, Crompton et al. (1997) found that among the six elements that were used to measure quality of life parks, recreation, and open space were the most important in their decisions to relocate.

Increases in property values create additional tax revenue for cities. Several studies in the last decades have looked at the impact that proximity to parks and open spaces has on property values. One study on the impact of open spaces on residential property values in Portland, Oregon found that "being within 1,500 feet of a natural-area park on average accounted for 16 percent of a home's sale price holding all other factors constant" (Crompton et al. 1997).

Management Implications

Maximizing the economic benefits of city Conservation Lands as outlined above is dependent on proper management. Land management objectives should balance the benefits of recreational and ecological uses today and for future generations. Therefore, the CLMP should include a complete understanding of the ecological environment and recreational

activities offered by Missoula's open spaces and a vision for balancing these benefits into the future.

Of striking importance is the impact this management plan can have on the local economy through secondary economic benefits. These secondary benefits have true dollar value to the local economy. If the lands are correctly managed to maximize the primary economic benefits then they will also be maximizing the value of properties in close proximity and thereby increasing property tax revenues collected by the city. Additionally, consumer expenditures on recreational goods and services in the local economy will be increased.

APPENDIX F: INTERIM POLICY FOR USE AND PERMITS ON CONSERVATION LANDS

Missoula Parks and Recreation Department, Staff and Board aspire to serve the citizens of Missoula to the best of our abilities. Staff recommends an Interim Moratorium on all Competition, Special Events, Commercial Events, and Group Activities/Gatherings on Conservation Lands until the following tasks can be completed: 1) a Conservation Lands inventory of trails, roads and sensitive areas, 2) levels of acceptable change are determined, and 3) a management plan for all Conservation Lands is developed
The following areas will be considered an exception to the Moratorium:

- Kim Williams: The railroad right of way of the Kim Williams Nature Trail
- RS Greenway: Old Duncan Road RS Greenway Trail from Mountain View to the intersection with the single track leading to Duncan Drive
- Greenough Park: The paved trails, bridges, and cushion trails leading from the parking lot in Greenough Park. Greenough parking areas, developed turf areas, picnic and playground areas. Single track and interpretive trails are part of the moratorium.
- Lincolnwood Trailhead to Duncan: RS Bridge and Lincolnwood Trail connector trail to Fox Farm Road.
- Mount Jumbo's powerline easement: property between Rattlesnake Dr. and the road connecting Lincoln Hills Drive to Tamarac.
- Clark Fork Natural Area and R. MacDonald Riverfront Trails
- Northside Greenway Trail
- Sentinel Fire Road from Maurice University or Montana land. (Note USFS permit required when leaving City Conservation Lands.
- Randolph Homestead on North Hills within area co-managed by NMCDC, FVLT, MP&R.

Staff recommends the current permit process and fees as outlined in the "Parks and Recreation Master Fee, Permit, and Use Policy" reviewed annually by the Park Board and City Council be instituted for all events in areas exempt from the Moratorium.

Deposit: $1,000 is required. Organization is responsible for total restoration of damages to the land due to event or activity. If damage exceeds the deposit amount, permitted organization will be held financial responsibility.

Staff further recommends an Interim Permit for Conservation Lands for Education Events and Work/Volunteer Days
Education Events may be permitted if: 1) the event clearly meets the goals of education as described above, 2) the fee structure is set to recover only direct costs of the program, and 3) all other permit requirements are met. The fee for the Interim Education Permit will be waived if no fee is charged for the Education Event. If a fee is charged for the Education Event, the permit fee will be 5% of gross revenue or $50 whichever is greater. Volunteer Work Days will be permitted at no charge if the

program meets the goals and definition of a Volunteer Work Day and is approved by the Recreation Manager and Conservation Land Manager.

Completed applications for events must be submitted to the Recreation Manager a minimum of 60 days prior to the proposed event. This Interim Policy will be reviewed annually with the "Parks and Recreation Master Fee, Permit, and Use Policy and Charges."

CONSERVATION LANDS PERMIT APPLICATION

CITY OF MISSOULA, Parks and Recreation **SPECIAL-USE APPLICATION & PERMIT FOR COMMERCIAL EVENTS (Non-profit and For-profit)** Authority: Parks and Recreation Advisory Board – Interim Permit Policy for use of Conservation Lands Date:	PARKS AND RECREATION USE TYPE Conservation Lands DATE RECEIVED ISSUE DATE EXPIRATION DATE REG. / FOR. / DIST. AUTH. ID. STATE / COUNTY

PART I - APPLICATION

1. APPLICANT INFORMATION:

Name of Group: Applicant's Agent:

Name of Contact: Agent's Address:
Address:

Phone: ( ) - Agent's Phone: ( ) -
Fax Number: ( ) -

Corporate Tax ID or SSN: E-mail Address:

IF AN OPERATING PLAN (Exhibit A) IS REQUIRED, SIGN APPLICATION AND STOP HERE. OTHERWISE, COMPLETE ITEMS 2 THROUGH 7.

2. DESCRIPTION OF PROPOSED ACTIVITY:

3. LOCATION & DESCRIPTION OF PARKS AND RECREATION SYSTEM LANDS & FACILITIES APPLICANT WOULD LIKE TO USE (INCLUDE MAP):

4. ESTIMATED NUMBER OF PARTICIPANTS & SPECTATORS FOR PROPOSED ACTIVITY:

Participants: Spectators:

5. STARTING & ENDING DATE & TIME OF PROPOSED ACTIVITY:

Start: End:
Date Time Date Time

6. ESTIMATED REVENUE COLLECTED FOR EVENT:

Amount: Type of Fees:
(Include event charges, vendor fees, discounts, sponsorship related fees, gratuities)

7. NAME OF PERSON(S) WHO WILL SIGN A SPECIAL-USE AUTHORIZATION ON BEHALF OF THE EVENT:

I hereby acknowledge that is an application only, and that the use and occupancy of Parks and Recreation System lands is not authorized until an authorization is signed and issued by an authorized officer.

Printed Name: _____ Signature: _____ Date:

Printed Name: Signature: _____ Date:

PART II - PERMIT

1. Use under this permit shall begin on _____(date) and end on (date). The permit shall not be extended.

2. The estimated fee for this use is $ (amount). It shall be paid in advance and is not refundable. Within 30 days of conclusion of the event the holder shall submit final records of gross revenue collected for reconciliation for any additional fees due the City of Missoula.

3. [DB Value 'HOLDER_NAME'] (the holder) is hereby authorized to use, subject to the terms of this permit, Parks and Recreation System lands described as: _____, as shown in attached Exhibit(s) .This authorization covers approximately ___ acres and/or miles.

4. The holder is authorized to conduct the following activities and install the following improvements in the permitted area:

5. The holder shall conduct the authorized activities according to the attached approved plans and specifications, Exhibit(s) . The holder shall not install any improvements not specifically identified and approved above or in exhibits.

6. No soil, trees, or other vegetation may be destroyed or removed from Parks and Recreation System lands without specific prior written permission from the authorized officer.

7. The holder shall comply with all federal, state, county, and municipal laws, ordinances, and regulations which are applicable to the area or operations covered by this permit.

8. The holder shall maintain the improvements and premises to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the authorized officer. The holder shall fully repair and bear the expense for all damages, other than ordinary wear and tear, to Parks and Recreation System lands, roads and trails caused by the holder's activities.

9. The holder has the responsibility of inspecting the use area and adjoining areas for dangerous trees, hanging limbs, and other evidence of hazardous conditions which would pose a risk of injury to individuals. After securing permission from the authorized officer, the holder shall remove such hazards.

10. The holder shall be liable for any damage suffered by the City of Missoula resulting from or related to use of this permit, including damages to Parks and Recreation resources and costs of fire suppression.

11. The holder shall hold harmless the City of Missoula from any liability from damage to life or property arising from the holder's occupancy or use of Parks and Recreation System lands under this permit.

12. The holder agrees to permit the free and unrestricted access to and upon the premises at all times for all lawful and proper purposes not inconsistent with the intent of the authorization or with the reasonable exercise and enjoyment by the holder of the privileges thereof.

13. This permit is subject to all valid existing rights and claims outstanding in third parties.

14. This permit may be revoked or suspended upon breach of any of the conditions herein or at the discretion of the authorized officer. Upon expiration or revocation of this authorization, the holder shall immediately remove all improvements except those owned by the City of Missoula, and shall restore the site within days, unless otherwise agreed upon in writing. If the holder fails to remove the improvements, they shall become property of the City of Missoula, but that will not relieve the holder of liability for the cost of their removal and restoration of the site.

15. This permit is a license for the use of federally owned land. It does not grant any interest in real property. This permit is not transferable. Upon approval of the authorized officer, the holder may enter into agreements with third parties to exercise the rights and privileges granted by this authorization.

16. The holder is required to comply with standards for adequacy and type of services set out in the attached operating plan.

17. Gambling or gambling machines or devices will not be permitted on Parks and Recreation System lands regardless of whether or not they are lawful under State law or county ordinances.

18. The holder, in advertisements, signs, brochures, letterheads, and like materials, as well as orally, shall not misrepresent in any way, either the accommodations provided, the status of the authorization, or the area covered by it or the vicinity. The fact that the permitted area is located on the Parks and Recreation shall be made readily apparent in all formats of the holder's brochures and advertising regarding the use and management of the area and authorized facilities.

19. Pursuant to _____., interest shall be charged on any fee amount not paid within 30 days from the date the fee or fee calculation financial statement specified in this authorization becomes due. The rate of interest assessed shall be _____. Interest on the principal shall accrue from the date the fee or fee calculation financial statement is due.

    In the event the account becomes delinquent, administrative costs to cover processing and handling of the delinquency will be assessed.

    A penalty of 6 percent per annum shall be assessed on the total amount delinquent in excess of 90 days and shall accrue from the same date on which interest charges begin to accrue.

    Payments will be credited on the date received by the designated collection officer or deposit location. If the due date for the fee or fee calculation statement falls on a non-workday, the charges shall not apply until the close of business on the next workday.

    Disputed fees are due and payable by the due date. No appeal of fees will be considered by the Parks and Recreation without full payment of the disputed amount. Adjustments, if necessary, will be made in accordance with settlement terms or the appeal decision.

    If the fees become delinquent, the Parks and Recreation will:

    Liquidate any security or collateral provided by the authorization.

    If no security or collateral is provided, the authorization will terminate and the holder will be responsible for delinquent fees as well as any other costs of restoring the site to it's original condition including hazardous waste cleanup.

Upon termination or revocation of the authorization, delinquent fees and other charges associated with the authorization will be subject to all rights and remedies afforded the City of Missoula pursuant to 31 U.S.C. 3711 *et seq*. Delinquencies may be subject to any or all of the following conditions:

Administrative offset of payments due the holder from the Parks and Recreation.

Delinquencies in excess of 60 days shall be referred to City of Missoula for appropriate collection action as provided by _____.

20. For the purpose of administering this permit (including ascertaining that fees paid were correct and evaluating the propriety of the fee base), the holder agrees to make all of the accounting books and supporting records to the business activities, as well as those of sublesees operating within the authority of this authorization, available for analysis by qualified representatives of the Parks and Recreation or other City of Missoula agencies authorized to review the Parks and Recreation actvities. Review of accounting books and supporting records shall be made at dates convenient to the holder and reviewers. Financial information so obtained shall be treated as confidential. The holder shall retain the above records and keep them available for review for 5 years after the end of the year involved, unless disposition is otherwise approved by the authorized officer in writing.
21. Appeal of any provisions of this authorization or any requirements thereof shall be subject to the appeal regulations of the Missoula Parks and Recreation Advisory Board.

22. This permit is accepted subject to the conditions set forth herein, including any conditions in any exhibits attached to and made apart of this authorization.

23. The above clauses shall control if they conflict with additional clauses or provisions.

PART III – FEES (Minimum or % of Gross Revenue)

Land use rental fees are 5% of adjusted gross receipts for onetime events and 3% of adjusted gross receipts for multiple events under one permit. Adjusted gross receipts is the gross revenue less the cost to the holder of the permit of prizes awarded. Only those prizes which are paid for by the holder or come from the entry fee costs can be deducted. Donated prizes cannot be deducted.

Minimum Fee for permitted use of Conservation Lands is $100 per event

DEPOSIT: $1000 deposit is required. Organization is responsible for total restoration of damages to the land due to event or activity. If damage exceeds the deposit amount, permitted organization will be held financially responsible for total restoration cost.

PART IV – BONDING AND INSURANCE REQUIREMENTS

A Certificate of Insurance from your insurance provider which shows:
The permit applicant as the insured party
A minimum *of$750,000/0ccurrence* and $1.5 million/general aggregate.
Valid date throughout the requested permit dates.
City of Missoula as an additional insured on the certificate.

I have read and understand the terms and conditions and agree to abide by them.

CITY OF MISSOULA
Parks and Recreation

HOLDER: _____

Authorization is granted:

By:

By:

By:

Name:

Date:

Title:

Date:

HOLDER MUST HAVE THIS PERMIT (OR A LEGIBLE COPY) IN POSSESSION DURING THE AUTHORIZED ACTIVITY

EXHIBIT ___
OPERATING PLAN

This optional format is designed to identify all aspects of a recreation event held on Parks and Recreation System lands and will help in developing an Operating Plan for an event. Depending on the size of your event, some items may not apply. Attach additional pages, if necessary to complete the information.

This operating plan is hereby incorporated as part of the authorization in accordance with clauses 5 and 16 of the Special-Use Application and Permit for Recreation Events (FS-2700-3c), if the proposal is accepted and the application is approved.

1. On site agent: _____ Day phone: ( ) -
   Evening phone: ( ) -
   Fax or e-mail: ( ) -

2. Dates:

3. Description of event:

4. Location (**attach map**):

5. Number of acres needed:

6. Planned number of participants: Maximum number:

7. Number of spectators anticipated: Maximum number:

8. Duration of event (include pre/post event set-up days):

9. Overnight areas needed: Yes☐ No☐ If yes, describe:

10. After hour activities for multiple-day events (music, food, etc.):

11. Notification of adjacent permit holders or landowners: Yes☐ No☐
    List of contacts:

12. List other permits required and coordination or cooperating agreements (attach copies):

FACILITIES

13. Facilities provided (i.e. tents, canopies, stage, booths, benches, chairs, showers):

14. Provisions for drinking water (quantity, locations, bottled vs. truck):

15. Signing (i.e. route marking, parking, trails, event schedules):

16. Sanitation Plan (i.e. number of toilets, garbage cans, recycle bins):

17. Accommodations for disabled visitors (i.e. parking, access):

18. Describe power supply requirements:

19. Describe public address system requirements:

VENDORS

20. Will food or beverages be provided? Yes☐ No☐ If no, go to 27.

21. Included in price? Yes☐ No☐

22. Agreements with vendors or caterers: Yes☐ No☐

23. Number of vendor or caterers:

24. Location of food or beverage (identify on map):

25. Alcohol for sale? Yes☐ No☐ Vendor obtained state and local permits? Yes☐ No☐

26. Insurance coverage for alcohol: Yes☐ No☐
    Attach a copy of the liability portion & and all endorsements and exclusions

27. Other products for sale (i.e. t-shirts, hats, ice, souvenirs):

28. Other equipment for rental (i.e. snowmobiles, skis, boards, jet-skis, rafts, kayaks):

29. List additional third party agreements:

PARKING AND VEHICLES

When planning for parking, be aware that one lane must always be open for emergency vehicles.

30. Amount of parking needed (i.e. number of spaces, acres, include disabled parking):

31. Locations (identify on map):

32. Parking attendants and locations used (i.e. parking direction, lot full posting, information):

33. Parking lot security (i.e. overnight parking, remote lots):

34. Traffic controls (i.e. one way, signing):

35. Shuttle service (type, when and where used):

36. Will any road closures be needed? (where and how long):

SAFETY/COMMUNICATIONS/MEDICAL

37. Attach Medical Plan and include the following:
    Access for emergency vehicles (i.e. ambulance, helicopter landing zones)
    Number and location of first aid stations
    Names and qualifications of any medical staffing
    List of emergency phone numbers and local hospitals/clinics

38. Describe communications type and number of equipment used:

39. Specify safety closures for high risk areas and protection of spectators (i.e. barriers, closures, restricted areas):

ADVERTISING

All advertisements must include acknowledgment that the event is located on the Parks and Recreation.

40. Description of event advertising (i.e. flyers, radio, TV, magazines, internet):

41. Target audiences (i.e. local regional, national, limited membership):

42. Planned filming (i.e. land, air, water):

43. What is the reason for filming (i.e. advertising, promotion):

44. Type of advertising proposed for the event (i.e. banners, signs, posters, commercial vehicles):

CLEANUP

45. Time frame to remove all facilities and garbage after the event (including removal of signs, advertising flagging, route markers):

46. Garbage collection site location (landfill or transfer station):

47. Mitigation plan to rehabilitate resource damage (i.e. closures, revegetation):

48. Time frame to complete mitigation:

FEES

Land use rental fees are 5% of adjusted gross receipts for onetime events and 3% of adjusted gross receipts for multiple events under one permit. Adjusted gross receipts is the gross revenue less the cost to the holder of the permit of prizes awarded. Only those prizes which are paid for by the holder or come from the entry fee costs can be deducted. Donated prizes cannot be deducted.

DEPOSIT: $1000 deposit is required. Organization is responsible for total restoration of damages to the land due to event or activity. If damage exceeds the deposit amount, permitted organization will be held financially responsible for total restoration cost.

APPENDIX G: RECREATIONAL INVENTORY

Table H-1 Recreational Inventory (EDAW 2004; Valliant pers. comm.)

	Recreational Activity		Recreational Facility				Resource Value			
Parcel	**Fishing/ Hunting**	**Trail Miles**	**Picnic Area/ Benches**	**Playground**	**Horseshoes**	**Volleyball Court/ Ball Diamond**	**Viewshed**	**Wildlife Values**	**Native Plants**	**Linkage**
Alvina		0.06	X				X	X		X
Ben Hughes	X	0.36	X	X		X	X	X	X	
Blackthorn Addition		0.02								X
Cattail Corner								X	X	
Clark Fork Natural Area	X		X				X	X	X	
Cohosset										
Creekside Trail		0.31					X			
Dinsmore-Orchard Homes	X	0.19					X	X	X	X
Floral Park		0.08								
Fort Missoula Triangle										
Greenough	X	1.60	X	X	X	X	X	X	X	X
Hamilton						X				X
Hellgate Park		0.16			X		X			
Hemayagan		0.43					X	X	X	

	Recreational Activity		Recreational Facility				Resource Value			
Parcel	**Fishing/ Hunting**	**Trail Miles**	**Picnic Area/ Benches**	**Playground**	**Horseshoes**	**Volleyball Court/ Ball Diamond**	**Viewshed**	**Wildlife Values**	**Native Plants**	**Linkage**
High		0.36					X	X	X	
Highland		0.22					X	X	X	X
Homestead		0.11	X				X		X	
Jacobs Island	X		X				X	X	X	
Khanabad										
Kim Williams/ Hellgate Canyon	X	3.08					X	X	X	X
Meadowlark Acres		0.27	X							X
Moose Can Gully/ Hill View Heights		0.59					X	X	X	X
Mount Jumbo Backbone		1.81					X	X	X	X
Mount Jumbo Saddle		8.36					X	X	X	X
Mount Jumbo South		7.18					X	X	X	X
Mount Sentinel		6.33					X	X	X	X
Ninkpata										
North Hills/Randolph		8.64					X	X	X	X
North Hills/Schilling							X	X	X	X

	Recreational Activity		Recreational Facility				Resource Value			
Parcel	**Fishing/ Hunting**	**Trail Miles**	**Picnic Area/ Benches**	**Playground**	**Horseshoes**	**Volleyball Court/ Ball Diamond**	**Viewshed**	**Wildlife Values**	**Native Plants**	**Linkage**
North Hills/Sunlight		2.92					X	X	X	X
Northview							X	X	X	
Bancroft Ponds		0.42	X				X	X	X	
Oziya										
Papoose										
Peery		0.17	X							X
Powerline Easement		1.14					X		X	X
Rattlesnake Trail	X	0.62					X	X	X	X
Riverside Natural Area	X	0.44						X	X	
Stanley										
Takima-Kokaski							X	X	X	
Tiortis										
Tower Street	X	1.61					X	X	X	X
Willow Wood										
Woodbine										

APPENDIX H: CHAPTER SIX FROM THE MOUNT JUMBO MANAGEMENT PLAN

Mount Jumbo Management Plan Chapter Six

—Elk Winter Range—

Adopted by City Council on June 23, 1997

This section addresses the winter and early spring requirements of elk on the urban fringe, while providing maximum compatible access to public lands.

Much of the information below was provided by the Montana Department of Fish, Wildlife & Parks and the Lolo National Forest, partners in the Mount Jumbo Project.

Introduction

The presence of 50-100 elk on Mount Jumbo each winter and early spring poses unusual opportunities and challenges for Missoula citizens, particularly now that the mountain has passed from private to predominately public ownership.

With its acquisition of Mount Jumbo land, the Missoula community has assumed partial responsibility for this highly visible elk herd. Security from excessive human disturbance was an important attribute of the elk winter range on Mount Jumbo when most human access was prohibited by private landowners. Without awareness and planning under public ownership, increased human activity on the mountain during the critical winter and early spring months likely would have caused this elk herd to abandon its winter perch above Missoula's central business district.

Clearly, potential conflicts between winter-spring public use and wintering elk require special and focused management consideration. No other management issue is likely to warrant the regularly scheduled closure of City property on the mountain. It is assumed that the broadest public interest are served by a management solution that allows as much public use of city property as possible and practical, without unduly risking the continued presence and survival of elk on Mount Jumbo during winter and early spring.

Relation to Management Objectives

The Elk Winter Range section of the *Mount Jumbo Management Plan* addresses Objective 1 (i.e., "protect and enhance natural values . ."), Objective 3 (i.e., "maintain space and other habitat components allowing native wildlife to continue their traditional use of the property . .") and Objective 4 ("preserve the land's

watchable wildlife . .”), and the extent to which Objective 5 (i.e., “provide diverse recreational opportunities . .”) may be achieved without compromising the higher management priorities.

Simply, this section of the management plan presents analysis and recommendations for allowing as much desired recreational opportunity on Mount Jumbo as possible and practical without unduly risking the abandonment of the Mount Jumbo winter range by the elk herd.

Concerns surrounding elk (and mule deer) winter and early spring use of Mount Jumbo are unique, and are the only concerns that merit the consideration of large area closures to the public to provide critical space and security for wildlife. Closures are employed as a management tool by the Montana State Fish Wildlife and Parks Department as well as the Forest Service, and are addressed in the *Missoula Urban Open Space Plan*, which states:

> Ready access to the open space system is one of the vision’s most basic guiding principles. This does not mean that every area of open space must be fully accessible to the public. There are sound environmental or economic reasons for keeping certain open space lands ‘off limits’ to people, either year-round or at particular seasons of the year. Ready access does mean that all geographic areas of the community and all population groups have a variety of open spaces and outdoor recreation experiences available and convenient to them.

Other management concerns for wildlife may be adequately addressed in conjunction with habitat protection and enhancement (i.e., Objectives 1 and 2) in the vegetation and public use sections of the *Mount Jumbo Management Plan*.

Issues and Opportunities

Mount Jumbo provides habitat for more than 100 vertebrate species. The largest and most visible are the wild ungulates, or hooved animals, that are primarily dependent on Mount Jumbo during the winter and early spring months. Protection of elk winter range was a major objective of citizens, local organizations, and local government agencies in the decision to publicly acquire Mount Jumbo. The city and state acquisitions on Mount Jumbo have prevented residential development from destroying this important winter habitat (see the *Mount Jumbo Natural Resource Gazette* for an explanation of the effects of residential development on elk and deer).

With the habitat protected, it is now in the hands of Missoula citizens to work cooperatively to provide the space and security elk require to continue using Mount Jumbo during the critical winter and early spring months, and preserve current viewing opportunities from homes, businesses and roadsides all

across the city. Without adequate control of public access in winter and early spring, the risk of elk abandoning the Mount Jumbo winter range is high.

The challenge is to first understand the tolerances of the wintering elk population for human activity, and then allow public recreational opportunities to approach-but not exceed--these predicted tolerances. This task is complicated by the fact that elk may not tolerate disturbance levels that some humans assume they should be able to tolerate. It is further complicated by the fact that elk appeared to tolerate limited association with humans in the past when relatively few citizens were willing to trespass or had obtained permission to use private lands on Mount Jumbo.

Now that the land is in public ownership at the fringe of a rapidly growing city, elk may not tolerate the human activities they tolerated in the past because more people will participate. Finally, any public use restrictions must be simple and understandable to allow people a fair opportunity to understand and comply. The Stewardship Subcommittee strove to apply as much creativity to this problem as practical limits and predicted elk tolerances allow.

Elk Distribution and Winter Ecology

Numbers and Migrations: During winter and spring, 50-100 elk and 100-130 mule deer reside on Mount Jumbo. Most of the elk and about one-half of the mule deer are migratory. From May-October, elk are infrequent users of Mount Jumbo, having migrated to summer/fall ranges on the Lolo National Forest. In late fall, elk and many mule deer return to the Mount Jumbo area from these more northern summer ranges. Most elk and deer are on the winter range by December 1. Elk typically occupy the southern portion of Mount Jumbo during the most severe portions of the winter. From mid-March through April elk most often use habitat from the saddle north to National Forest lands. A few elk and more than 50 mule deer remain in the Mount Jumbo area throughout the summer and fall.

Winter Ecology: Please refer to the *Mount Jumbo Natural Resource Gazette* for detailed information on elk winter range. The following narrative briefly summarizes information from the *Gazette* and applies it to Mount Jumbo.

Winter and spring range limit the abundance and distribution of elk and deer populations, because forage is limited and environmental conditions cause physiological stress. No other suitable winter range is available to elk and mule deer that traditionally winter on Mount Jumbo because all nearby habitats are already fully occupied by humans and/or wintering populations of elk and deer.

Elk generally avoid areas of human activity and disturbance (Lyon and Ward 1982, Edge and Marcum 1991). Forest recreationists caused elevated heart rates and displacement of elk in Wyoming (Ward et al.

1973, Ward and Cupal 1979). Elk in Yellowstone Park displayed extreme avoidance of winter recreationists traveling on foot (Cassirer et al. 1992). Lyon and Ward (1982) concluded,

> . . it is important that recreational areas and access be kept away from elk winter ranges . . Winter range plays such a significant role in elk management that in some areas it is critical to continued elk survival.

Such information has been the basis for the Montana Department of Fish, Wildlife & Parks to prohibit human access as a matter of policy from December 1 to May 15 on public lands that the agency manages primarily for elk winter range values.

Observations of elk distribution on four winter ranges in the Missoula Valley support the findings of researchers that have documented elk avoidance of human disturbances elsewhere. These four are examples of areas purposefully dedicated to recreation. What is now the Blue Mountain Recreation Area (Lolo National Forest) once supported a wintering elk population. Since the creation of the Recreation Area in 1980, winter recreation has increased several fold, but winter elk use had declined to near zero by 1990. Mount Sentinel (University of Montana) and nearby Pattee Canyon Recreation Area (Lolo National Forest) appear to provide adequate elk winter habitat, but together they support few, if any elk. Likewise, few elk stay in the Rattlesnake National Recreation Area (Lolo National Forest), even though winter recreation is directed away from areas of concentrated elk use. On the other hand, more than 130 elk migrate through the Rattlesnake to spend the winter on privately owned (and undisturbed) land west of Rattlesnake Creek in the Grant Creek area.

Elk Ecology on the Mount Jumbo Winter Range: At the beginning of winter, elk utilize most of Mount Jumbo, foraging intensively on native bunchgrasses that typically are buried under fluffy snow that is easy to paw through. This early winter period is an important foraging opportunity for elk to conserve and add to accumulated fat stores before winter conditions become more difficult. Even in a “mild” winter, elk benefit from undisturbed access to this readily available forage during the early winter period because similar feeding areas at higher elevations are routinely covered with deeper snow.

As winter progresses in January and February, snows deepen and settle, forming layers of crust that are difficult to walk or paw through for food. Elk are typically in a “negative energy balance” during mid-winter because the energy needed to forage often exceeds the energy they obtain from their food. During this period of the winter, elk typically concentrate their use on steep, south and west facing slopes and ridges where the forces of wind and sunlight combine to expose spots of grass (i.e., the south one-half of Mount Jumbo). At this time, food is extremely limited and elk increasingly rely on energy conservation strategies and fat reserves for survival until the snow melts and green forage emerges in spring. Elk distribution and daily movements shrink. Any disturbance causes them to consume calories that cannot be readily replaced.

By early March, elk are in the poorest physical condition they will experience all year, particularly pregnant females as they approach the final trimester when rapid fetal development occurs. At this time, they are dependent on spring green-up, and undisturbed access to that green-up, to replace lost calories and supply energy to developing fetuses. Green-up first occurs at the lowest elevations and on south and southwest-facing slopes (i.e., the south one-half of Mount Jumbo).

Elk energy requirements continue to increase as fetuses grow during the spring. Accordingly, elk select the most succulent forage, generally following the receding snowpack upward in elevation to feed on tender new growth. Since most of Mount Jumbo is free of snow at this time (i.e., mid March-April), elk are able to move more easily between bedding and feeding areas, and may feed in some human-impacted areas under the cover of darkness if provided with secure daytime bedding areas nearby. The area north of the saddle on Mount Jumbo serves as such a daytime bedding area and allows elk access to nighttime feeding opportunities on all portions of the mountain. By May 1, foraging areas have been exposed on upper elevation ranges along Rattlesnake Creek on the Lolo National Forest, and elk naturally disperse from Mount Jumbo to utilize them.

Calving normally occurs between mid-May and mid-June, as elk make their way toward their summer ranges. Although instances of elk calving on Mount Jumbo have been documented, the mountain is not an important calving habitat for the herd.

Risks to Elk and Elk Viewing: Uncontrolled human use of Mount Jumbo during winter and early spring presents high risks to elk and elk viewing. If human use becomes excessive in amount and distribution, elk may be expected to abandon the Mount Jumbo winter range. In the unlikely event that elk remain in the face of increased human use during winter, they will be subject to increased stress and decreased access to critical habitats during the period of the year when they are least able to respond. In either case, the result probably will be decreased survivorship (i.e., fewer calves or healthy calves born and lowered calf survival through their first winter) and the eventual loss of this elk herd. An additional consideration is the small size of this herd (less than 100 individuals), which imposes inherent limitations on its resilience in the face of decreased survivorship. It is important to note that while this elk herd certainly is adapted to survive limited losses due to periodically severe winter conditions, its long-term persistence may be critically linked with the ability to recover and increase herd numbers and condition during mild winters, with full access to the resources available on the Mount Jumbo winter range.

As a general rule, elk are most likely to tolerate disturbances that occur below their occupied elevations on mountain slopes such as Mount Jumbo. Elk are less likely to tolerate human activities that occur at or above the elevations they prefer to occupy, and also may abandon winter ranges that are isolated from adjacent elk habitat by human activity that completely surrounds them geographically. Thus, the saddle and the upper ridgelines of Mount Jumbo are critical winter security areas for this elk herd. These areas

are regularly used by the herd as movement corridors, and they are natural escape routes. Elk on Mount Jumbo seem capable of maintaining a continual awareness of and limited tolerance for human activities below them, as long as escape routes over the ridgeline and saddle remain secure. However, experience has shown that wild elk will likely abandon and avoid habitats where escape routes are no longer secure or cannot be "trusted."

Missoula Conservation Lands Management Plan

Properties Managed By Conservation Lands Program

0 0.4 0.8 Miles

North Hills Open Space (Schilling)
North Hills Open Space (Sunlight)
Powerline Easement - East
Rattlesnake Trail
Mount Jumbo (Saddle)
Papoose
Stanley
North Hills Open Space (Randolf)
Hamilton
Khanabad
Mount Jumbo (Backbone)
Riverside Natural Area
Alvina
Tower Street
Greenough
Mount Jumbo (South)
Dinsmore-Orchard Homes
Clark Fork Natural Area
Jacobs Island
Ben Hughes
Hellgate Park
Creekside Trail
Kim Williams / Hellgate Canyon
Mount Sentinel
Fort Missoula
Old Fish Pond
Oziya
Hemayagan
Willow Wood
Cattail Corner
Northview
Takima- Kokaski
Cohosset
Highland
Floral Park
Homestead
Woodbine
High
Meadowlark Acres
Blackthorn Addition
Peery
Moose Can Gully/Hillview Heights

Legend

- Roads
- Conservation Lands
- Park Preserves
- Public Natural Areas
- Urban Parklands with Special Resources Present

Source: Missoula Parks and Recreation 2009d

MISSOULA
Parks & Recreation

Missoula Conservation Lands Management Plan

MTFWP Designated Elk Winter Range

0 0.45 0.9 Miles

North Hills Open Space (Schilling)
North Hills Open Space (Sunlight)
Powerline Easement - East
Rattlesnake
Papoose Trail
Mount Jumbo (Saddle)
North Hills Open Space (Randolf)
Hamilton
Stanley
Khanabad
Riverside Natural Area
Mount Jumbo (Backbone)
Alvina
Greenough
Tower Street
Clark Fork Natural Area
Dinsmore-Orchard Homes
Mount Jumbo (South)
Jacobs Island
Ben Hughes
Hellgate Park
Creekside Trail
Kim Williams / Hellgate Canyon
Mount Sentinel
Fort Missoula
Old Fish Pond
Oziya
Hemayagan
Willow Wood
Cattail Corner
Northview
Takima- Kokaski
Cohosset
Highland
Floral Park
Homestead
Woodbine
High
Meadowlark Acres
Peery
Blackthorn Addition
Moose Can Gully/Hillview Heights

Legend

- Roads
- Conservation Lands
- Mt. Jumbo Herd
- Grant Creek Herd

Source: MTFWP 2009

MISSOULA
Parks & Recreation

Missoula Conservation Lands Management Plan

MTFWP-Designated Mule Deer Winter Range

0 0.4 0.8 Miles

North Hills Open Space (Schilling)
North Hills Open Space (Sunlight)
Powerline Easement - East
Rattlesnake
Papoose Trail
Mount Jumbo (Saddle)
North Hills Open Space (Randolf)
Hamilton
Stanley
Khanabad
Mount Jumbo (Backbone)
Riverside Natural Area
Alvina
Greenough
Tower Street
Dinsmore-Orchard Homes
Clark Fork Natural Area
Mount Jumbo (South)
Jacobs Island
Ben Hughes
Hellgate Park
Creekside Trail
Kim Williams / Hellgate Canyon
Mount Sentinel
Fort Missoula
Old Fish Pond
Oziya
Hemayagan
Willow Wood
Cattail Corner
Northview
Takima- Kokaski
Cohosset
Highland
Floral Park
Homestead
Woodbine
High
Meadowlark Acres
Peery
Blackthorn Addition
Moose Can Gully/Hillview Heights

Legend

- Roads
- Conservation Lands
- Mule Deer Winter Range

Source: MTFWP 2009

MISSOULA
Parks & Recreation

Missoula Conservation Lands Management Plan

MTFWP - Whitetailed Deer Winter Range

0 0.4 0.8 Miles

North Hills Open Space (Schilling)
North Hills Open Space (Sunlight)
Powerline Easement - East
Rattlesnake Trail
Mount Jumbo (Saddle)
Papoose
North Hills Open Space (Randolf)
Stanley
Khanabad
Hamilton
Riverside Natural Area
Alvina
Mount Jumbo (Backbone)
Tower Street
Greenough
Clark Fork Natural Area
Dinsmore-Orchard Homes
Mount Jumbo (South)
Jacobs Island
Ben Hughes
Hellgate Park
Creekside Trail
Kim Williams / Hellgate Canyon
Mount Sentinel
Fort Missoula
Old Fish Pond
Oziya
Hemayagan
Cattail Corner
Willow Wood
Northview
Takima- Kokaski
Cohosset
Highland
Floral Park
Homestead
Woodbine
High
Meadowlark Acres
Peery
Blackthorn Addition
Moose Can Gully/Hillview Heights

Legend

- Roads
- Conservation Lands
- Whitetailed Deer Winter Range

Source: MTFWP 2009

MISSOULA
Parks & Recreation

Missoula Conservation Lands Management Plan

Bird and Fish Species of Concern

0 0.5 1 Miles

Legend

- Roads
- Conservation Lands

Species of Concern

- Lazuli Buntings
- American Redstarts
- Bald Eagle Potential Nesting Territories
- Bull Trout
- Westslope Cutthroat Trout
- Swainson's Hawk
- Grasshopper Sparrow
- Flammulated Owl
- Lewis's Woodpecker

Source: Montana Natural Heritage Program 2009

MISSOULA
Parks & Recreation

Missoula Conservation Lands Management Plan

Plant Species of Concern

0 0.4 0.8 Miles

North Hills Open Space (Schilling)
North Hills Open Space (Sunlight)
Powerline Easement - East
Rattlesnake Papoose Trail
Mount Jumbo (Saddle)
North Hills Open Space (Randolf)
Stanley
Hamilton
Khanabad
Riverside Natural Area
Mount Jumbo (Backbone)
Alvina
Greenough
Tower Street
Clark Fork Natural Area
Dinsmore-Orchard Homes
Mount Jumbo (South)
Jacobs Island
Ben Hughes
Hellgate Park
Creekside Trail
Kim Williams / Hellgate Canyon
Mount Sentinel
Fort Missoula
Old Fish Pond
Oziya
Hemayagan
Willow Wood
Cattail Corner
Northview
Takima- Kokaski
Cohosset
Highland
Floral Park
Homestead
Woodbine
High
Meadowlark Acres
Peery
Blackthorn Addition
Moose Can Gully/Hillview Heights

Legend

- Roads
- Conservation Lands

Species of Concern

- Missoula Phlox
- Obscure Evening-primrose
- Ring Lichen
- Toothcup

Source: Montana Natural Heritage Program 2009

MISSOULA
Parks & Recreation

Missoula Conservation Lands Management Plan

Mueggler and Stewart Grassland Habitat Types

0 0.4 0.8 Miles

North Hills Open Space (Sunlight)
North Hills Open Space (Schilling)
Powerline Easement - East
Rattlesnake Trail
Mount Jumbo (Saddle)
Papoose
Stanley
Khanabad
Hamilton
North Hills Open Space (Randolf)
Mount Jumbo (Backbone)
Alvina
Riverside Natural Area
Tower Street
Greenough
Clark Fork Natural Area
Dinsmore-Orchard Homes
Mount Jumbo (South)
Jacobs Island
Ben Hughes
Hellgate Park
Creekside Trail
Kim Williams / Hellgate Canyon
Mount Sentinel
Fort Missoula
Old Fish Pond
Oziya
Hemayagan
Willow Wood
Cattail Corner
Northview
Takima- Kokaski
Cohosset
Highland
Floral Park
Homestead
Woodbine
High
Meadowlark Acres
Blackthorn Addition
Peery
Moose Can Gully/Hillview Heights

Legend

Roads

Conservation Lands

Mueggler and Stewart Habitat Types

- bluebunch wheatgrass/ western wheatgrass
- bluebunch wheatgrass/ western wheatgrass-green needlegrass
- bluebunch wheatgrass/ Sandburg bluegrass-needle and thread
- rough fescue/ bluebunch wheatgrass

Source: Mueggler and Stewart 1980; NRCS 1994

MISSOULA
Parks & Recreation

Missoula Conservation Lands Management Plan

Current Forest and Riparian Habitat Types

0 0.4 0.8 Miles

North Hills Open Space (Sunlight)
North Hills Open Space (Schilling)
Powerline Easement - East
Rattlesnake Trail
Mount Jumbo (Saddle)
Papoose
Stanley
Hamilton
Khanabad
North Hills Open Space (Randolf)
Riverside Natural Area
Alvina
Mount Jumbo (Backbone)
Tower Street
Greenough
Clark Fork Natural Area
Mount Jumbo (South)
Dinsmore-Orchard Homes
Jacobs Island
Ben Hughes
Hellgate Park
Creekside Trail
Kim Williams / Hellgate Canyon
Mount Sentinel
Fort Missoula
Old Fish Pond
Oziya
Hemayagan
Willow Wood
Cattail Corner
Northview
Takima- Kokaski
Cohosset
Highland
Floral Park
Homestead
Woodbine
High
Meadowlark Acres
Blackthorn Addition
Peery
Moose Can Gully/Hillview Heights

Legend

Roads
Conservation Lands

Forest Habitat Types

- Ponderosa Pine Grassland
- Ponderosa Pine Low Shrub
- Douglas Fir Tall Shrub
- Douglas Fir Pine Grass
- Douglas Fir Low/Tall Shrub

Riparian Habitat Types

- Cottonwood Tall Shrub
- Cottonwood Low Shrub
- Sandbar Willow

Source: NRCS 1994; Pfister et al. 1990

Missoula Conservation Lands Management Plan

Recreational Trails

0 0.5 1 Miles

North Hills Open Space (Schilling)
North Hills Open Space (Sunlight)
Powerline Easement - East
Rattlesnake Trail
Mount Jumbo (Saddle)
North Hills Open Space (Randolf)
Mount Jumbo (Backbone)
Peschel Easement
Alvina
Greenough
Stahl Easement
Tower Street
Dinsmore-Orchard Homes
Mount Jumbo (South)
Creekside Trail
Hellgate Park
Ben Hughes
Kim Williams / Hellgate Canyon
Mount Sentinel
Old Fish Pond
Hemayagan
Highland
Homestead
Floral Park
High
Meadowlark Acres
Moose Can Gully/Hillview Heights
Peery
Line/Hayden/Rimel Easement

Legend

- Roads
- Conservation Lands
- Conservation Easement
- City Trailhead

Conservation Lands Trails

- Public Non-Motorized
- Future Trail Public Non-Motorized
- Pedestrian Only
- Future Trail Ped Only
- Future Trail Use Undetermined

Source: Missoula Parks and Recreation 2009c

Missoula Conservation Lands Management Plan

Native Grassland Health Indicators

0 0.4 0.8 Miles

North Hills Open Space (Sunlight)
North Hills Open Space (Schilling)
Powerline Easement - East
Rattlesnake Trail
Mount Jumbo (Saddle)
Papoose
Stanley
Hamilton
Khanabad
North Hills Open Space (Randolf)
Riverside Natural Area
Alvina
Mount Jumbo (Backbone)
Tower Street
Greenough
Clark Fork Natural Area
Mount Jumbo (South)
Dinsmore-Orchard Homes
Jacobs Island
Ben Hughes
Hellgate Park
Creekside Trail
Kim Williams / Hellgate Canyon
Mount Sentinel
Fort Missoula
Old Fish Pond
Oziya
Hemayagan
Willow Wood
Cattail Corner
Northview
Takima- Kokaski
Cohosset
Highland
Floral Park
Homestead
Woodbine
High
Meadowlark Acres
Blackthorn Addition
Peery
Moose Can Gully/Hillview Heights

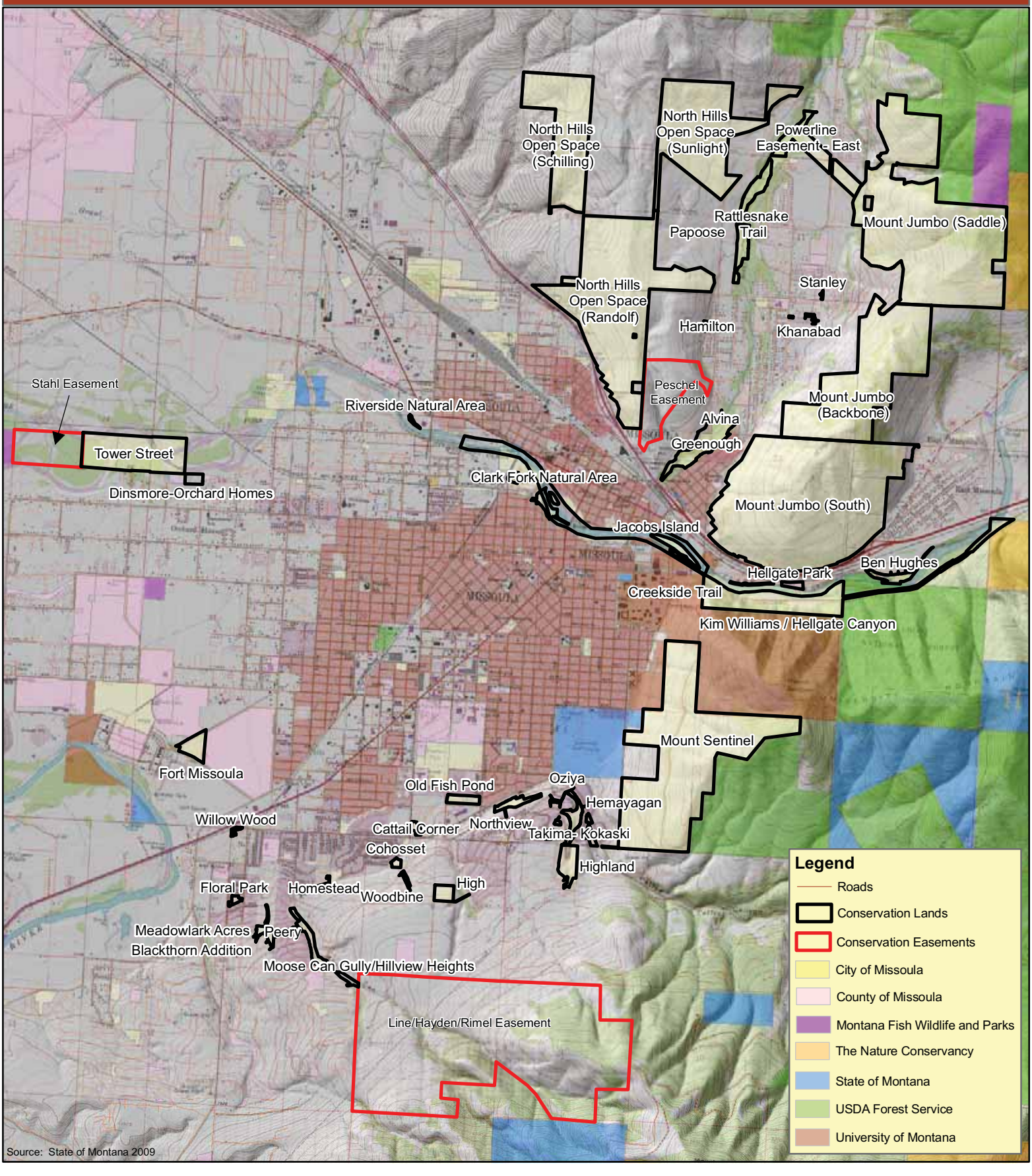
Legend

- Roads
- Conservation Lands

Health Indicators

- Pristine Grassland
- Grassland - Native Dominant
- Grassland - Weed Dominant
- Inundated Grassland
- Sensitive

Source: Missoula Parks and Recreation 2009c


Missoula
Missoula Parks & Recreation
Missoula Conservation Lands Management Plan
Ownership
0
0.45
0.9
Miles
North Hills Open Space (Schilling)
North Hills Open Space (Sunlight)
Powerline Easement - East
Rattlesnake Trail
Papoose
Mount Jumbo (Saddle)
North Hills Open Space (Randolf)
Stanley
Hamilton
Khanabad
Stahl Easement
Peschel Easement
Riverside Natural Area
Mount Jumbo (Backbone)
Alvina
Greenough
Tower Street
Clark Fork Natural Area
Dinsmore-Orchard Homes
Mount Jumbo (South)
Jacobs Island
Ben Hughes
Hellgate Park
Creekside Trail
Kim Williams / Hellgate Canyon
Mount Sentinel
Fort Missoula
Old Fish Pond
Oziya
Hemayagan
Willow Wood
Cattail Corner
Northview
Takima-Kokaski
Cohosset
Highland
Floral Park
Homestead
Woodbine
High
Meadowlark Acres
Peery
Blackthorn Addition
Moose Can Gully/Hillview Heights
Line/Hayden/Rimel Easement
Legend
Roads
Conservation Lands
Conservation Easements
City of Missoula
County of Missoula
Montana Fish Wildlife and Parks
The Nature Conservancy
State of Montana
USDA Forest Service
University of Montana
Source: State of Montana 2009