
City of Boulder Open Space and Mountain Parks

# Agricultural Resources Management Plan

July 2017

# Thank you to our farmers and ranchers

Open Space and Mountain Parks would like to give our sincere appreciation and thanks to the farmers and ranchers who lease city agricultural lands for their stewardship and essential role in continuing the historical practice of working agricultural lands.

OSMP

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Jack Sasson

## Mission of the Open Space and Mountain Parks Department

The Open Space and Mountain Parks Department preserves and protects the natural environment and land resources that characterize Boulder. We foster appreciation and use that sustain the natural values of the land for current and future generations.

## City of Boulder Charter Article XII; Sec. 176. Open Space Purposes - Open space land.

Open space land shall be acquired, maintained, preserved, retained, and used only for the following purposes:

- Preservation or restoration of natural areas characterized by or including terrain, geologic formations, flora, or fauna that is unusual, spectacular, historically important, scientifically valuable, or unique, or that represent outstanding or rare examples of native species;
- Preservation of water resources in their natural or traditional state, scenic areas or vistas, wildlife habitats, or fragile ecosystems;
- Preservation of land for passive recreation use, such as hiking, photography or nature study, and if specifically designated, bicycling, horseback riding, or fishing;
- Preservation of agricultural uses and land suitable for agricultural production;
- Utilization of land for shaping the development of the city, limiting urban sprawl and disciplining growth;
- Utilization of non-urban land for spatial definition of urban areas;
- Utilization of land to prevent encroachment on floodplains; and
- Preservation of land for its aesthetic or passive recreational value and its contribution to the quality of life of the community.

## Introduction

**The purpose of the Agricultural Resources Management Plan is to maintain and enhance agricultural-related values for the community by ensuring the long-term sustainability of agricultural operations, by taking a conservation approach that supports the ecological health of OSMP lands, and by fostering key connections between the community and its agricultural lands.**

## Plan Summary

The City of Boulder's Charter describes the purposes of open space land (facing page). These include the preservation of agricultural uses and land suitable for agricultural production and the preservation of water resources in their traditional state. Through the strategic acquisition of land and water, the city's Open Space and Mountain Parks (OSMP) Department has conserved over 45,000 acres—with 15,000 acres leased to agricultural producers. In addition to the lands the city leases, thousands of acres of agricultural lands and operations have been protected through conservation easement agreements with the city.

For over 150 years these lands and waters have been the foundation of agriculture in Boulder. Farmers and ranchers continue working these lands to provide food and other agricultural products and have also built and fostered a wide range of structures, community relationships, ecosystems, and scenic legacy of barns, farmhouses, ditches, hayfields and pastures.

The Agricultural Resources Management Plan (Ag Plan) identifies strategies to recognize, continue and, where beneficial, enhance those long-standing relationships, resources and facilities to support operations. Looking forward, the plan also calls for new approaches and innovations so that agriculture in the Boulder Valley can continue to thrive and develop in a future of social and environmental change. Such an approach is nothing new, as farmers and ranchers have been adapting to new conditions since 1859 when the first farmers who arrived in Boulder from the eastern US and Europe had to adjust their methods to be successful in the semi-arid American west.

The Ag Plan supports and develops OSMP's Agricultural Program with three focus areas:

1. Maintaining and enhancing the city's agricultural operations and relationships with current and future lessees;
2. Integrating agriculture with scenic, cultural and ecological stewardship; and
3. Supporting and enriching opportunities for people to connect with agriculture.

Some of the key new approaches and enhancements of existing practices are listed on the following page under these focus areas.

## Plan Summary

- **Maintain and enhance the city's agricultural operations and relationships with current and future lessees.**
  - Increase technical assistance and support for current and future agricultural operators.
    - Support ranchers and farmers in their existing operations to increase efficiency and explore new markets for continuing operations.
    - Foster partnerships among producers to meet local demand or develop new products for emerging markets.
    - Identify topics of interest through periodic surveys of producers; and provide consultation and information from subject area experts.
    - Assist grant writing for marketing of local products, processing equipment or other priorities.
    - Determine the best approach to encourage and support the next generation of farmers and ranchers.
  - Foster relationships or opportunities for farmers and ranchers to directly connect with the local community.
    - Explore ways to connect farmers and markets to local markets – "keeping it local".
  - Improve infrastructure, both water–related and structural, to support agricultural operations.
    - Continue to invest first in maintaining and improving existing infrastructure - 'taking care of what we have'.
    - Establish baseline information and standards for maintaining existing infrastructure.
    - Formalize a process to evaluate and develop new agricultural facilities.
    - Focus on adaptive management across multiple values covering agriculture, prairie dogs, bobolinks, Preble's meadow jumping mouse habitat, recreational use, and elements effecting agricultural producers.
    - Develop a water management strategy that supports sustainable agricultural operations and anticipates a warmer and drier climate.
  - Expand the variety of agriculture operations on OSMP lands as appropriate with a focus on diversified vegetable/pastured livestock farming and micro dairies.
    - Introduce new operations based on market needs, working closely with existing farmers and ranchers to avoid impairment of existing successful operations.
    - Evaluate newly acquired properties for diversified vegetable/pastured livestock farming opportunities.
    - Work closely with adjacent neighbors to ensure good neighbor relationships are respected.
  - Update business practices to support agricultural operators' ongoing ability to farm; to maintain fairness in value, transparency in process, and fiscal responsibility; as well as to consider and mitigate the special conditions and requirements faced by ranchers and farmers working in and adjacent to an urbanized region.
- **Integrate agricultural, scenic, cultural and ecological stewardship.**
  - Complete cultural resource surveys of agricultural structures and prioritize archaeological assessments where activities are likely to disturb the ground (e.g., potential diversified vegetable/pastured livestock farm sites).

## Plan Summary

- Develop criteria to ensure the protection, use and enjoyment of historic structures.
- Improve the understanding of how working agricultural landscapes contribute to the viewsheds of the Boulder Valley.
- Evaluate changes to water rights management to benefit ecological systems.
- Identify and mitigate any adverse effects of agriculture on surface and ground water quality.
- Assess soil health and evaluate the condition of grazed lands.
- Establish a native plant propagation program integrating agriculture directly with ecosystem restoration.
- Establish pollinator-friendly habitat and maintain habitats for other sensitive species.
- Graze livestock to benefit ecological conditions *outside* of leased areas.

¤ **Support and enrich opportunities for people to connect with agriculture.**

- Develop educational and outreach programming to tell the stories of agriculture on OSMP lands and deepen community members' knowledge of local agriculture.
- Provide opportunities for community members to volunteer, experience and support local agriculture.
- Enhance recreation activities on agricultural working lands that support both a high quality visitor experience and efficient agricultural operations.
- Increase community awareness of agricultural operations and irrigation practices so OSMP visitors can safely and respectfully enjoy recreation opportunities on and around agricultural lands.
- Consider experiences or types of agriculturally related activities related to connecting the community to agriculture. This includes activities in the following four categories: agritourism, farm events, farm stores, and community farming.
- Test pilot projects to provide stronger connections to the community and develop partnerships that connect the local community to Boulder's local food and working landscapes. Integrate successful projects into OSMP's programs.

## Plan Structure

The Ag Plan is divided into four chapters:

¤ **Agricultural Management** - Deals with agricultural production and infrastructure;

¤ **Ecological Integration**[1] - Addresses the integration of ecological systems with agricultural management;

¤ **Community and Visitor Integration** - Focuses on the many relationships among agriculture and the people of the Boulder Valley with focus on OSMP visitors and volunteers; and

¤ **Acquisition** - Focuses on preserving the lands and water upon which OSMP agriculture is based.

Each of the chapters contains one or more sections dealing with the topics relevant to the chapter. The list of chapters and related sections can be seen in the plan's table of contents (p. 4-5). Each section of the plan contains subsections describing: the relevant policy guidance, existing conditions, objectives, management strategies, measures of success and estimated implementation costs.

[1] The subsections of the Ecological Integration chapter were derived, in large part, from the OSMP Grassland Ecosystem Management Plan.

## Plan Structure

**Policy Guidance** provides a summary of the most relevant laws, regulations and policies guiding and directing OSMP's actions with regard to the section topic. The list is not meant to be exhaustive, but rather a way to highlight the policy factors that most affect OSMP management.

**Existing Conditions** is a summary of the most important attributes of the section topic. This section contains available information about the factors that characterize the topic and the relationship to existing or proposed objectives.

**Objectives** provide a statement of desired conditions. The objectives identify what is at the heart of the section; and provide policy guidance for more specific, and actionable management strategies.

**Management Strategies** describe the actions, technical analyses, business practices and future planning efforts to achieve the section's objectives.

**Case Studies** (optional) are provided in some sections of the plan to more fully explore a particular strategy.

**Measures of Success** include a general description of the indicators or other measures that can be used to evaluate whether the plan strategies are moving OSMP in the direction of our objectives.

**Research Opportunities** (optional) are listed in some sections of the plan to inform OSMP's research program priorities. In most cases research is identified as a means to better understand the way agricultural operations operate, relate to larger issues, or as a means to better understand or compare the effectiveness of new or existing management strategies.

**Estimated Implementation Costs** gives an approximate cost or range of costs for the management strategies and related actions. The symbols in Figure 1 are used to indicate cost ranges.

Estimated Implementation Costs

| |
|---|
| $ = less than $10,000 |
| $$ = $10,000 - $49,999 |
| $$$ = $50,000 - $99,999 |
| $$$$ = $100,000 - $500,000 |
| $$$$$ = more than $500,000 |

Figure 1

## Relationship to Other Plans

The Ag Plan will affect and influence other OSMP master, area, resource and program management plans. The Ag Plan provides policy direction and outlines broad strategies for integration into short and long-term work plans. The OSMP Grassland Ecosystem Management Plan (Grassland Plan) identified Agricultural Operations as one of the plan's focus areas and developed a framework to deliver agricultural services and manage agricultural resources in a manner consistent with ecological objectives. The Ag Plan integrates the relevant direction from the Grassland Plan and considers OSMP's agricultural management objectives at a finer scale.

## Relationship to Other Plans

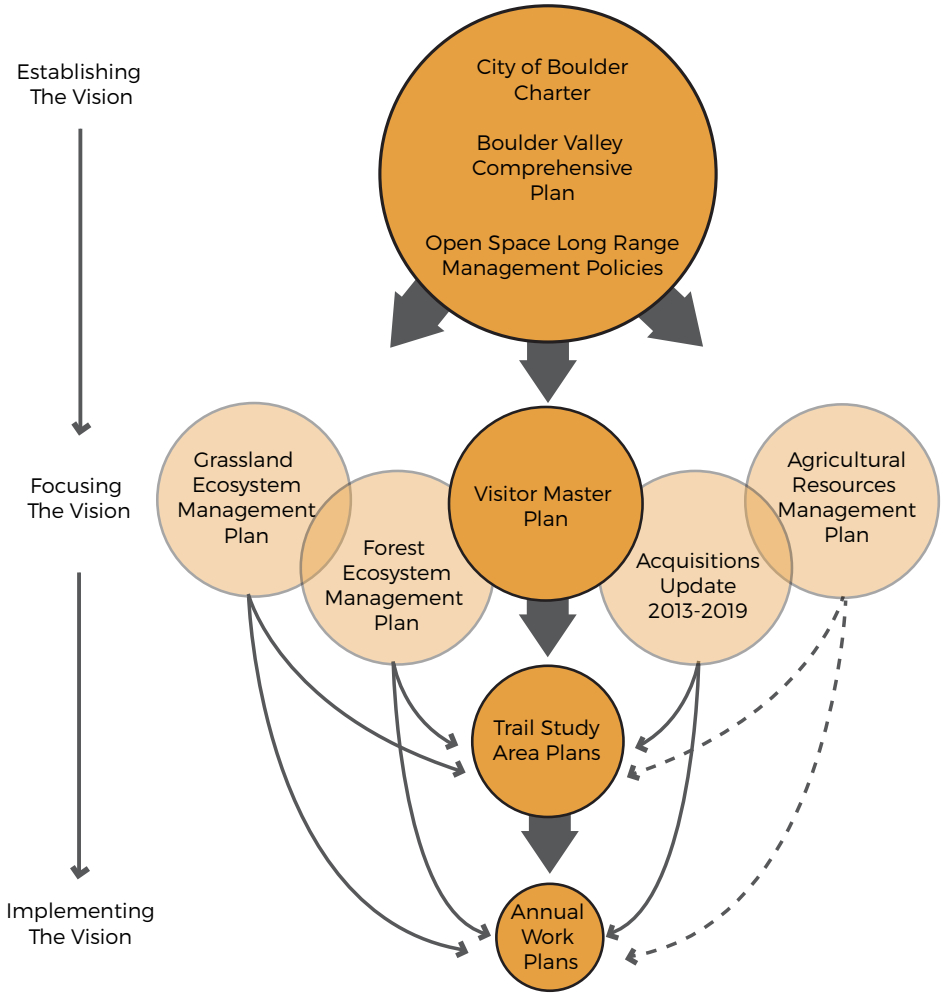



Figure 2

## Planning and Public Process

Since the City of Boulder kicked off the planning and public process for the Ag Plan, OSMP has:

- Hosted three public open houses to reach out to the community and gather feedback.
- Solicited community feedback on draft materials through three comment periods.
- Invited the public to participate in a questionnaire about how the community values and enjoys city agricultural lands. There were approximately 250 participants.
- Reached out to existing agricultural lessees and held four additional meetings to provide information and seek input on plan topics.
- Received approximately 100 comments on draft materials from community members.

Kirstin Boyer

# Agricultural Management

# Working Lands

## Existing Policy Guidance

### City Charter ARTICLE XII. OPEN SPACE

Sec. 176 Open Space Purposes – Open space land

- Preservation of agricultural uses and land suitable for agricultural production.
- Preservation of water resources in their natural or traditional state, scenic areas, or vistas, wildflife habitats, or fragile ecosystems.

### Boulder Valley Comprehensive Plan (BVCP)

9.01 Support for Agriculture

- The city and county will encourage the preservation of working agricultural lands and sustainable production of agricultural lands as a source of food and feed.
- The city and county will demonstrate and encourage the protection of significant agricultural areas and related water supplies and facilities.

## Existing Conditions

Both the forested foothills to the west and the grasslands to the north, south and east of the city contribute to Boulder's distinct identity and beautiful setting. While some of the native prairie is maintained by natural processes, the majority of OSMP grasslands are maintained by agricultural practices. These grasslands are working lands where farmers and ranchers make their livelihood by raising crops and livestock.

OSMP has a long history of working in partnership with agricultural operators to manage open space lands. Immediately following the passage of the first open space sales tax in 1967, the city relied almost entirely upon agricultural lessees for the day to day management of open space grasslands.

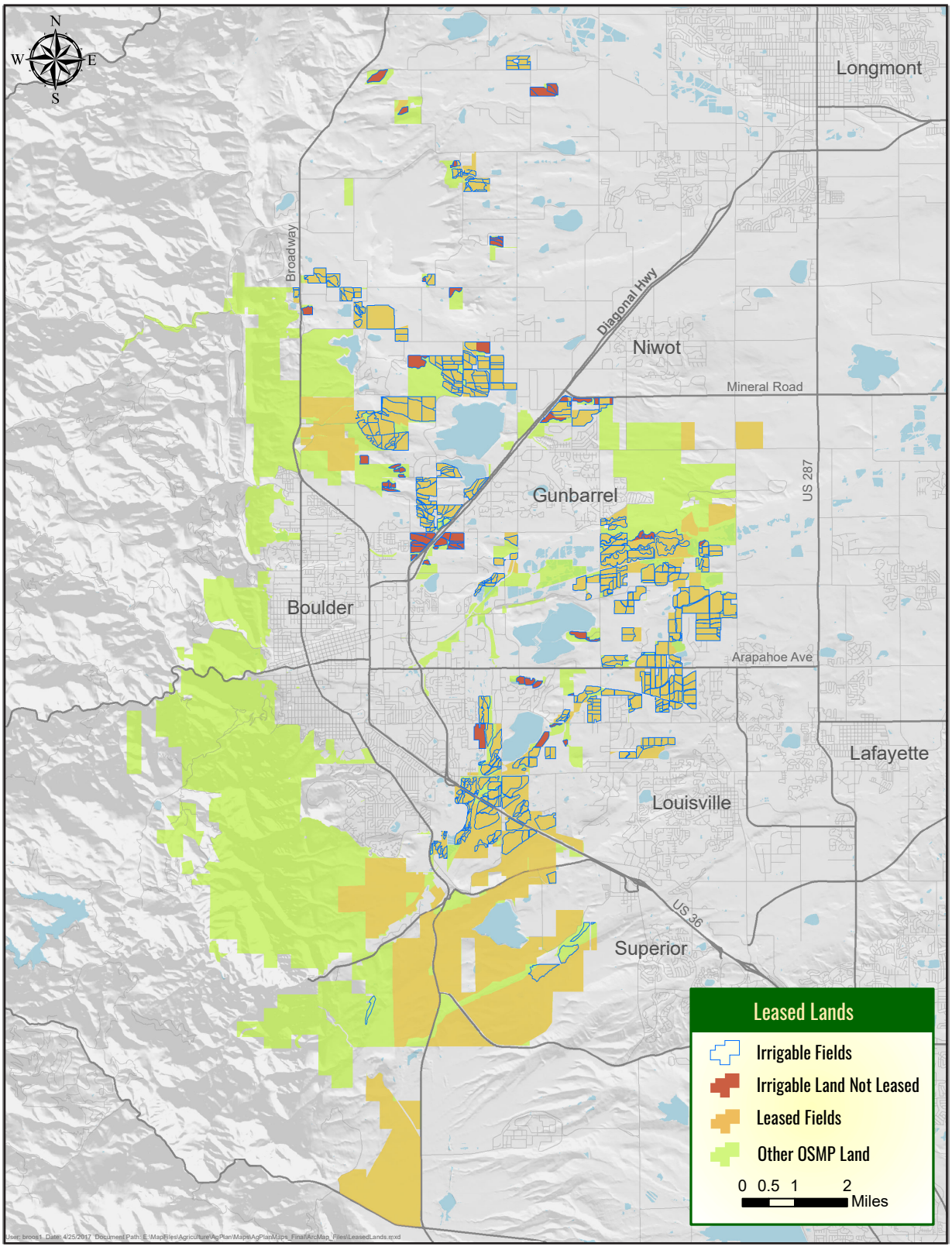
Today, almost 15,000 acres of land are leased to local farmers and ranchers in support of their operations. Of that, about 6,000 acres are irrigable (Map 1). Of the irrigable acres, about 700 acres are not currently leased. Some of these are small isolated parcels, properties where the agricultural or irrigation facilities are in disrepair, lands where agricultural values have been degraded by prairie dogs or places where OSMP is pursuing management objectives that are incompatible with irrigated agriculture.

Irrigated land and the water rights that allow for irrigation are critical to the continued support of working agricultural lands on OSMP. OSMP owns water rights in the four major creek drainages in the Boulder Valley (Boulder, South Boulder, Lefthand and Coal Creek). This portfolio contains many senior water rights that provide reliable sources of irrigation in most years.

Colorado water law requires the application of irrigation water for beneficial uses; and water rights must be used in order to protect the value of the city's water rights. The OSMP lessees play a critical role for OSMP in distributing these water rights across the OSMP landscape and by conducting routine maintenance on the irrigation and agricultural infrastructure.

OSMP currently leases land to 26 different lessees, some of whom

# Map 1: Leased Lands



# Working Lands

## Existing Conditions

have hired labor to assist them in the operation and maintenance of irrigation infrastructure. The agricultural lessees not only make lease payments to the department, their operation and maintenance activities on the leased landscape lead to significant cost savings to the department. If OSMP did not have agricultural operators utilizing its water portfolio, the department would have to hire multiple staff members to conduct these operations and maintenance activities. It has been estimated that the department would need to hire an additional 15 staff members to operate and maintain the department's irrigated lands and infrastructure, costing the department over $1 million dollars each year!

Agricultural lessees play an essential role in continuing the historical practice of working agricultural lands. As OSMP partners, they are stewards of Boulder's land and water resources, and are often the first to identify and often remedy, threats to infrastructure or resources.

## Objectives

- **Maintain and support working agricultural lands, including the preservation of water resources by maintaining land for agricultural uses.**

## Management Strategies

### Lease lands to agricultural producers.

This has been a winning strategy for both local farmers and ranchers and the City of Boulder for the past 50 years.

### Restore irrigation and agricultural uses to selected sites.

The process to restore historic irrigation and agricultural uses is outlined in Figure 3.

Process to Restore Irrigation and Agricultural Uses to Selected Sites

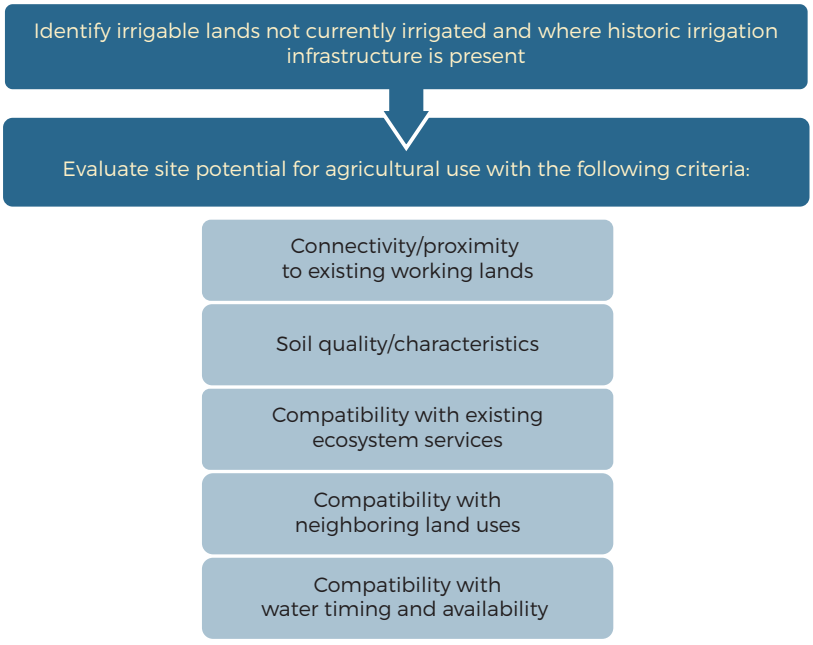



Figure 3

# Working Lands

## Measures of Success

- Acres in agricultural production (number of acres leased).
- Percent of irrigable land leased for agricultural purposes. (desired condition = all selected sites)

## Estimated Implementation Costs

- $$ - $10,000 - $49,999 per site for infrastructure improvements and deferred maintenance to restore historic irrigation and agricultural uses on selected sites.

OSMP

# Leasing Agricultural Lands

## Existing Policy Guidance

**Boulder Revised Code**

- 2-2-8. Conveyance of City Real Property Interests
  (a) The city manager may convey, grant or lease any interest in any city real property for a term of three years or more only if the manager first obtains City Council approval in the form of a motion, after which the manager may sign the deed or other instrument making the conveyance, grant or lease.

**City Charter ARTICLE XII. OPEN SPACE**

Sec. 171 Function of the department

- Shall acquire, supervise, administer, preserve, and maintain all open space land and other property associated therewith and may grant nonexclusive licenses and permits and agricultural leases for crop or grazing purposes for a term of five years or less.

Sec. 177 Disposal of open space land

- No open space land owned by the city may be sold, leased, traded, or otherwise conveyed, nor may any exclusive license or permit on such open space land be given, until approval of such disposal by the City Council. Such approval may be given only after approval of such disposal by the affirmative vote of at least three members of the Open Space Board of Trustees after a public hearing held with notice published at least 10 days in advance in a newspaper of general circulation in the city, giving the location of the land in question and the intended disposal thereof. No open space land owned by the city shall be disposed of until 60 days following the date of City Council approval of such disposal. If, within such 60-day period, a petition meeting the requirements of Section 45 and signed by registered electors of the city to the number of at least five percent of the registered electors of the city as of the day the petition is filed with the city clerk, requesting that such disposal be submitted to a vote of the electors, such disposal shall not become effective until the steps indicated in Section 46 and Section 47 have been followed.
- This section shall not apply to agricultural leases for crop or grazing purposes for a term of five years or less.

**BVCP**

9.03 Sustainable Food Production Practices

- The city and county will promote sustainable food production practices on publicly-owned lands.

# Leasing Agricultural Lands

## Existing Conditions

Today, OSMP leases about 15,000 acres of working lands to 26 farmers and ranchers. Many have been working the same lands for decades, some for over 30 years–and some before the lands were acquired by the city as open space. Figure 4 shows the distribution of tenancy. These long-term partnerships are beneficial to both the city and lessees, support the local agricultural heritage of Boulder Valley and have provided for continuous stewardship of OSMP's working landscape.

Properties are first leased–or "put up for bid"–after an acquisition of a new property is determined to be appropriate for agricultural operations or when a change in management is necessary. Such changes could result from a lessee retiring or being unable to comply with stewardship requirements, or the transition of a property from one type of agricultural use to another. Once available to lease, public notice is provided of the available land and water, along with a stewardship model describing OSMP's general parameters for agricultural use of those resources. For example, staff will identify the type of agricultural operation (e.g. hay, grazing, vegetable/pastured livestock farm) and important stewardship responsibilities. Potential operators submit stewardship proposals, along with a figure of what they are offering to pay. The applicant whose proposal and qualifications are the best match with OSMP's management objectives is selected. Figure 5 outlines the existing agricultural lease and renewal process.

Lessee Tenure

| 20+ years | 11-20 years | 6-10 years | 0-5 years |
|---|---|---|---|
| 33% | 25% | 29% | 13% |

Figure 4


Lisa Dierauf

# Leasing Agricultural Lands

## Existing Conditions

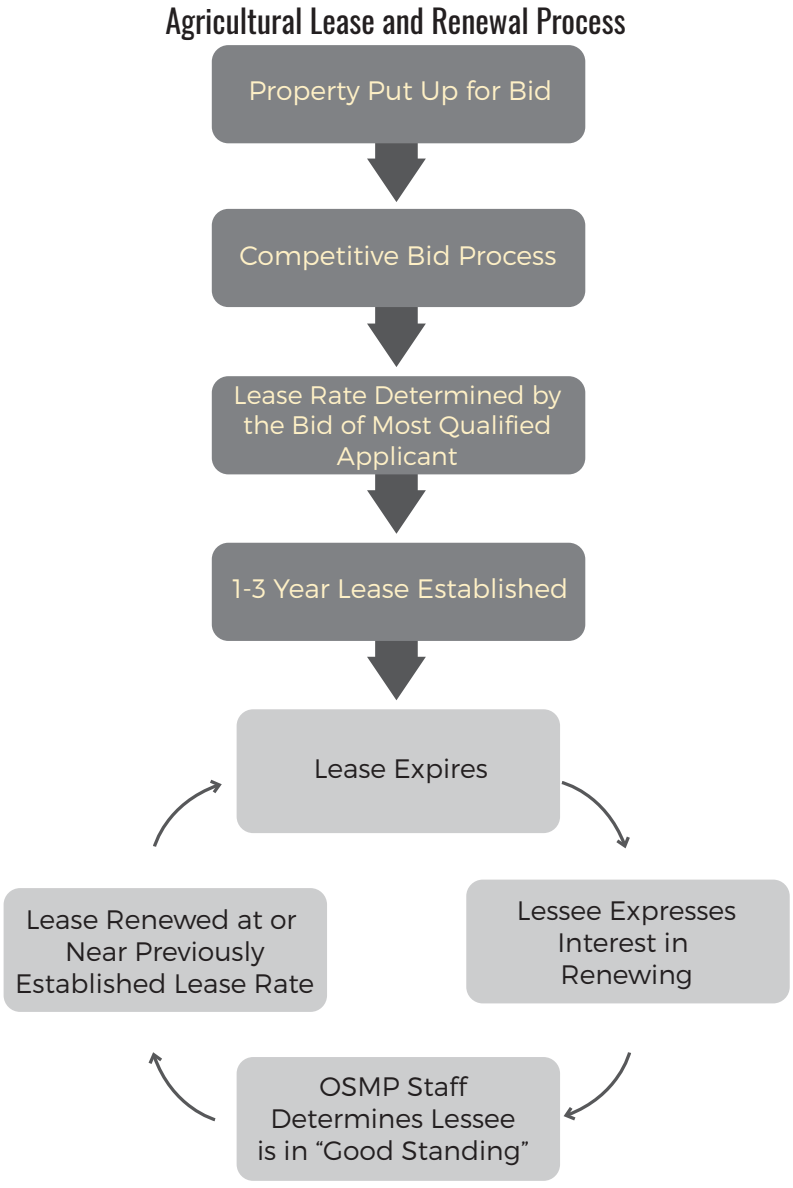



Figure 5

Leases are renewed if the agricultural management on the property has adhered to terms and responsibilities outlined in the lease. Although all leases are short-term (less than three years), the practice of repeatedly renewing leases has resulted in strong long term relationships between the city and lessees in "good standing".

# Leasing Agricultural Lands

## Existing Conditions

However, this model has also had some unintended consequences. One of which is that there hasn't been a periodic review of lease rates, as leases have been renewed at or near the originally established rates. This has resulted in discrepancies among the rates being charged to OSMP lessees for similar properties; older leases tend to have lower rates. Staff's analysis also indicates that most of the rates charged to OSMP lessees are considerably lower than peer agencies and rates on comparable privately owned lands in the Boulder Valley (Figure 6).

### Comparison of OSMP Lease Rates with Best Available Comparable Data

(Values are rounded to nearest dollar and unless otherwise noted, rates are per acre or per Animal Unit Month [AUM][2] for grazing.)

| Crop or Land Type | OSMP | Boulder County POS* | Colorado State University** | Colorado State Land Board*** | USDA Colorado-wide**** |
|---|---|---|---|---|---|
| Fully irrigated and suitable for growing vegetables | **$100-$150** | $100 + | $120 - $350 | -- | -- |
| Average cropland or good quality hay land | **$24-$75** | $60 - $75 | $120 - $300 | -- | $140 |
| Low quality irrigated land or marginal hay land | **$13-$35** | $40 - $60 | -- | -- | -- |
| Non-irrigated cropland | **$10-$12.50** | $16 | $20 - $55 | N/A | $29 |
| Irrigated pasture | **$11-$17** | $30 | -- | -- | -- |
| Per AUM grazing fee | **$6-$10** | $18 | $15 - $30 | $14 - $19 | $17 |

*Boulder County Parks and Open Space (BCPOS) Cash Rent Guidelines (courtesy BCPOS), County rates vary according to factors such as soil types, quality of water right, slope, fencing, weed intensity and parcel size.
**Colorado State University Farm and Ranch Survey (2015-most recent biennial report, data from 2014).
***Rates provided from AUM Rates Effective January 1, 2016 using data from Northeast and East Central Regions as these lands most closely approximate conditions on OSMP.
****United States Department of Agriculture (USDA) Agricultural Statistics Service statewide averages. Non-irrigated cropland (2016) and Per AUM grazing fee (2016).

Figure 6

[2]AUM – Animal Unit Month = Amount of forage needed to provide for a 1,000 lb. cow and her suckling calf grazing for one month.

# Leasing Agricultural Lands

## Existing Conditions

Agricultural leases also outline the terms and conditions of access and other permitted uses. Lessees are typically provided greater access to open space land and permission for a wider variety of activities than recreational visitors in their leased areas and along the ditches serving their leased areas. Some examples include: off-trail access in Habitat Conservation Areas (HCAs), limited and sensitively designed access to closed properties, management of off-leash working dogs in no dog or otherwise leash required areas, and off-road ATV/vehicle/equipment use. Lessees must also agree to modify agricultural practices from time to time to accommodate the multiple objectives of the OSMP program. OSMP collaborates closely with Boulder County Animal Control officers to ensure the humane treatment of livestock and farm animals.

In addition to lease payments, lessees must also indemnify the City of Boulder against the significant risks associated with agricultural operations. Lessees also acknowledge the risk involved in conducting agricultural activities and storing personal property on OSMP land. Lessees are required to carry and provide the city proof of commercial or farm liability insurance policies. Lack of insurance or cancellation of insurance may result in termination of lease agreements.

## Objectives

- **Maintain an agricultural lease program compatible with agricultural and resource stewardship and a working lands program.**

- **Clearly define management responsibilities, agricultural stewardship expectations and permissible uses with lessees.**

## Management Strategies

**Develop a fee structure compatible with agricultural and resource stewardship and a working lands program and evaluate the feasibility of a compensation program for stewardship activities by 2020.**

First, a range of base rates to be charged for the various, common agricultural uses of OSMP land will be established. OSMP staff will work closely with existing agricultural lessees and other agricultural economic experts to establish the range of base rates. This range of base rates will also take into consideration and be consistent with the range of rates charged by others for comparable land and lease conditions. OSMP's closest peer organization is Boulder County Parks and Open Space (BCPOS). Staff expects the range of future base lease rates to be similar to those charged by BCPOS; however, the OSMP range of base rates will account for differences in management policy and resource conditions.

# Leasing Agricultural Lands

## Management Strategies

Using the range of base rates as a starting point, a property specific lease rate will be established. The property specific lease rate will incorporate the relevant factors affecting production and operational efficiency in each leasehold. Examples of these factors are shown in Figure 7 . Staff will consider the relative effect of these factors and make upward or downward adjustments from the range of base rates for each lease area.

### Lease Rate Factors

| | | |
|---|---|---|
| **Land** | | |
| Soil type | Slope | Extent of lease area |
| Extent and type of weeds | Presence of prairie dogs | Range/intensity of ag use |
| **Water** | | |
| Amount of water | Duration of water availability | Condition of water delivery infrastructure |
| **Facilities** | | |
| Fencing condition | Fencing needs | Building availability and condition |
| Maintenance and repair responsibilities | Other special facilities | Lessee provided facilities and equipment |
| **OSMP Related Special Conditions/Requirements** | | |
| Recreation related | Ecological management and restoration | Other OSMP management requirements |

Figure 7

Agricultural economists may be consulted to establish lease rates, conduct ability to pay analyses, or to evaluate the feasibility of compensation or other strategies to offset the costs of OSMP required stewardship activities. Administration costs and departmental documentation needs (e.g. number of AUMs) will also be taken into consideration when evaluating the lease rate structure.

The intent of the fee structure is to recognize the value of the stewardship that the agricultural community provides for these lands and charge a fair amount related to the intensity of the agricultural use of the land and relative to other local agricultural operators. It is not the intent of the department to operate the agricultural leasing program as a cost recovery program or at lease rates that maximize revenue to the department. Stewardship of agricultural and other resources and providing an economically viable opportunity for local farming and ranching families are the highest priorities.

# Leasing Agricultural Lands

## Management Strategies

### Develop Stewardship Plans.

Plans will be developed with lessees and will address, but not be limited to the topics listed in Figure 8.

Topics Addressed in Stewardship Plans

- Ecological targets for leased properties and the requirements for compatible resource goals and agricultural management practices
- Access and permitted uses
  - Off-trail access in HCAs without an off-trail permit
  - Access to closed properties
  - Commercial sales (such as direct-market hay sales without a commercial use permit)
  - Off-leash working dogs in no dog or otherwise leashed areas
  - Livestock guard dogs and/or guard llamas
  - Off-road ATV/vehicle/equipment use
- Lessee financial and maintenance responsibilities
- OSMP responsibilities
  - Infrastructure improvements
  - Maintenance
  - Water assessments
- IPM
- Insurance requirements and documentation
- Documentation of livestock grazing activities sufficient to calculate accurate lease invoicing and payment information
- Recreation related special conditions/requirements

Figure 8

# Leasing Agricultural Lands

Ann Duncan

# Leasing Agricultural Lands

## Management Strategies

### Establish new first time lease process that incorporates the new fee structure and stewardship plans.

Figure 9 outlines the revised process for establishing new agricultural leases. This process would be used when a new property is purchased and available for agricultural uses or when there is a change in agricultural lessee because of a change in agricultural management, lessee retirement or other voluntary forfeiture of the lease by the current lessee.

Staff evaluated several lease models including the existing conditions model where lease rates are determined by the bid of the most qualified applicant. This model may not be as effective in remedying the discrepancies among the rates being charged to OSMP lessees for similar properties or be as effective in establishing rates that are as regionally equitable as the proposed model in Figure 9.

New Agricultural Lease Process

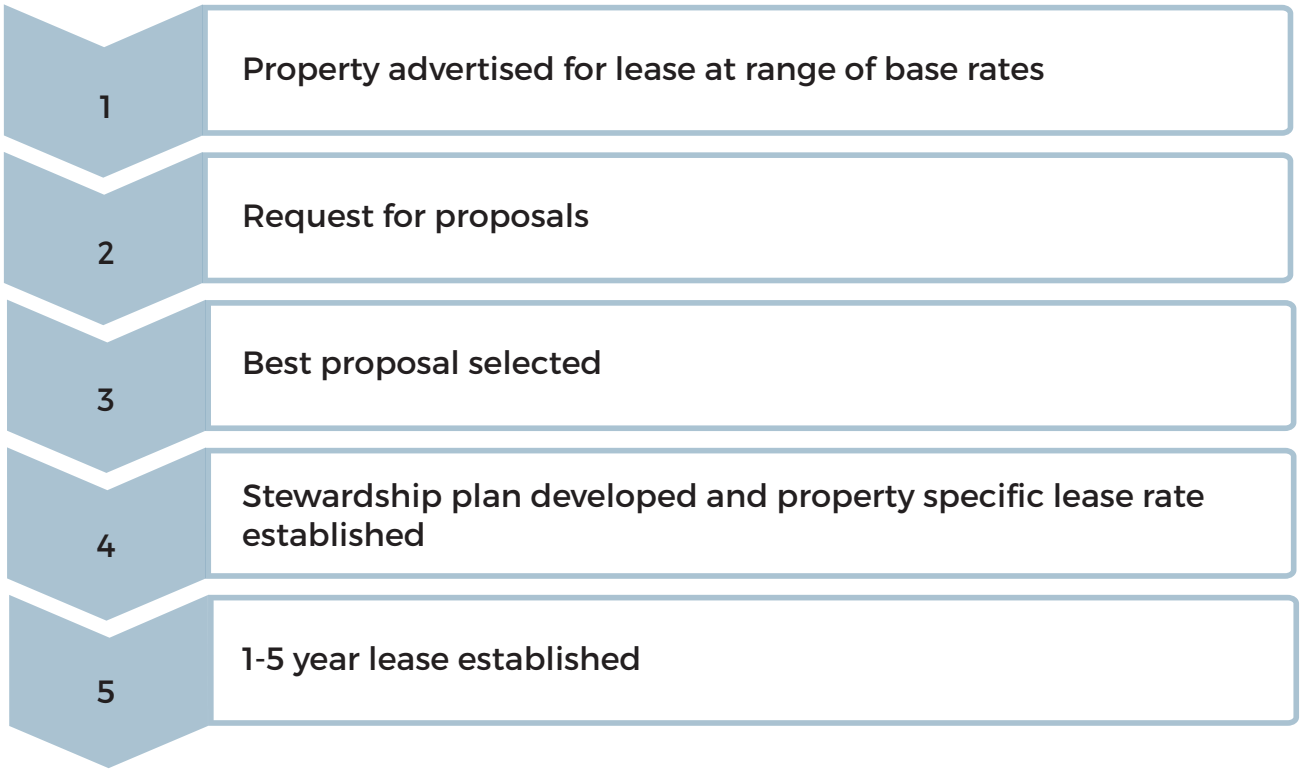



Figure 9

# Leasing Agricultural Lands

## Management Strategies

### Additional Details for New Agricultural Lease Process

1 Property advertised for lease at range of base rates

When a new property becomes available for agricultural uses or there is a change in agricultural lessee, the property will be advertised as available for lease to the agricultural community. The range of base rates will be included in the advertisement.

2 Request for proposals

OSMP staff will develop a request for proposals. The request for proposals will include the general parameters for agricultural use and stewardship of the property as well as evaluation criteria for evaluation of the proposals.

3 Best proposal selected

All proposals will be evaluated using the criteria outlined in the request for proposals. OSMP staff will determine which proposal best meets the parameters and will select the most qualified applicant to successfully manage the property.

4 Stewardship plan developed and property specific lease rate established

A stewardship plan will be developed for the property. The stewardship plan will include details about permitted agricultural uses, intensity of agricultural use and stewardship requirements. It will detail any OSMP required special conditions including requirements related to recreation and/or ecological management. It will outline the condition of facilities on the property and detail who is responsible for facilities maintenance and repair.
See Figure 6 & 7 for a full list of the factors that will be considered when determining lease rates. The base rate will be modified accordingly, and a rate will be established and agreed upon.

5 1-5 year lease established

A 1-5 year lease will be established at a property specific rate taking into account the considerations and uses outlined in the stewardship plan.

# Leasing Agricultural Lands


Jack Sasson

## Management Strategies

**Establish a new renewal process that incorporates the new fee structure and stewardship plans.**

Figure 10 outlines the lease renewal process. Future leases are proposed to be 1-5 years in length and include a stewardship plan. The stewardship plan will be reviewed annually by OSMP and each agricultural lessee to maintain good communication and working relationships, and provide the opportunity to adaptively manage and address any issues/compliance with the stewardship plan.

Staff also considered a model where a property would be advertised as available on a set schedule (e.g. every 6-9 years). However, staff anticipated this process would become a resource-consuming formality when the agricultural stewardship of the property has met expectations as the most-qualified bidder would almost always be the current lessee. In addition, staff experience indicates that there is a general reluctance by local producers to bid against each other and little desire for policies that would create more uncertainty in their ability to continuously farm or ranch a property.

# Leasing Agricultural Lands

**Management Strategies**

## Lease Renewal Process

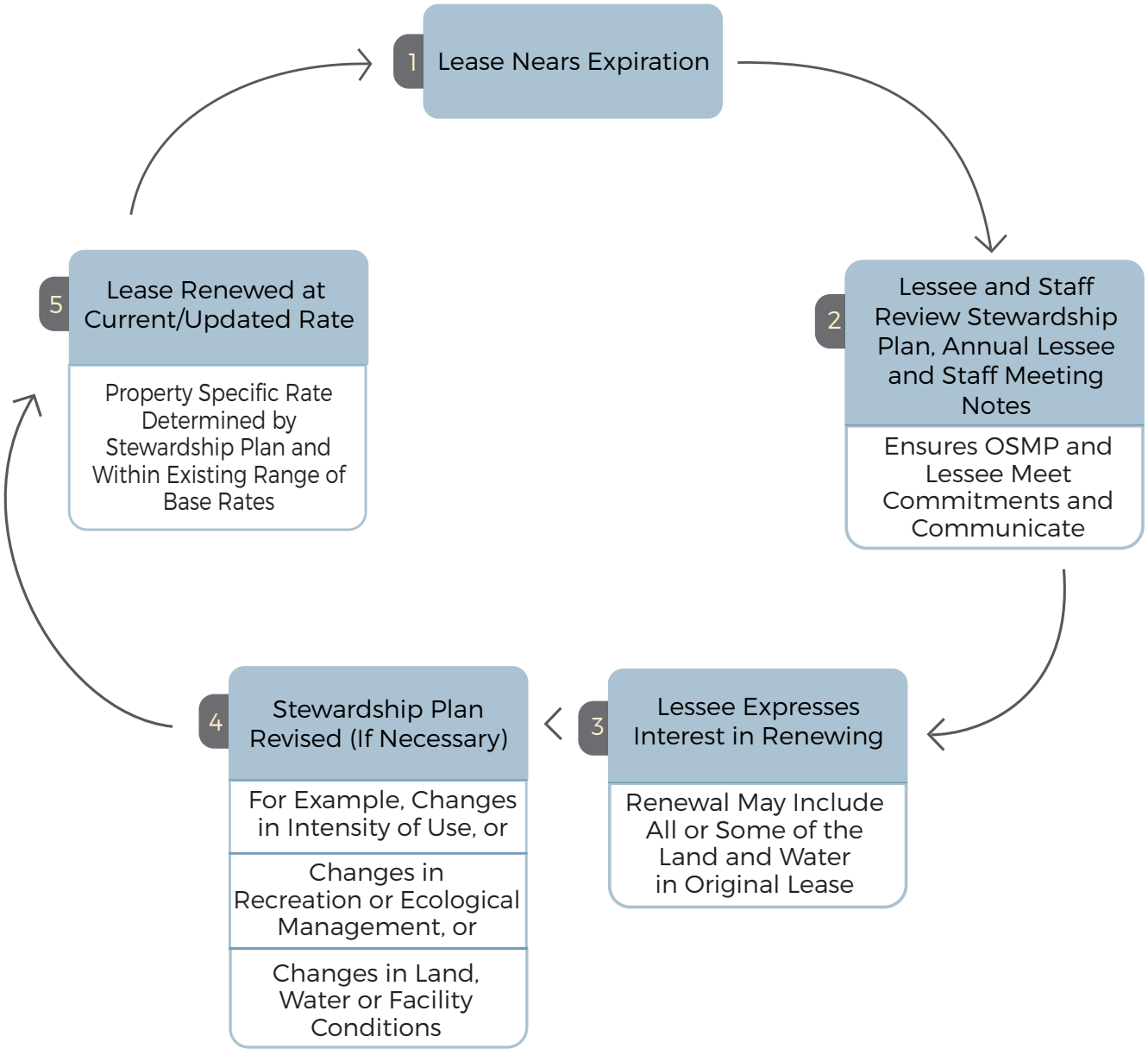



Figure 10

# Leasing Agricultural Lands

## Management Strategies

### Transition existing lessees into new lease and renewal process. (Figure 11)

After the range of base rates has been established (OSMP staff will work closely with existing agricultural lessees and other agricultural economic experts to establish the range of base rates) existing leases will be transitioned to the new process rates as they expire.

Staff will develop an incremental/phased approach to implementing an updated fee structure. For some lessees, there could be significant changes, especially for those who have experienced only nominal rate increases for many years. Recognizing the potential financial effect on existing lessees, staff is proposing that the smallest increases would be made over the shortest period of time (1-2 years) with larger increases phased in over a longer time frame (3-5 years).

## Measures of Success

- Tenure of lessees.
  (Desired condition = long term relationships)
- Proportion of leases signed and renewed at updated OSMP-established lease rates.
  (Desired condition = all leases)
- Proportion of leases that have a Stewardship Plan.
  (Desired condition = all leases)
- Proportion of leases in compliance with Stewardship Plan.
  (Desired condition = all leases)

## Estimated Implementation Costs

- No additional costs identified at this time.

# Leasing Agricultural Lands

## Management Strategies

### Transition Process for Existing Lessees

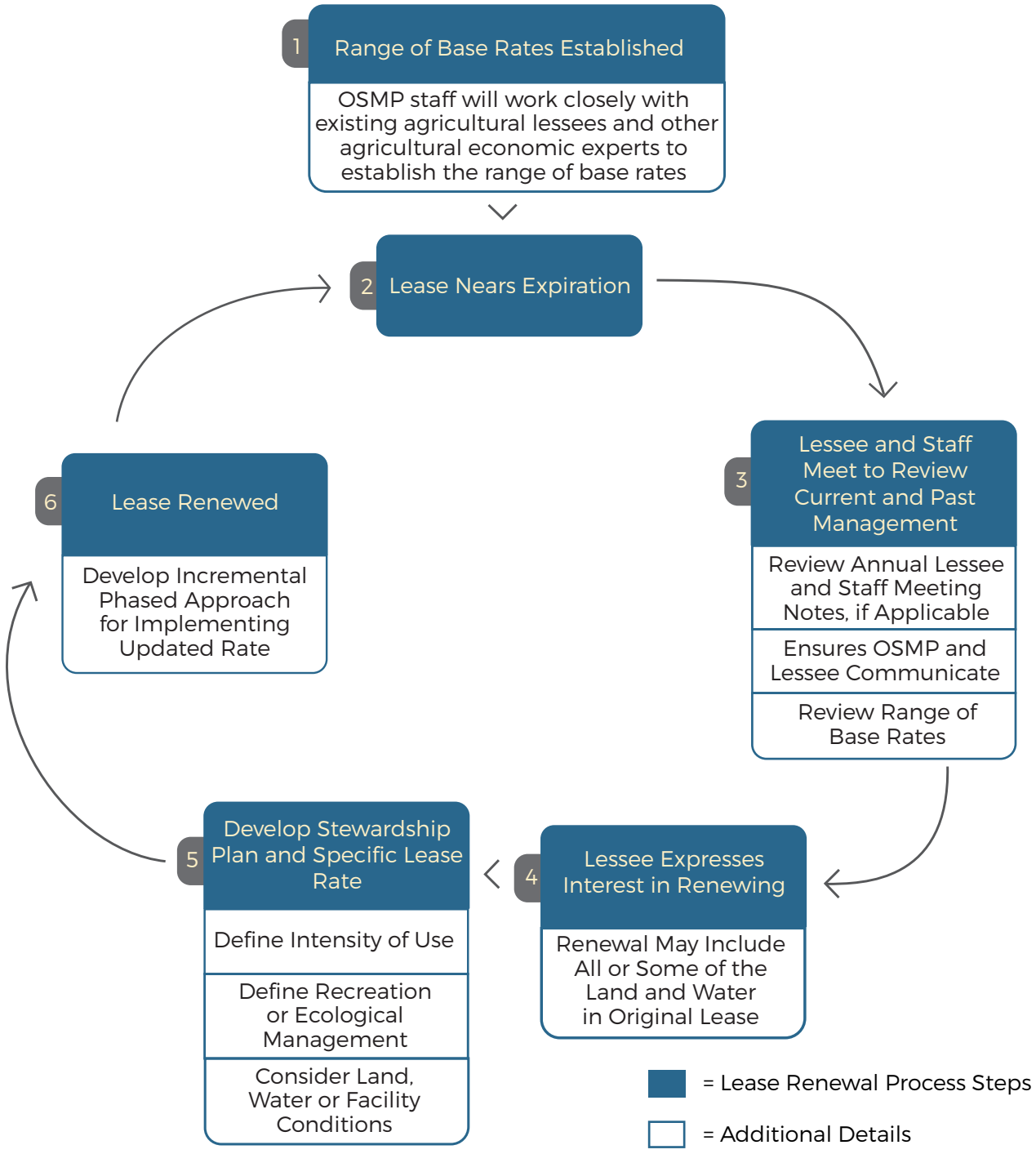



Figure 11

# Diversity of Agriculture and Local Foods

## Existing Policy Guidance

***State***

**Colorado Right to Farm Enabling Statutes**

(1)(a) Except as provided in this section, an agricultural operation shall not be found to be a public or private nuisance if the agricultural operation alleged to be a nuisance employs methods or practices that are commonly or reasonably associated with agricultural production.

(b) An agricultural operation that employs methods or practices that are commonly or reasonably associated with agricultural production shall not be found to be a public or private nuisance as a result of any of the following activities or conditions:

- Change in ownership;
- Nonpermanent cessation or interruption of farming;
- Participation in any government sponsored agricultural program;
- Employment of new technology; or
- Change in the type of agricultural product produced.

***Local***

City Council identified the promotion of local foods as a city priority at the 2014 Council Retreat.

Open Space Board of Trustees approved the departmental practice of prohibiting the use of transgenic[3] crops on open space in 2000.

**City Charter ARTICLE XII. OPEN SPACE**

Sec. 176 Open Space Purposes – Open space land

- Preservation of agricultural uses and land suitable for agricultural production.

**City of Boulder Resilience Strategy**

Action 2.2 Ensure the Resilience of the Local Food System

Design and conduct a local food system assessment.

The city will conduct an entirely new food security assessment, deviating from traditional scales of analysis and definitions of "security." An assessment of this type will require a broad range of partnerships from the business, agricultural, transportation and water sectors, among others, to understand how changes in the complex dynamics of the food production, delivery and consumption system can both be impacted by disruption, but also meaningfully mitigated by local action.

**Boulder Valley Comprehensive Plan**

9.04 Access to Healthy Food

- The city will support cooperative efforts to establish community markets throughout the community and region. Such efforts include working to identify a location or develop facilities to allow one or more year-round farmers' markets, supporting sales of produce from small community gardens and working with local partners on food programs. The city and county support increased growth, sales, distribution and consumption of foods that are healthy, sustainably produced and locally grown for all Boulder Valley residents with an emphasis on affordable access to food and long term availability of food.

[3]Transgenic denotes an organism that contains genetic material into which DNA from an unrelated organism has been artificially introduced.

# Diversity of Agriculture and Local Foods

## Existing Conditions

For the past 50 years, OSMP in concert with local ranchers and farmers, has successfully maintained an agricultural program primarily focused on the production of cattle/beef and hay. Environmental conditions such as soil quality and water availability lead to the majority of agricultural production on OSMP lands being focused on livestock grazing or hay/forage production. In addition, annual crops (wheat, corn, barley, etc.), vegetable/pastured livestock farming and horses are also important elements of the OSMP agricultural program. Figure 12 lists the various types of agricultural operations, acres farmed/ranched and number of operators engaged in agricultural production on OSMP lands.

Map 2 shows the locations of the various types of agricultural operations currently found on OSMP lands.

### Agricultural Production on OSMP Lands

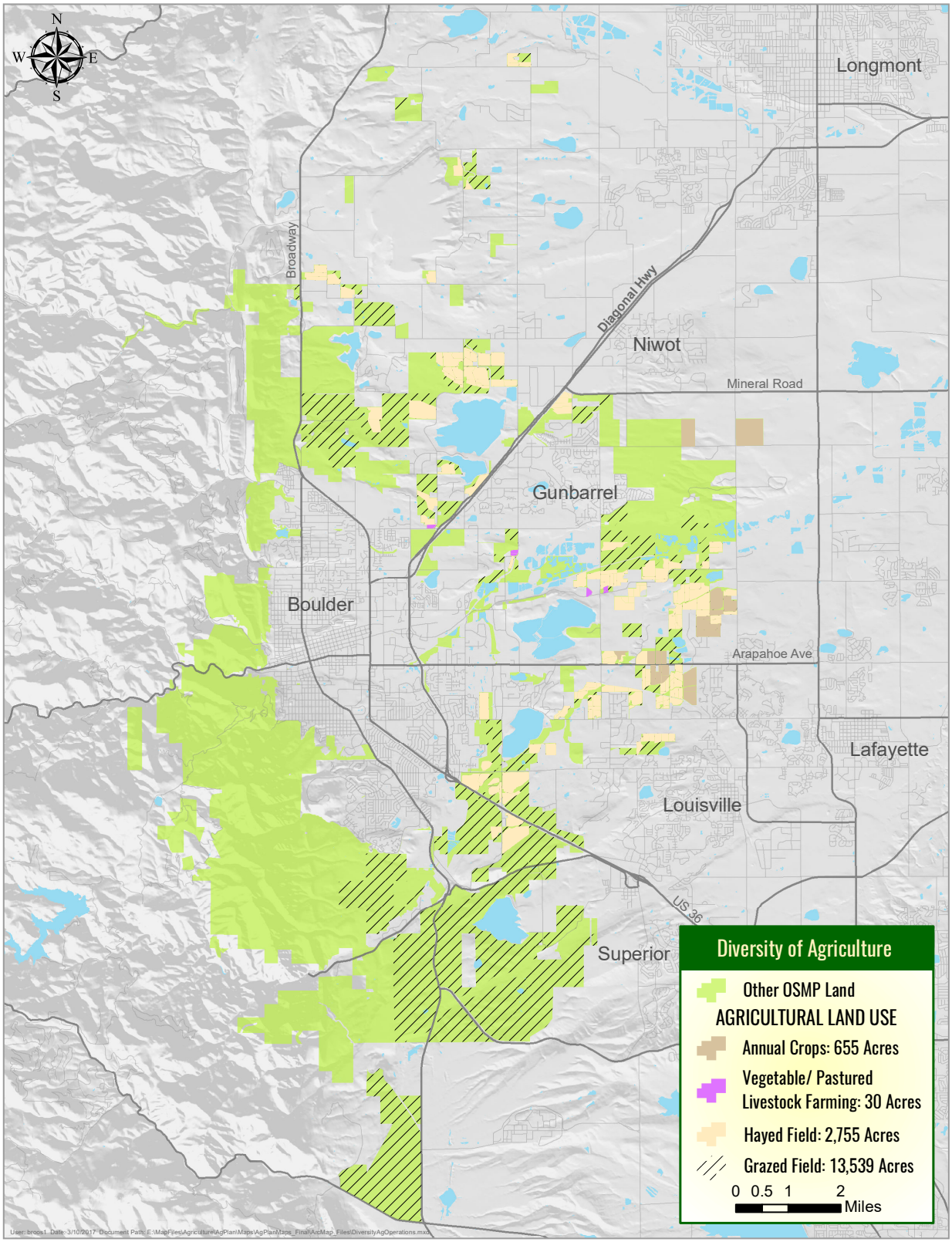
| Type of Agricultural Production/Activity | Acres Farmed/Ranched | Number of Operations* |
|---|---|---|
| Cattle/beef Production | 13,539 | 19 |
| Hay Production (grass alfalfa) | 2,755 | 20 |
| Annual crops (wheat, corn barley, etc.) | 655 | 2 |
| Diversified vegetable/pastured livestock farming | 74 | 3 |
| Horse boarding | N/A | 3** |
| Micro Dairies[4] | 0 | 0 |

* Many lessees engage in several types of agricultural production.
** Many more lessees keep/board their own horses as part of their ranching operation.

Figure 12

[4]Micro dairies are pasture-based dairies where the number of animals permitted is typically based on the property's zoning designation and parcel size. Pasture-based dairies are distinguished from dairies with feed yards because the animals graze in pastures rather than being fed in yards where feed is imported to sustain a higher density of animals than the vegetation would support. Micro dairies are included in this list because the infrastructure necessary for this type of operation exists on several OSMP properties.

# Map 2: Diversity of Agriculture



# Diversity of Agriculture and Local Foods

## Existing Conditions

OSMP mostly leaves the approach to production choices at the discretion of lessees. The department does prohibit the use of genetically modified organisms (GMOs) and transgenic crops, and restricts certain pesticides which can influence a lessee's crop choice. Overall lessees have been free to decide what to grow and to a large degree how to grow it. Lessees' choices about which agricultural commodities to produce are influenced by market forces and land/water suitability and availability.

Lessees have also been free to decide where to sell their products. Lessees' choices about where to sell agricultural commodities are influenced by local and national markets, local land use regulations, and the proximity to processing facilities (e.g. beef processing facilities). Currently, there are very limited existing opportunities for direct on-site sales from OSMP lessees to local customers. A small number of lessees market hay and cattle directly from OSMP properties (Figure 13), other lessees sell their products, predominately diversified vegetables and pastured livestock products off-site to local customers. Other agriculturally related uses such as farm stands and farm dinners or events that support on-site direct sales have either not been permitted per the lease agreement or were not a focus for lessees.

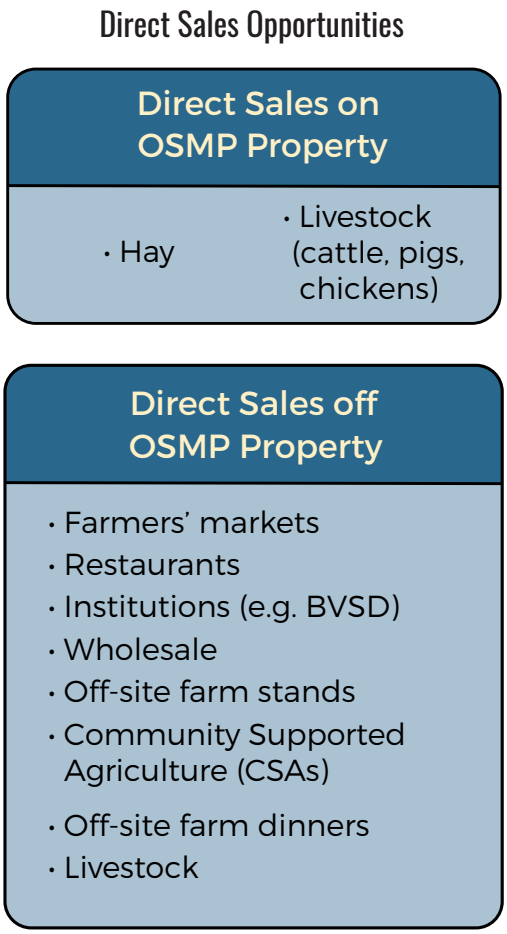



Figure 13

# Diversity of Agriculture and Local Foods

## Existing Conditions

With community interest in "keeping it local" and increased demand for local foods some lessees are interested in having more opportunities to connect with the local community and for a greater diversity of direct on-site sales and off-site opportunities for sales to local markets. Selling directly to local markets provides opportunities for agricultural producers to diversify their income and may increase the resiliency and success rates for local agricultural producers.

## Objectives

- **Maintain and support a diversity of agricultural operations and uses on OSMP lands, with the exception of genetically modified organisms (GMOs).**
  This includes all the types of agricultural production/activities listed in Figure 12 on page 33.
- **Establish/restore diversified vegetable/pastured livestock farms or micro dairies in accordance with city values, community demand and land availability.** OSMP will continue to leave the approach to production choices at the discretion of lessees. OSMP will focus on providing opportunities for local producers.
- **Provide or improve resources to connect lessees to local markets.**
- **Support and create opportunities for direct sales on-site and off-site.**

## Management Strategies

**Evaluate the suitability of other agriculturally related enterprises/activities on OSMP.**
This includes activities in the four categories of Agritourism, Farm Events, Farms Stores and Community Farming shown in Figure 14. These activities may provide opportunities for agricultural producers to diversify their products and incomes and may increase the resiliency and success rates for local agricultural producers. These activities also provide opportunities for agricultural producers to connect with the local community and for a greater diversity of direct on-site sales to local markets.

Agriculturally Related Activities

| | |
|---|---|
| **Farm Stores**<br>·Farm stands<br>·Seasonal markets | **Agritourism**<br>(aka "Agritainment")<br>·Pumpkin patches<br>·U-Pick activities<br>·Petting zoos<br>·Hay rides |
| **Farm Events**<br>·Farm-to-table dinners<br>·Family events | **Community Farming**<br>·Demonstration farms<br>·Community gardens<br>·Food forests |

Figure 14

# Diversity of Agriculture and Local Foods

## Management Strategies

Evaluate activities for which there is a recognized demand, that are established as an emerging trend, fit a community/lessee desire and meet the charter purpose for open space. Determining the relevance and appropriateness of these activities to OSMP lands will require a process and criteria to evaluate them, and any impacts to neighbors. The Community Connections and Partnerships section of the plan in the Community and Visitor Integration chapter outlines the evaluation criteria and process for considering whether and how to integrate these activities into OSMP's agricultural program.

### Explore offering new opportunities and activities related to agriculture.

Because these activities are new to OSMP lands, incrementally phase in new activities as pilot projects (Figure 15). This allows opportunities for OSMP and lessees to gain experience and adaptively manage over time. The following activities were found to be suitable for future pilot projects through the evaluation process in the Community Connections and Partnerships section of the plan in the Community and Visitor Integration chapter: "u-pick" opportunities, farm-to-table dinners, farm stands and demonstration farming.

Note: Consistent with the OSMP Charter purposes and goal of preserving agricultural lands, activities or events provided by a lessee must remain an accessory use. Agricultural production must remain the primary use.

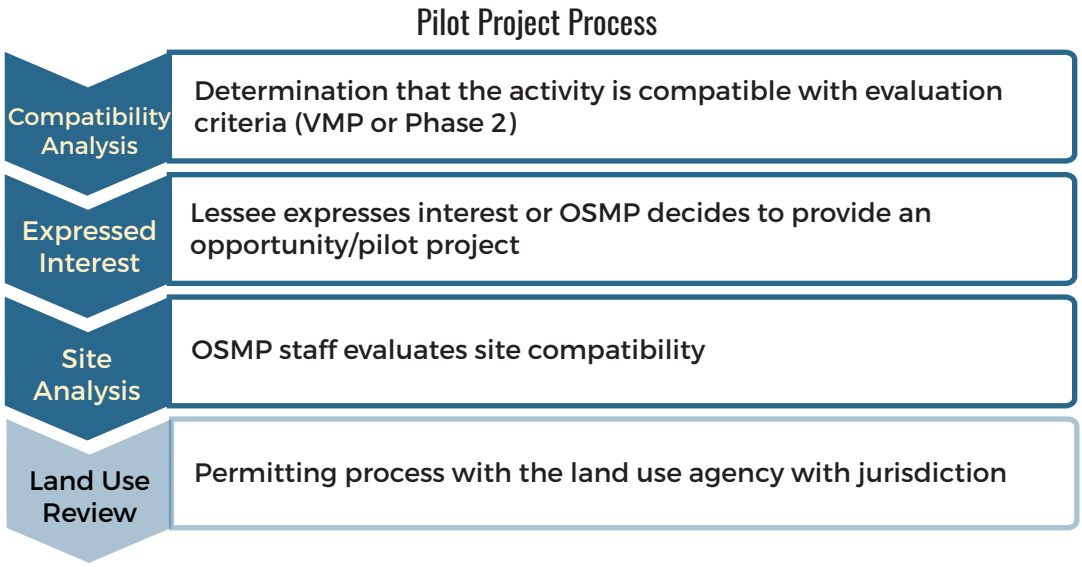



Figure 15

### Provide the infrastructure necessary to support a diversity of agricultural operations.

Work with lessees to identify current and future infrastructure needs, repairs and/or enhancements. Investments in infrastructure will focus on maintaining or enhancing infrastructure that is supporting existing operations as well as enhancing or providing new infrastructure to support a diversity of new operations/ uses. The Infrastructure-Structures and Infrastructure-Water Delivery sections of the plan outline additional management strategies related to providing/maintaining/enhancing OSMP agriculturally related infrastructures.

# Diversity of Agriculture and Local Foods

## Management Strategies

**Identify Best Opportunity Areas (BOAs) for diversified vegetable/pastured livestock farms and micro dairies.**

In order to identify BOAs for diversified vegetable/pastured livestock farms and/or micro dairies staff first identified OSMP properties that have suitable soils, adequate water availability, and have or are near the infrastructure (includes housing and outbuildings) necessary to support a diversified vegetable/pastured livestock farm or micro dairy. The properties which have these essential agricultural characteristics were then evaluated for compatibility with management area designations and existing resource management goals including management for sensitive species (Figure 16).

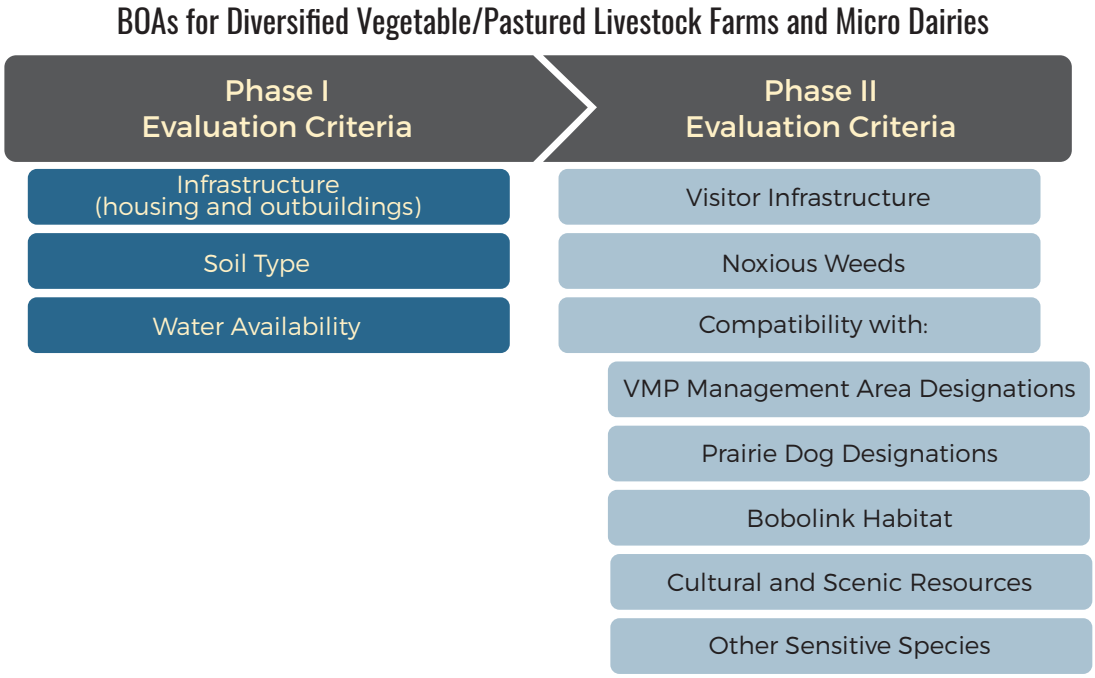
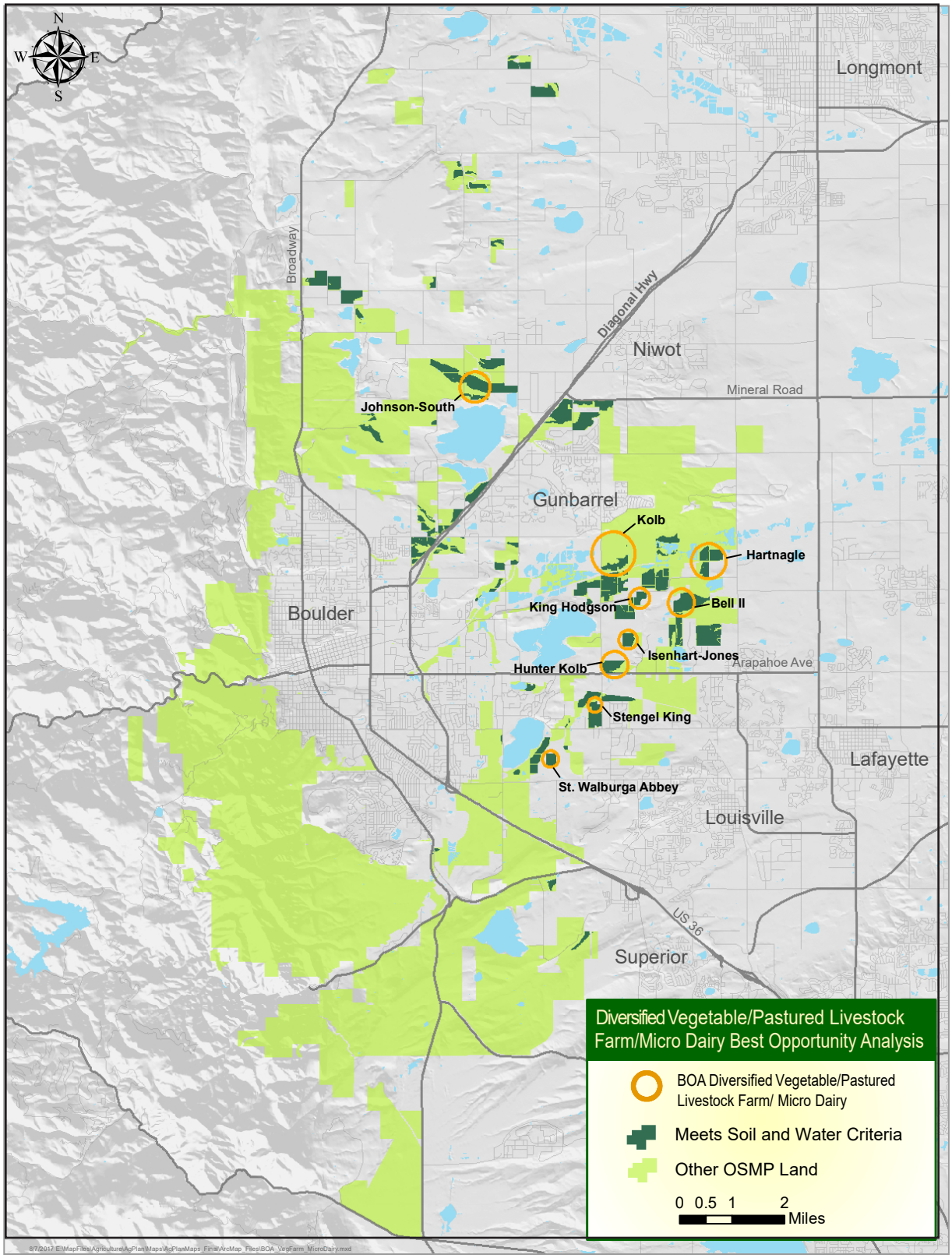



Figure 16

Through this process staff identified nine sites that are suitable for a diversified vegetable/pastured livestock farm and/or micro dairy (Map 3). The majority of these sites are currently hayfields but were historically engaged in vegetable production or were once a micro dairy. Five of the sites contain infrastructure such as outbuildings and housing and three sites contain a milking barn. The other four sites do not contain infrastructure and therefore, are only suitable for expanding a nearby existing operation. In addition, only a portion of the land identified in each BOA is suitable. The maximum range of acres converted or restored to the historical agricultural use of the property (if all BOAs were converted) would likely range from approximately 80-250 acres, with only half tilled or in production at one time.

**Establish diversified vegetable/pastured livestock farms in accordance with demand and availability.** This approch will avoid establishing more diversified vegetable/pastured livestock farms than can be supported, but also respond to the community's desire for locally grown food.

# Map 3: Diversified Vegetable/Pastured Livestock Farm/Micro Dairy Best Opportunity Analysis



# Diversity of Agriculture and Local Foods

**Boulder County Meat Brand Feasibility Study**

Cattle grazing has long been an important contributor to the agricultural economy in Boulder County, and is increasingly being recognized as a valuable ecosystem management tool by local natural resource management professionals. Because of this, OSMP and BCPOS staff recently collaborated with local beef producers to conduct a branded meat product feasibility study to evaluate the opportunity to market a local, value added product. The study was paid for with grant funds from the USDA along with some matching funds from City of Boulder and Boulder County.

The feasibility study included a beef producer survey and a local market analysis. The producer survey indicated that a majority of local producers would consider participating in a meat marketing cooperative and that there would not need to be significant changes in production practices to meet the specifications of a local, natural beef product. The market analysis indicated that there is demand and consumer support for a branded meat product representing where and how the product was produced. Some of the proposed requirements included that the calves must be born in Boulder County, raised and grown in Colorado, be individually identified from birth to slaughter and meet USDA Certified Natural requirements.

The recommendations and guidance for the next steps are currently being evaluated by a steering committee of local beef producers. (Meetz, 2016)

## Management Strategies

### Mitigate impacts to existing operations and neighbors, if any, resulting from establishing/ restoring diversified vegetable/pastured livestock farms or micro dairies.

Generally, staff will evaluate sites taking into account the considerations in the following order: new acquisitions, sites that do not impact existing lessees, sites where impacts to lessees and neighbors can be mitigated, sites that meet multiple objectives. Examples of mitigation measures include adjusting management on other leased lands or including other additional lands in the lease. Staff will analyze land availability in partnership with existing lessees. Leased BOA properties will only be established/ restored during the lease renewal process and when there is agreement from existing lessees (Figure 17).

### Explore the feasibility of a variety of ways to connect lessees to local markets.

OSMP staff in conjunction with lessees will assess different ways to increase the amount of food and feed grown on OSMP that stay local. With OSMP's primary focus on the land/agricultural production, OSMP's role shifts to facilitation the further removed an activity is from the process of growing food.

As the majority of OSMP lessees market their grain and livestock via national commodity markets, staff in conjunction with lessees will evaluate opportunities to market beef and grains for feed and food locally. The proximity of OSMP lands to a major population center increases the ability of lessees gaining added value for their locally-produced items. These opportunities can include, but are not limited to, a feed mill, a grist mill, or a meat marketing cooperative.

# Diversity of Agriculture and Local Foods

## Management Strategies

### Explore synergies between local agricultural producers to meet local demand or develop new products.

Lessees that are already marketing locally know the depth of demand for local products and can provide insight into gaps in the market. Staff believes that there is potential to build better business relationships between local agricultural producers so that these demands are met within the community. For example, multiple growers working together may be able to develop products and/or fulfill demand for locally grown commodities such as certified organic hay, bird seed or chicken feed, which may be currently purchased outside of the area. Lessees could also join forces or contract grow (grow for another lessee) and market a greater variety of products through an existing lessee's direct marketing channels.

### Explore providing support to lessees for grant writing.

There are several competitive grant programs available associated with processing and marketing value-added products (e.g. the Value Added Producer Grant). To apply for these grants agricultural producers develop business plans for working capital expenses related to producing and marketing a value-added product. OSMP staff will explore ways to assist lessees in either developing business plans and/or submitting a grant package.

Conversion Process

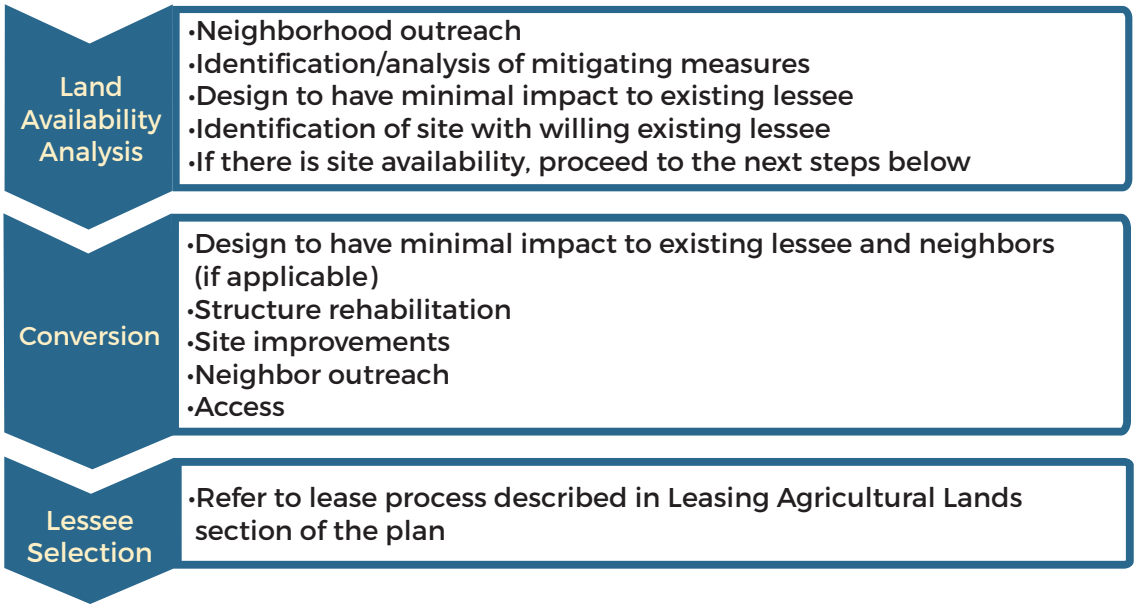
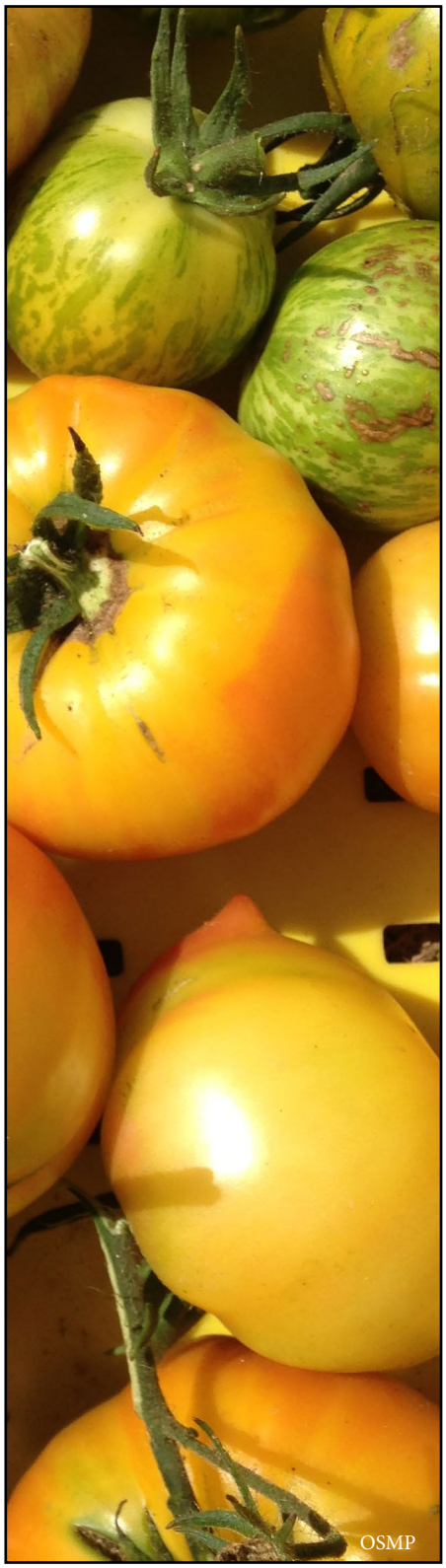



Figure 17

# Diversity of Agriculture and Local Foods


OSMP

## Measures of Success

- Types of agricultural operations and agriculturally related uses/ activities on OSMP lands. (Desired condition = a variety of types of operations)
- Number of acres dedicated to the various types of agricultural operations. (Desired condition = a variety of types of agriculture with a focus on increasing local vegetable production)
- Number of operators engaged in on-site direct sales. (Desired condition = increase in direct sales)
- Percent of operators selling to local markets (Desired condition = increase in local foods)

## Estimated Implementation Costs

- The potential infrastructure costs associated with the pilot programs, providing on-site agriculturally related activities, are included in the Community Connections and Partnerships section of the plan.
- The infrastructure costs associated with maintaining, repairing, and/or enhancing the infrastructure necessary to support a diversity of agricultural operations are included in the Infrastructure – Structures and Infrastructure – Water Delivery sections of the plan.
- $$ - $$$$$ - Infrastructure improvements to convert/restore diversified vegetable/pastured livestock farming and/or micro dairies on the BOAs.
  - Preliminary estimates for sites with a residence and outbuildings range from $150,000 to more than $500,000 per site. The majority of the costs associated for conversion are associated with rehabilitating historic structures and residences. The costs for the agricultural infrastructure range from $25,000-$40,000.
  - Preliminary estimates for "expansion" sites for existing farming operations range from $25,000-$40,000 per site and are related to agricultural infrastructure.
- $$ - Providing staff (or consultant) support to lessees to explore synergies, connecting lessees to local markets and grant writing.

# Diversity of Agriculture and Local Foods

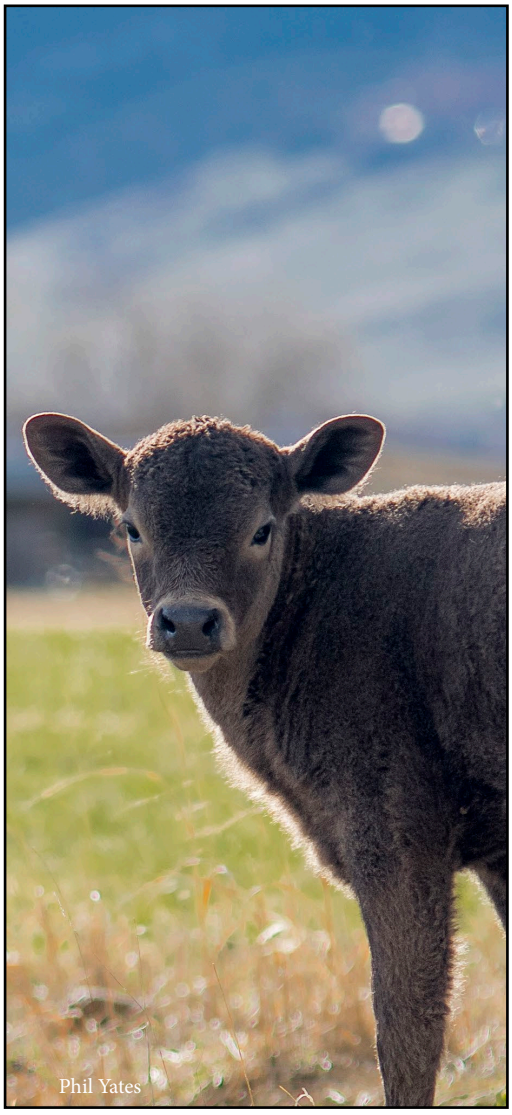
# Connecting Farmers to Resources

## Existing Policy Guidance

**BVCP**

9.05 Regional Efforts to Enhance the Food System

- The city and county will participate in regional agricultural efforts and implement recommendations at a local level to the extent appropriate and possible.



Phil Yates

## Existing Conditions

The historic focus of the city's agricultural program has been to provide farmers and ranchers with the foundational resources of land and water. OSMP staff currently provides technical support, when requested by lessees and as capacity allows.

There are some additional resources available to agricultural operators in the region (Figure 18).

### Additional Resources in the Region

| Organization | Services Provided |
|---|---|
| CSU Boulder County Extension | • Beginner farmer training<br>• Agribusiness management |
| Colorado State University (CSU) | • Research |
| Boulder & Longmont Soil & Water Conservation Districts | • Technical guidance on<br>-Water quality & quantity<br>-Cost sharing<br>-Noxious weeds<br>• Cost sharing |
| Natural Resource Conservation Service (NRCS)* | • Grants<br>• Cost sharing |

*Some programs are intended for farmers and ranchers operating on private lands or with longer duration leases than the city currently allows.

Figure 18

Some of the existing resource-related barriers facing OSMP lessees and other agricultural operators in the Boulder Valley are related to labor availability and the ability to expand operations and/or apply for grants. A feasibility study conducted in 2016 investigating a meat-marketing cooperative identified the availability of pasture lands and a lack of labor as the biggest factors in preventing local beef producers from expanding existing operations (Meetz, 2016). Because many lessees do not own sufficient land of their own, it can be difficult to obtain loans for expansion of their operations, as land ownership is often the main source of equity for agricultural operators.

# Connecting Farmers to Resources

## Existing Conditions

The lack of qualified labor, particularly for organic vegetable operations, is also a limitation and challenge for some. Real estate prices and the lack of affordable rental properties make housing a challenge for farm workers and impact farm labor availability.

One of the most well-known trends in American agriculture is the aging farmer. According to the United States Department of Agriculture, 2012 Census of Agriculture, the average age of farmers has increased to 58 and there appear to be fewer people who want to fill their boots. This nationwide trend is consistent with local trends on city's leased lands and relevant to the city's ability to maintain working lands. Currently, OSMP staff does not assist existing long-time lessees with succession or transition planning.

## Objectives

- **Provide or improve information and resources to support local and aspiring agricultural operators.**

## Management Strategies

**Examine the feasibility of providing additional resources as listed in Figure 19.**

Potential Additional Resources

| | |
|---|---|
| ·Farmer apprentice program | ·OSMP demonstration farm |
| ·Succession planning | ·Equipment sharing |
| ·Technical advice/agronomy services | ·Partnerships with other agencies (CSU Extension or BCPOS) |
| ·Farm worker/lessee housing | ·Producer surveys and outreach |
| ·Evaluate the possibility of working with appropriate agencies to allow participation in programs that support conservation practices on local agricultural lands | |

Figure 19

## Measures of Success

- Resources available to support local and aspiring agricultural operators.
  (Desired condition = increase in resources)
- Number of qualified applicants for properties available to lease.
  (Desired condition = at least one)
- Number of lease renewals.
  (Desired condition = most renew)

## Estimated Implementation Costs

- $50,000 to more than $500,000 dependent on feasibility study and staffing.

# Infrastructure-Structures

## Existing Policy Guidance

**City Charter ARTICLE XII. OPEN SPACE**
Sec. 176 Open Space Purposes – Open space land

- Open space land may not be improved after acquisition unless such improvements are necessary to protect or maintain the land or to provide for passive recreational, open agricultural, or wildlife habitat use of the land.

**Open Space Long Range Management Policies (Open Space LRMP)**
Facilities can be constructed on OSMP land if necessary to support approved activities as specified in an Open Space management plan (and in accordance with the Charter Sec. 176).

Structures should be consistent with Open Space purposes, be compatible with natural processes, functional, energy efficient and cost-effective.

Existing buildings will be considered before new construction is contemplated.

All facility costs including initial construction, refurbishment, or restoration, ongoing maintenance and operational costs should be considered.

Facilities will be integrated into the Open Space environment so as to result in minimum impact.

Facilities will be designed and developed to avoid competing with or dominating Open Space features.

## Existing Conditions

Agricultural structures currently found on OSMP include, but are not limited to fences, barns, pole barns, loafing sheds, residences, outbuildings and corrals. The majority of agricultural structures on OSMP lands were constructed prior to the city's ownership. A survey of all OSMP facilities and structures completed in 2016, suggests that many of the existing structures are in poor condition. It is likely that significant repairs or replacement structures will be needed in the future.

Historically, very few new agricultural structures have been requested by lessees or OSMP staff to support agricultural operations. This is in part due to the majority of agricultural operations on OSMP lands being focused on cattle production which generally require minimal infrastructure when compared to other types of agricultural operations such as vegetable production. However, the interest to diversify the types of agricultural operations on OSMP lands has been accompanied by a growing interest in additional agricultural structures being permitted, especially greenhouses and hoophouses.

## Objectives

- **Provide the infrastructure necessary to support a diversity of agricultural operations.**
- **Maintain agriculturally related structures in an acceptable condition.**

# Infrastructure-Structures

## Management Strategies

**Prioritize current and future infrastructure needs (Figure 20).**

Criteria for Prioritizing Infrastructure Needs

- Condition of structure
- Benefits to or necessity for agricultural operation
- Benefits to cultural resource protection (Historical significance, vulnerability)
- Cost
- Complexity of land use review process

Figure 20

**Work with lessees to identify current and future infrastructure needs, repairs and/or enhancements (includes fences).**

Investments in infrastructure will focus on maintaining, repairing, enhancing infrastructure that is supporting existing operations as well as enhancing or providing new infrastructure to support a diversity of new operations/uses.

**Evaluate new or replacement structures with the process/ criteria shown in Figure 21.**

The criteria/process shown in Figure 21 will be used to assess requests for new or replacement structures. The process is linear in that a determination that the conditions are met for the previous stage of the evaluation is necessary in order to move on to the subsequent criteria. If conditions are not met, the evaluation does not progress to the subsequent stage and the proposed structure is determined to not be appropriate for OSMP lands.

### Definitions- Greenhouses and Hoophouses

Greenhouses and hoophouses are used to extend the growing season earlier in the spring and later in the fall.

Greenhouses are permanent structures. The frames are made of aluminum, galvanized steel or wood. Glazings are glass, rigid clear plastic or polyethylene. Greenhouses have heat, mechanical ventilation, artificial light and irrigation systems. Greenhouses offer a controlled environment and plants are not typically grown directly in the ground.

Hoophouses are not permanent structures. They are typically tall enough to allow walk-in access. The frame is PVC, aluminum or galvanized steel, with wood for hips and baseboards. The frames are then covered in plastic. Plants are typically grown directly in the ground. Hoophouses lack the precision of an environmentally-controlled greenhouse, and they typically rely on passive heating and cooling.

# Infrastructure-Structures

## Management Strategies

New/Replacement Structure Evaluation Process

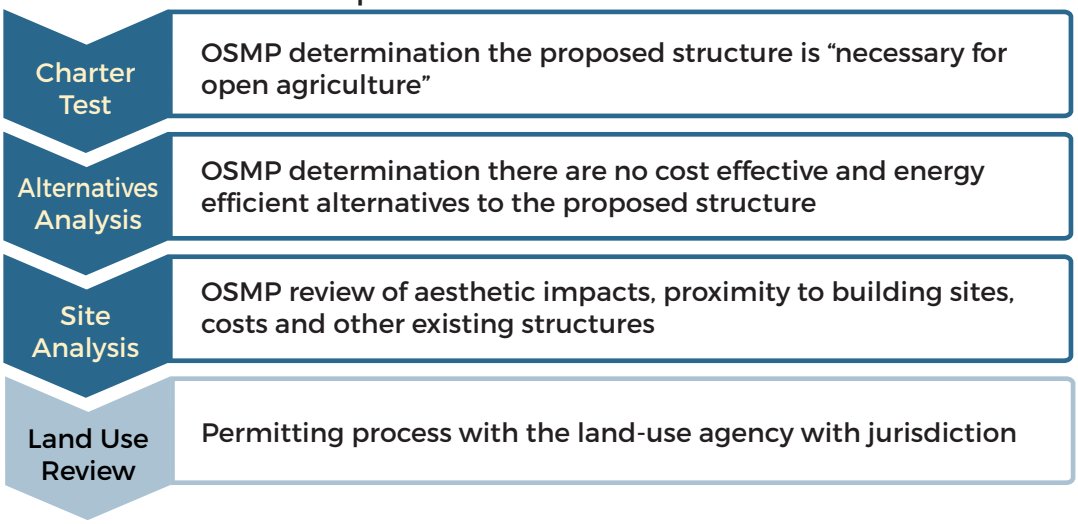
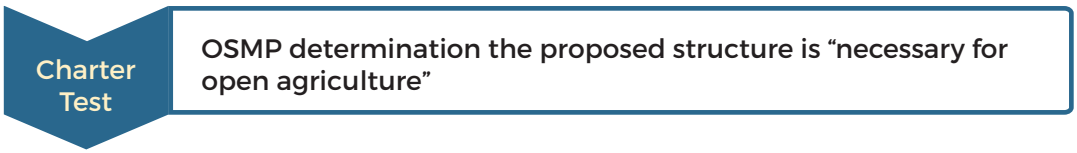



Figure 21

### Case Study: Greenhouse and Hoophouse Evaluation




Under the strictest interpretation, neither hoophouses nor greenhouses are necessary for an open agricultural operation. There are multiple types of agricultural operations such as livestock, hay or other perennial production that do not require hoophouses or greenhouses. The growing season in the Boulder Valley is generally long enough for annual vegetable farms to produce only a limited selection of vegetables. Either greenhouses or hoophouses are necessary for vegetable farms in the Boulder Valley to be economically viable and competitive because they extend the growing season and enhance the diversity of crops that can be produced.

Hoophouses and the crops grown in them can be considered as open agriculture because the crops are grown in the ground and while the structure moderates temperatures it does not create a tightly controlled environment. Using the same criteria, greenhouses do not meet the standard for open agriculture because they create a tightly controlled environment where plants are typically not grown in the ground. The City Attorney's Office (CAO) issued an opinion that crops started in a greenhouse and then transplanted to open space could be classified as open agriculture. In this example, staff would conclude that hoophouses meet the charter test and are necessary to maintain the land for the open agricultural use of vegetable farming. Given the findings of the CAO, staff would conclude that greenhouses used only to grow starts which were later

# Infrastructure-Structures

## Management Strategies

planted in the ground meet the charter test as well. Both hoophouses and greenhouses (with limitations) would proceed to the alternatives analysis.

**Alternatives Analysis**

OSMP determination there are no cost effective and energy efficient alternatives to the proposed structure

In regards to hoophouses, and greenhouses, there are significant differences in both energy efficiency and cost effectiveness. Traditional greenhouses are notoriously inefficient. While passive solar and net zero greenhouses are more energy efficient they lack the production capacity of traditional greenhouses and cost over 10 times more per square foot to construct. The construction costs and energy used per unit area are much higher for greenhouses. One study estimated glass-panel greenhouse construction at over $30.00 per square foot. Given the suitability of hoophouses to extend the growing season at much lower initial and ongoing costs including less energy, staff would consider that hoophouses do a better and acceptable job of extending the growing season while being cost and resource efficient. Hoophouses, but not greenhouses, would proceed to the site analysis step.

**Site Analysis**

OSMP review of aesthetic impacts, proximity to building sites, costs and other existing structures

This analysis is location specific. Proposals for hoophouses will be evaluated on a case-by-case basis to ensure that siting and design can be developed with acceptable levels of impact to OSMP uses and resources. If siting and design issues can be addressed, and the proposed project is determined to be a high priority, it would move forward in the process to be considered by the development review agency with jurisdiction.

## Measures of Success

- Proportion of operations for which the necessary infrastructure has been identified. (Desired condition = all operations)
- Proportion of operations for which the necessary infrastructure is currently available. (Desired condition = all operations)
- Proportion of necessary structures in an acceptable condition. (Desired condition = all necessary structures in acceptable condition)

## Estimated Implementation Costs

- $$$$$ - Structure improvements, construction, de-construction

# Infrastructure-Water Delivery

## Existing Policy Guidance

***State***

**Section 7 of Article XVI of the Colorado Constitution** protects the right to construct ditches and canals across public or private land upon payment of just compensation.

**Title 37, Article 84 of the Colorado Revised Statutes** generally describes the legal responsibility of water right users or owners.

- Ditch companies or entities controlling any canal or ditch used for irrigation purposes are required to deliver any water requested by users between April 1 and Nov. 1 of each year (37-84-118).
- The owners of any ditch for irrigation or other purposes are required to maintain the ditch banks in such a way as to prevent flooding or damage to the property of others, prevent water from wasting and must return any unused water with as little waste as possible back to the stream from which it was diverted (37-84-101; 37-84-107).
- The owners of any irrigation ditch or reservoir that diverts water from any stream are required to construct and maintain a headgate of suitable height and strength to control the water at ordinary stages of flow (37-84-112).
- OSMP is responsible for any ditch or reservoir for which it has sole water rights ownership or operation including the field laterals that are used by agricultural lessees.

***Local***

**Open Space LRMP**

The Department will maintain the integrity of all water delivery and storage structures on its property and cooperate with the office of the State Engineer to the greatest extent possible to meet applicable requirements.

Alternative funding sources, including participation by other water users, ditch companies, and others, may be required where legally or financially appropriate and feasible.

The Open Space staff will work with ditch companies that have written easements and prescriptive uses on open space land to encourage maintenance practices that minimize damage to other resources.

Practices to maximize irrigation efficiency will be incorporated.

**Grassland Ecosystem Management Plan (Grassland Plan)**

Construct, repair, enhance and maintain irrigation delivery systems.

# Infrastructure-Water Delivery

## Existing Conditions

The existing network of water delivery infrastructure diverts water from the four major streams in the Boulder Valley and distributes it to individual water rights owners and their properties. Irrigation ditch infrastructure typically includes a headgate that diverts water from the stream, a ditch or canal and a series of smaller diversion structures and laterals. Irrigation water and the associated infrastructure are critical and foundational elements for several types of agriculture common on OSMP lands, without which hay production, many annual crops, and vegetable production would not be possible. The existing network of water delivery infrastructure and irrigation water used on open space is not only critical to agricultural production, but also supports wetlands, and unique wildlife habitats and vegetation communities. Managing water for open space involves the simultaneous protection of the resource for agriculture, instream flows, wetlands, native flora and fauna and recreation.

OSMP owns water rights in more than 50 separate water entities, with full ownership of seven irrigation ditches and multiple reservoirs. Staff estimates OSMP's water portfolio is conservatively valued at 60-70 million dollars. The general condition of the infrastructure is fair, based upon the latest condition assessment information from 2010 and current anecdotal information. Repairs are anticipated as the system is aging and multiple structures are nearing their functional life expectancy.

In cases where OSMP is the sole owner, OSMP is responsible for the operation and maintenance of the ditch. Agricultural lessees play a critical role in the operation and maintenance of the infrastructure that delivers water to OSMP properties by performing the majority of the day-to-day water delivery operations required to irrigate leased lands. This includes regular inspection activities, yearly debris removal, and periodic cleaning of the ditch bottom using excavation equipment when necessary. There are also record keeping and reporting requirements to demonstrate due diligence of ditch operations.

OSMP

# Infrastructure-Water Delivery

## Irrigating Working Lands

Water rights in Colorado are administered by the State of Colorado using the prior appropriations doctrine. Under the "use it or lose it" principle of the prior appropriations doctrine, water must be used beneficially to preserve the right. Therefore, when acquiring water rights there is an inherent obligation to preserve the public investment in these rights by utilizing and maintaining these rights in a beneficial manner.

OSMP utilizes its valuable water portfolio to support agricultural production and other environmental values found on OSMP lands.

OSMP

## Existing Conditions

In many cases OSMP is only a shareholder or minority owner of an irrigation ditch company. In those cases, irrigation companies are responsible for the maintenance and operation of the ditches they own as they cross OSMP lands, and have easements that allow them to access OSMP lands. The maintenance practices and standards for private ditch companies sometimes differ from those of OSMP but they have the right to conduct maintenance according to their standards and practices that are deemed reasonable and necessary, and are within the bounds of their easements. OSMP can only suggest management practices regarding infrastructure maintenance and operations practices. For example, removal of trees or shrubs can negatively impact habitats along ditch corridors and dispersal or deposition of ditch debris on ditch banks can cause problems with floodplain management, local water quality and create a potential weed invasion threatening infestation of the surrounding landscape. In addition, ditch maintenance activities can have direct effects on rare or threatened species such as Preble's meadow jumping mice and bald eagles or their habitats. In cases where ditch operation activities affect federally or state listed species, those activities may be regulated or bound by best management practices by the appropriate agency.

Agricultural irrigation ditches have also both enhanced and impaired riparian and wetland areas. Please see the Riparian and Wetland sections of the plan in the Ecological Integration chapter for information on the unique habitats related to agricultural irrigation.

## Objectives

- **Maintain existing irrigation infrastructure in good condition as required by state law.**
- **Provide the infrastructure necessary to meet the needs of the diverse agricultural operations on OSMP lands.**
- **Ensure the water delivery system infrastructure and associated maintenance is compatible with natural resource objectives.**

# Infrastructure-Water Delivery

## Management Strategies

**Maintain a regularly updated inventory of irrigation infrastructure that includes location and conditions information.**

**Develop criteria to prioritize current and future infrastructure needs.**

**Partner with lessees to provide and maintain infrastructure necessary to meet the needs of their agricultural operations.**

**Develop and implement irrigation infrastructure Best Management Practices (BMPs) for water delivery infrastructure maintenance and construction on OSMP lands.**
Share and encourage BMPs with irrigation ditch companies conducting maintenance on OSMP lands.

**Evaluate the water delivery infrastructure and associated operational and maintenance activities to enhance related natural resources.**
OSMP has initiated an Environment Water Sharing Feasibility study to identify natural resource values on OSMP lands that are significantly supported or enhanced by agricultural irrigation practices. The study is anticipated for completion by mid-2017 and will help inform water infrastructure management.

**Conduct ditch and/or lateral burns to improve irrigation and reduce labor intensiveness of ditch maintenance.**
Continue to partner with City of Boulder fire personnel and evaluate opportunities for OSMP to conduct ditch and/or lateral burns.

## Measures of Success

- Percent of irrigation infrastructure in good condition as required by state law. (Desired condition = all infrastructure in good condition)
- Proportion of operations for which the necessary irrigation infrastructure is currently available. (Desired condition = all operations)
- Proportion of irrigation infrastructure maintenance sites in compliance with departmental BMPs. (Desired conditon = all sites)

## Estimated Implementation Costs

- $$$$$
- There is approximately $650,000 of deferred or needed water infrastructure maintenance or improvements[5]. (examples include: concrete diversion structures, culverts or other ditch crossings, or irrigation efficiency improvements)

[5]Staff used the inventory and estimates in the Grassland Plan as a starting point, determining which projects were still outstanding.

# Soil Conditions

## Existing Policy Guidance

**Open Space LRMP**
Open Space staff will minimize soil loss and blowing dust by implementing appropriate agricultural and soil management practices.

Impacts on soil resources will be monitored, as feasible. Management actions may be taken to mitigate adverse, potentially irreversible, impacts on soils caused by compaction, contamination and erosion. Conservation practices will be implemented to reduce these impacts. Soil degradation will be minimized. If soil is imported, actions will be taken to avoid introduction of exotic plant species.

The department will preserve the soil resources of Open Space lands and prevent, to the extent possible, the erosion, physical removal, or contamination of the soil, or its contamination of other resources. Detailed soil maps defining the distribution of soil series will be used to provide interpretations needed to promote soil conservation and to guide management decisions by Open Space staff.

**Grassland Plan**
Manage agricultural activities to minimize soil erosion and protect soil fertility.

## Existing Conditions

Maintaining healthy soils is critical for the long-term sustainability of agricultural lands. Healthy soils are those that store nutrients and water needed to support native plants and crops. Vegetative cover in return prevents or minimizes soil erosion. See Soil Health sidebar on pg. 55 of the plan for more information regarding soil health.

Agricultural related activities, such as grazing, tilling and some integrated pest management practices necessary for annual grain and vegetable production, can be detrimental to soil quality. As soil health declines on tilled lands, inputs such as fertilizers and pesticides are necessary to maintain productivity. However, inputs are not a long-term sustainable practice and may reduce resiliency. Prairie dogs can also have a negative effect on soil quality. In areas with high burrow densities, grazing by prairie dogs results in a decrease in native vegetation, an increase in non-native vegetation, and an increase in soil erosion from wind and precipitation events.

Currently, there is no regular monitoring by OSMP of soil conditions. Soils are in a variety of conditions, and there are varying levels of soil organic matter and biological activity due to historic and current cropping activities, grazing regimes and prairie dog occupation. Visual observations indicate soil health on perennial hayfields and pastures with managed grazing is generally good. The year-round vegetative cover due to the nature of hay and perennial production, along with matching grazing activities to the amount of available forage limits the possibility for soil erosion, thereby contributing to the generally good conditions. Visual observations of fields that have been continuously tilled for many years indicate that soil quality has been diminished. This is evident through observations of soil tilth (or physical condition), and aggregate stability after tillage as well as drainage and crusting issues following intense precipitation events. Agricultural practices such as continuous annual tilling, limited additions of organic matter, and limited or no perennial rest periods ("leys") have contributed to the decline in soil health.

# Soil Conditions

## Objectives

- **Manage agricultural activities to minimize soil erosion and protect soil fertility.**
- **Maintain soil organic matter and soil biological diversity within ranges of natural variation on native range lands and other untilled lands in agricultural production.**
- **Increase or maintain soil organic matter and soil biological diversity on tilled/converted lands in agricultural production with non-native vegetation.**

## Soil Health

Soil health is the continued capacity of soil to sustain plants, animals and humans. Healthy soils are ecosystems that provide nutrients for plant growth, absorb and hold rainwater for use during drier periods, filter and buffer potential pollutants, serve as foundations for agricultural activities, and provide habitats for soil organisms.

### Soil Organic Matter and Soil Biological Diversity

Soil organic matter is the organic matter component of soil, consisting of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and organic substances synthesized by soil organisms. Soil organic matter plays an important role in soil structure stabilization, improves nutrient availability, enhances the soil's capacity to store nutrients and water and can directly influence plants through enhanced nutrient uptake (Chen et al., 2004). The ability to store more water is especially important in low-rainfall environments, such as Colorado. Soil organic matter also provides the foundation for microbial metabolism and the diversity of the soil food web (Magdoff and Weil, 2004). The type and diversity of plants and organic residues added to the soil can influence the type and diversity of organisms that make up the soil community and vice versa (Drinkwater et al., 1998). The majority of soil functions that are important in promoting plant growth are greatly enhanced by relatively high levels of soil organic matter and soil biological diversity (Greenland and Szabolcs, 1994).

Dave Sutherland

# Soil Conditions

## Management Strategies

**Apply Natural Resources Conservation Service (NRCS) BMPs as appropriate as shown in Figure 22 (USDA NRCS, 2011).**

NRCS BMPs

| Practice/Technique | BMPs | Benefits |
|---|---|---|
| Conservation Tillage | •Leave the previous year's crop residue on fields before and after planting the next crop.<br>•Acceptable methods include strip-till, no-till, ridge-till and mulch-till.<br>•Leave at least 30% of soil covered with residue after planting. | •Can reduce soil erosion 60-90%<br>•Improves soil and water quality by adding organic matter and reducing organic matter oxidation<br>•Increases soil organic matter quicker than rotations with several years of perennial vegetation |
| Cover Cropping | Plant crops between periods of cash crop production. (Many cash crops leave little residue and the soil surface is often left bare until the next crop is planted - can be up to eight months where the bare soil is left subject to erosion.) | •Prevents soil erosion<br>•Conserves soil moisture<br>•Improves soil physical and biological properties<br>•Protects water quality<br>•Reduces fertilizer cost<br>•Reduces need for pesticides<br>•Breaks pest cycle<br>•Potential agronomic benefits, depending on species selection |
| Diversified Crop Rotations | Plant diversity of cash crops with variations in broadleaves and grasses, annuals and perennials, cool-season and warm season species. | •Reduces soil erosion<br>•Increases soil organic matter<br>•Increases soil fertility<br>•Breaks pest cycles |
| Stubble Height | Leave a minimum of four inches of crop residue or grass height following mechanical harvest or grazing to protect the soil surface and reduce wind erosion. | •Captures moisture by trapping snow<br>•Reduces moisture loss from the soil by shading the ground<br>•Reduces water loss through evaporation<br>•Decreases air flow over the soil surface |
| Soil Amendments | Add soil organic matter to the soil through additions of compost, animal manure and green manures in tilled fields. | •Increases soil-water holding capacity<br>•Improves water infiltration<br>•Improves soil structure and porosity<br>•Food for soil organisms |

Figure 22

# Soil Conditions

## Management Strategies

**Develop soil health monitoring plan to track soil organic matter and soil health over time.**
Develop standards and thresholds for soil conditions, soil sampling protocols and monitoring schedule for irrigated annually tilled fields, dry land annually tilled fields and irrigated hayfields and pasture. Soil conditions for grazed native grasslands will be monitored through the grazing conditions assessments described in the Grazing in Native Grasslands section of the Ecological Integration chapter.

## Measures of Success

- Soil organic matter and soil biological diversity.
  (Desired condition = maintain or increase)
- Proportion of operations implementing BMPs.
  (Desired condition = all operations)

## Research Opportunities

- Explore the best ways to decrease tillage.
- Determine which living covers are appropriate for annually tilled fields.
- Investigate fiscally and environmentally viable intercropping and diversified commodity cropping systems.
- In cooperation with BCPOS, explore the feasibility of integrating livestock into dryland wheat systems.
- Investigate viable cover cropping systems for the area – including dryland and marginally irrigable land.
- Evaluate different methods for addressing soil quality reduction on degraded lands (e.g. unoccupied prairie dog systems) through a variety of techniques including the addition of soil amendments.
- Explore different methods of rapid soil respiration assessments to provide quick, reliable assessment of soil biological activity.
- See the Climate Change Preparedness section of the plan for research opportunities associated with carbon sequestration.

## Estimated Implementation Costs

- Less than $10,000 for annual soil sampling and tests, cover crop seed, compost.
- $10,000 to $49,999 for additional staff to collect samples.

# Integrated Pest Management (IPM)

## Existing Policy Guidance

***Federal***

The **Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. ch. 6 § 136 et seq.) (FIFRA) (1996)** provides for federal regulation of pesticide distribution, sale and use. All use of pesticides by OSMP staff and contractors must be consistent with the provision of FIFRA and associated regulations.

***State***

The **Colorado Pesticide Act (C.R.S. 35-9)** regulates registration, distribution, use, and disposal of pesticides. The **Colorado Pesticide Applicators' Act (C.R.S. 35-10)** regulates the use of pesticides and the licensing of pesticide applicators.

***Local***

**City of Boulder Integrated Pest Management (IPM) Policy** requires a hierarchical approach to pest management, beginning with prevention. Chemical controls are assumed to be potentially harmful to human and environmental health and should be the very last step after other methods have been found ineffective or unfeasible. Regardless of whether non-chemical or chemical controls are used to manage pests, pests should be mapped and monitored and a threshold established before treatment is considered. The IPM Policy requires that the following strategies be used in order, with prevention being the most effective and preferred strategy.

- Prevention is managing agricultural fields to prevent pests from becoming a threat.
- Cultural control is manipulating the cropping environment to make it less suitable for pests. Cultural methods include crop rotation and diversification, selecting pest-resistant cultivars and planting disease-free rootstock.
- Mechanical and Physical control are methods of killing a pest directly, blocking a pest out or making the environment unsuitable for a pest. This can include traps, mulches or cultivation.
- Biological control is the use of beneficial organisms, which includes predators, parasites, pathogens and competitors, to control pests and their resulting damage. Natural enemies can be augmented through releases or attracted to a cropping area through habitat engineering.
- Chemical control is the use of pesticides. In IPM, pesticides are used only when needed and in combination with other approaches for effective, long-term control.

# Integrated Pest Management (IPM)

## Existing Conditions

Weeds, fungal pathogens, viruses and insects can detrimentally effect crop yield and agricultural productivity. Lessees are responsible for integrated pest management (IPM) on leased properties. Organic operators typically focus on prevention, cultural and mechanical techniques only using Organic Materials Review Institute (OMRI)-approved chemicals as a last resort. Anticipated losses due to pests are incorporated into their crop plans. Conventional operators vary in their approach depending on the crop (Figure 23). Lessees that apply pesticides typically employ crop consultants who advise on and perform pesticide applications.

Conventional Agricultural Operators' IPM Approaches

| Type of Crop | IPM Approach Typically Used |
|---|---|
| Grass hay | Not sprayed |
| Alfalfa | Treated once a year for alfalfa weevil |
| Various commodity annual crops | Annual or as needed treatment for weeds, insects and fungal pathogens based on economic threshold (cost of application versus crop quality and quantity loss) |

Figure 23

OSMP has encouraged non-chemical pest management, when possible, and least persistent and least toxic pesticides when chemical treatment is determined to be necessary. The existing OSMP review and approval/ denial process for chemical treatments is shown in Figure 24. Lessees are required to provide the chemical name, application rate, target pest and acres proposed for treatment when making a request for pesticide application. Staff often conducts site visits to verify pest presence and the severity of the infestation. Staff evaluates the proposed treatment to ensure consistency with city IPM Policy and considers the concentration, rate, and total amount of pesticide to be applied, application method, as well as cumulative risk to non-target organisms, human health and the environment. Staff approves or denies the proposed chemical treatment based on a consideration of these factors. Staff may also recommend alternatives to the requested application, including reduced rates, the use of lower risk chemicals, or a change in the timing of application. Staff posts notification of chemical application both on the city pesticide hotline and on-site. Staff tracks the amount of pesticide product used at each site by target pest and lessee. In 2014, 536 acres were treated with pesticides in response to lessee requests. The three crop types most commonly treated with pesticides were small grains, alfalfa and corn.

# Integrated Pest Management (IPM)

## Existing Conditions

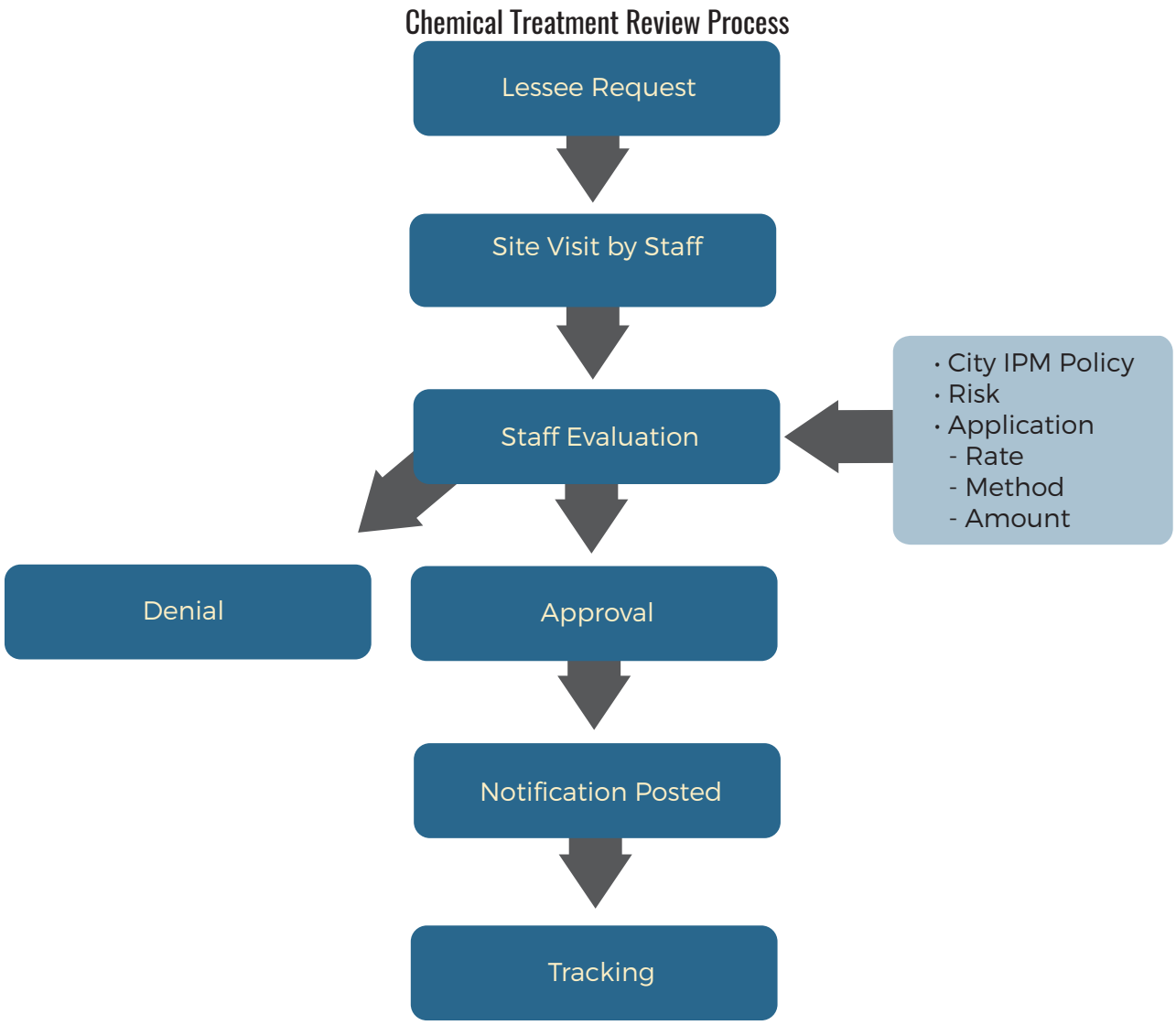



Figure 24

## Objectives

- **Reduce state-listed noxious weeds on OSMP lands with agricultural leases, prioritizing State List A Species for eradication and State List B Species for containment and suppression.**

# Integrated Pest Management(IPM)

## Objectives

- **Reduce or eliminate the use of pesticides, wherever possible. When reduction or elimination of pesticides is not possible, use the least toxic and least persistent pesticide.**

## Management Strategies

**Encourage lessees to explore BMPs focusing on preventative, cultural and mechanical methods that are best suited to their particular property (Figure 25).**

IPM BMPs

- Integrating livestock
- Using bubblers to remove weed seeds from irrigation water
- Planting cover crops to enhance soil fertility and assist with natural pest controls
- Incorporating conservation tillage practices
- Growing crops suited to the local environment
- Rotating crops and diversifying fields with intercropping
- Planting non-crop barriers and strips to provide habitat for wildlife and natural enemies, prevent soil and water erosion and buffer the off-site effects of any pesticide use

Figure 25

**Promote adoption of BMPs by exploring cost-sharing, lease reductions and collaboration with NRCS.**

Prioritize management of state-listed noxious and invasive species, especially in crop buffer areas.

Develop IPM site planning in partnership with lessees via Stewardship Plans (see Leasing Agricultural Lands section of the plan).

**Review and make determinations about chemical treatments according to the process outlined in Figure 26.**

Staff will determine appropriate buffers by taking into account drift potential, proximity to people and neighboring land uses and risks to aquatic life and/or wildlife.

# Integrated Pest Management (IPM)

## Management Strategies

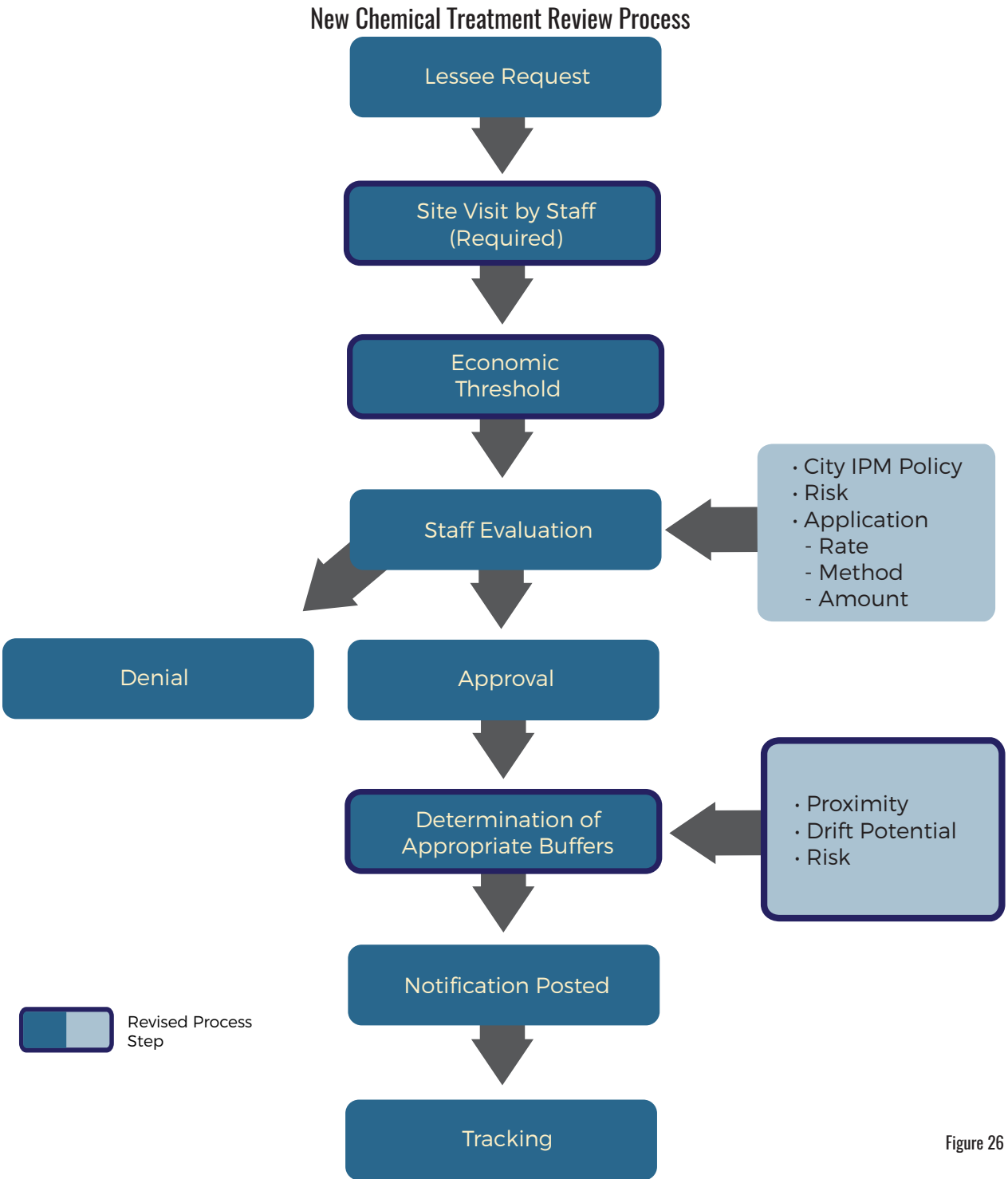



Figure 26

# Integrated Pest Management (IPM)

## Measures of Success

- Decrease in amount of pesticide applied and acreage of pesticide applications (it is unlikely that pesticide use will be eliminated as long as certain crops are grown on OSMP lands).
- Decrease in the volume of EPA Risk Category II pesticide applications.
- Proportion of operations in compliance with IPM requirement of established Stewardship Plans. (Desired condition = all operations)
- Decrease in state-listed noxious and invasive weeds on agricultural properties.

## Research Opportunities

- Alternatives for Warrior II for alfalfa weevil management.
- Prescriptive grazing for weed management on non-native grasslands.
- Non-chemical control options in commodity crops.

## Estimated Implementation Costs

- $-$$
- Less than $10,000 to $49,999 for possible program for cost-sharing of reduced risk chemicals and additional staffing for mandatory scouting.


Erin Doyle

# Climate Change Preparedness

## Existing Policy Guidance

***State***

The **Colorado Climate Plan (2015), Colorado Climate Change Vulnerability Study (2015)** and the **Colorado Water Plan (2015)** address the impacts of climate change on agriculture and outline strategies for climate change preparedness.

The **Climate Change in Colorado Report (2014)** involves the latest projections for future climate scenarios in Colorado.

***Local***

The **Boulder County Climate Change Preparedness Plan (2012)** was written specifically to prepare resource managers in BCPOS and OSMP for climate change. The natural resources and agriculture sections of the plan describe climate change impacts, opportunities to address climate change and policy recommendations.

The **City of Boulder's Climate Commitment** directly addresses the link between climate change and agriculture, focusing on the sequestration of carbon in soil organic matter as a greenhouse gas mitigation strategy.

The **City of Boulder, Colorado Drought Plan (2010)** provides guidance for recognizing droughts that will affect water supply availability and for responding appropriately to these droughts.

**BVCP**

3.15 Soil Carbon Sequestration

- The city and county recognize that soil carbon sequestration may have a range of potential benefits, including water retention, climate change mitigation, soil health and soil stabilization. Soil health is especially important for both the natural environment and agricultural lands. Section 9 (Food and Agriculture) includes a description of soil carbon sequestration policy for tilled agricultural lands. For the natural environment, the capacity of native grasslands and forests to sequester carbon will be important in city and county soil carbon sequestration efforts. Native grasslands and forests will be maintained and protected following resource management plans. Opportunities to manage soil carbon levels in such areas, when appropriate, need to be consistent with adopted plans and policies.

9.04 Soil Health and Soil Carbon Sequestration

- The city and county will consider strategies to enhance soil health and will explore and evaluate strategies to sequester soil carbon on certain agricultural lands. The city and county recognize that there is baseline work to be done, such as conducting research and literature reviews, identifying relevant information gaps, conducting baseline soil health tests, and determining if and how OSMP and county Parks and Open Space tilled lands best offer opportunities to address carbon sequestration, beginning with limited experimentation in tilled lands. The city and county also encourage the private sector to practice soil carbon sequestration.

General guidance addressing climate change preparedness is included in the **Boulder Resilience Strategy**.

# Climate Change Preparedness

## Existing Conditions

Over the past several decades, increased carbon dioxide ($CO_2$), methane, and carbon monoxide levels in the atmosphere have raised temperatures (IPCC 2013) and possibly contributed to large disturbance events. For example, in 2002 Boulder experienced a drought, the Fourmile Canyon fire occurred in 2010, and in 2013 Boulder and its surrounding areas experienced severe flooding that required federal aid; the severity of the flooding was attributed in part to climate change (Trenberth et al. 2015)[6]

Climate change may result in many environmental and weather-related changes for which we must be prepared. Anticipated regional changes are outlined in Figure 27.

Anticipated Future Climate Changes

| Likely Changes | Somewhat Likely Changes | Possible Changes |
|---|---|---|
| · Increase in $CO_2$<br>· 2.5-5˚C increase in temperature by 2050<br>· Increase in heat waves<br>· Earlier snow melt | · Increase in drought<br>· Increase in heavy precipitation<br>· Increase in frequency and severity of wildfires<br>· Larger snowstorms | · Changes in annual precipitation<br>· Increase in tornadoes<br>· Increase in hail storms |

Figure 27

The potential effects of increased carbon dioxide levels to agricultural productivity and management may be both direct and indirect (summarized in the following citations, and references therein: Adams et al. 2001, BCCCPP 2012; CCSP 2008; Howden et al. 2007; USGCRP 2009). Possible direct effects of having more carbon dioxide in the air are outlined in Figure 28.

[6] See related story in local newspaper: http://www.dailycamera.com/news/boulder-flood/ci_28360775/boulder-scientist-ties-severity-colorados-2013-flood-climate

# Climate Change Preparedness

## Existing Conditions

### Direct Effects of Increasing $CO_2$

| |
|---|
| · Positive yield response, but decreased nutritional quality (i.e. protein dilution in small grain cereal crops) |
| ·Higher Carbon to Nitrogen (C:N) ratios of forage crops |
| ·Increased performance of some $CO_2$-responsive weeds |
| ·Decreased efficacy of herbicide |

Figure 28

The indirect effects of rising carbon dioxide on agriculture will likely be seen through increased temperatures. Possible effects of higher temperatures are outlined in Figure 29.

### Indirect Effects of Increasing $CO_2$ (Higher Temperatures)

| |
|---|
| · Negative impacts on flowering, grain set and crop yield |
| ·Stress on plants resulting in a shift in the composition of proteins in cereal grains and reduced winter hardiness of perennial forage species |
| ·Longer growing seasons that could increase susceptibility to frosts |
| ·Higher winter minimum temperatures that could increase pest survival, pest ranges, populations of marginally-overwintering species, and the number of generations of insects that traditionally reproduced once per growing season |
| ·Decrease in irrigation water availability (volume and duration) |

Figure 29

More chemical use may be necessary to combat these pests, especially if plants are more susceptible to pests due to drought stress. Alternatively, crops that are insensitive to the new pests may be used. Cooling with irrigation is another technique that may be used to mitigate high temperatures.

Changing weather patterns also may have negative effects on agriculture. Extreme weather events, such as heat, cold, precipitation and hail can physically damage crops and wash away soil, seeds or plants. Waterlogged soils resulting from high volume rain events can cause delayed plantings or harvest, increased susceptibility to root diseases and increased soil compaction. Precipitation in the form of rain instead of snow affects the timing and quantity of available irrigation water, with implications for water rights.

How increases in carbon dioxide, increases in temperature and variable weather will interact to affect agriculture is largely unknown, and will likely be contingent upon several local factors. Predicting the effects of climate change on agriculture requires accounting for several interacting drivers including population growth, water availability, energy availability, shifting demographics, land use and economic vitality.

# Climate Change Preparedness

## Existing Conditions

The location and scale of agricultural operations may shift, especially where water demand is increasing and water availability and storage is limited or decreasing. For example, irrigated hayfields may be converted to pasture or native grasslands. Similarly, a conflict between the use of water for irrigated agriculture or for aquatic and riparian habitats or for municipal use may become a dominant trend.

Cattle grazing operations may also be impacted by climate-driven changes to forage. Earlier onset of spring and/or delayed onset of winter could increase the length of forage production season, while drought could shrink forage production. Elevated carbon dioxide and temperature could also reduce forage nutritional quality and change grassland species composition.

While agriculture is a significant source of emissions, agricultural operations may also be used to stabilize climate by sequestering carbon out of the atmosphere (Lal 2004).

## Objectives

- **Identify agricultural management practices that help prepare for a more arid future.**
- **Research the potential for agricultural practices to mitigate climate change, including a "carbon credit" incentive program for land managers to sequester carbon such as the State of California.**

Dave Sutherland

# Climate Change Preparedness


Jack Sasson

## Management Strategies

**Develop a water strategy to 1) increase efficiency of and prioritize water distribution, 2) explore water banking and storm water retention strategies; and 3) increase the use of low-water use crops and varieties.**
Please see the Infrastructure- Water Delivery, Riparian Areas- Creeks, and Wetlands- Ponds sections of the plan for more information on water related management strategies.

**Develop a grazing de-stocking protocol** (see the Grazing in Native Grasslands section of the plan).
Use prescriptive grazing as an ecological management tool that has sensitivities to climate variability and incorporate climate into the Rangeland Condition Assessments.

**Collaborate with farmers to increase the flexibility of agricultural management techniques.**
Consider adjustments to crop rotation and water use and try to understand farmers' views on climate change impacts and strategies they might adopt.

**Establish objectives for soil health on OSMP agricultural lands that include consideration of water holding capacities and water infiltration into soils during rainfall events, to mitigate the effects of predicted drought and severe rainfall events from climate change.**
Please see the Soil Conditions section of the plan for more information on soil related management strategies.

# Climate Change Preparedness

## Measures of Success

- Completion and implementation of a water strategy, a de-stocking protocol and a rangeland condition assessment protocol and monitoring.
- The number of research reports that address climate change preparedness.

## Research Opportunities

- Determine the efficacy of agricultural practices to sequester carbon and mitigate greenhouse gas emissions.
- Explore what types of agriculture, crop varieties and crop species (e.g., new dryland and low-water commodity crops and forage species) might be best suited to a more arid future.
- Explore whether crop diversity and other cropping strategies can add to crop system resilience.
- Explore creative ways to share water among stakeholders.

## Estimated Implementation Costs

- The costs are associated with the management strategies described and estimated in the Grazing in Native Grasslands, Infrastructure- Water Delivery, Riparian Areas- Creeks, and Wetlands- Ponds sections of the plan.

Lauren Kolb

Jack Sasson

# Ecological Integration

# Bobolink Habitat

## Existing Policy Guidance

***Federal***

The **Migratory Bird Treaty Act (1918)** protects migratory birds, such as bobolinks, and their nests.

***County***

The **Boulder County Comprehensive Plan (BCCP)** identifies critical wildlife habitat in Boulder County, which includes irrigated hayfields that support bobolinks on OSMP as well as a list of sensitive species, which includes bobolinks.

**Local**

The **Grassland Plan** establishes a goal of integrating agricultural management practices that support nesting habitat for bobolinks and identifies a select number of irrigated hayfields where management is to be modified to increase nesting potential for bobolinks. The Grassland Plan identifies two categories of fields with differing management regimes. Class A Bobolink Management Areas are only mowed after July 15 of each year (after bobolink fledging), unless otherwise determined by monitoring. Four fields, totaling 267 acres, were designated as Class A Bobolink Management Areas (Map 4). The standard set, or desired "good" rating, was to manage 100 percent of the four fields as Class A Bobolink Management Areas. Class B Bobolink Management Areas are mowed after July 15 (after bobolink fledging) in one year out of every three. Fourteen fields, totaling 356 acres, were identified as candidates for Class B Bobolink Management Areas and five of these fields were ultimately designated (Map 4). The other nine fields remain as candidates due to complicated land use and prioritization of agricultural use. The standard set was to manage 75 percent of the 14 hayfields or 10.5 fields (the Grassland Plan incorrectly identified 10 instead of 10.5 fields as 75 percent of 14) as Class B Bobolink Management Areas in a given year. Due to the varying size of the Class B candidate fields, a range of acres determined by summing the largest 10.5 fields and the smallest 10.5 fields, 223-316, has been included to clarify the standards established by the Grassland Plan.

# Bobolink Habitat

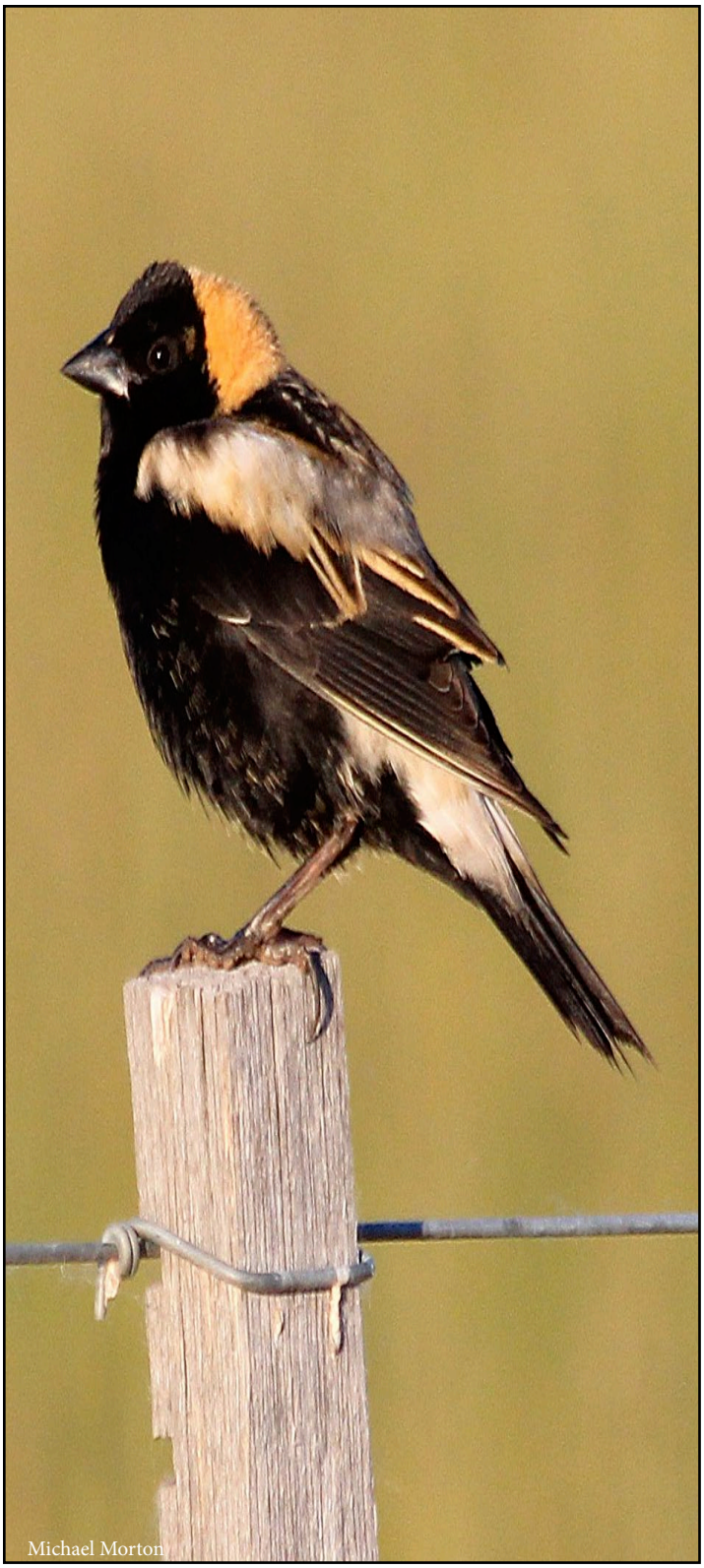
## Existing Conditions

Since the adoption of the Grassland Plan in 2010 the four fields (267 acres) that were designated Class A Bobolink Management Areas have been managed consistent with the associated management regime. The standard set in the Grassland Plan, or desired "good" rating, has been met. Nine fields, totaling 246 acres, which are a combination of designated and candidate Class B Management areas, have been managed consistent with the associated management regime. The total number of acres managed meets the standard set in the Grassland Plan, or desired "good" rating. Map 4 displays the Grassland Plan Bobolink Management Areas.

While the later mowing dates associated with the management areas can help conserve bobolink populations they reduce agricultural productivity by potentially reducing the number of hay harvests and the quality of the harvested hay.

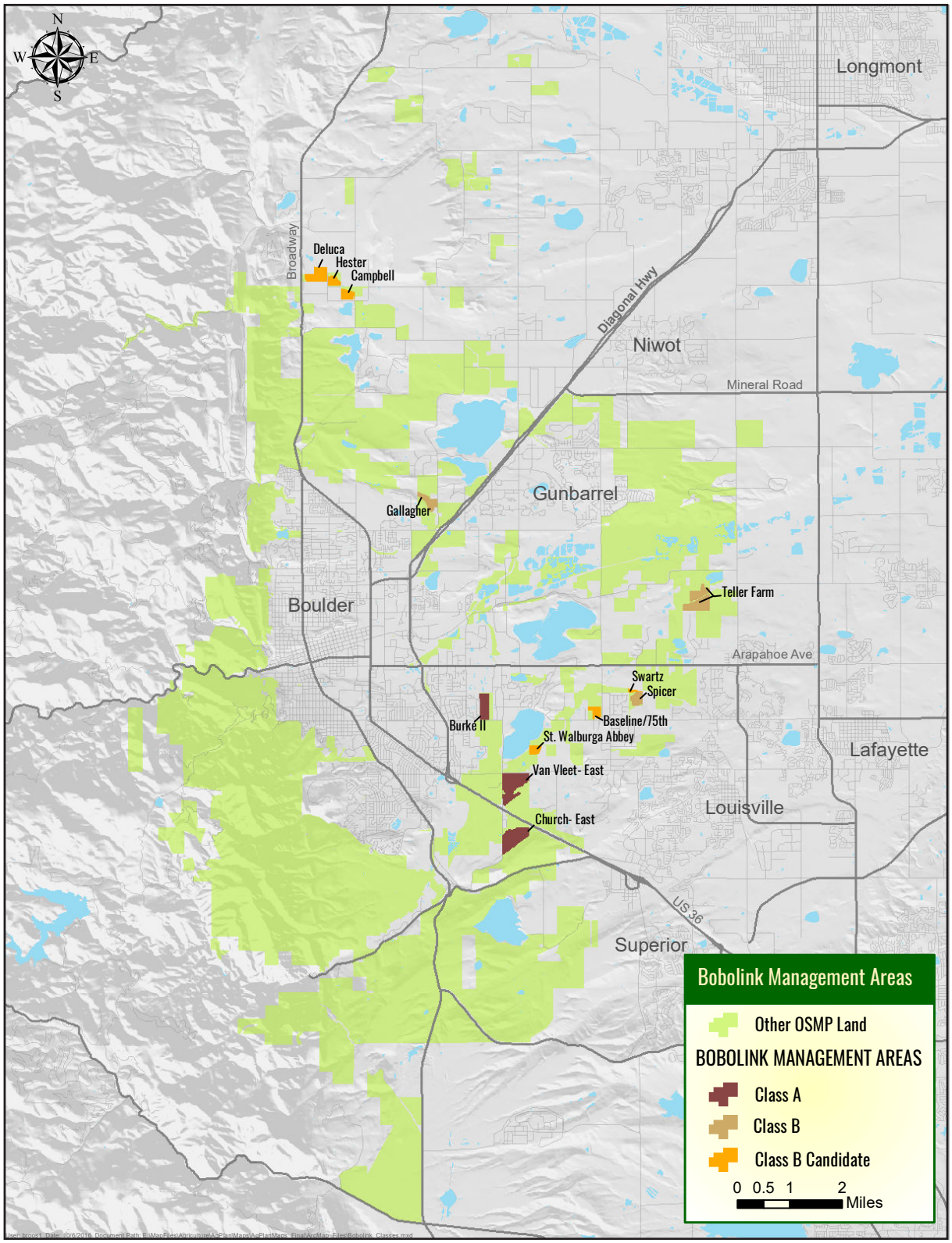
### Bobolink Nesting Habitat

Bobolinks are ground-nesting songbirds that originally nested in tallgrass or mixedgrass prairie, but because of land conversion and the proliferation of irrigation, have now increased their use of irrigated hayfields. Bobolinks tend to breed later in the nesting season compared to other ground nesting birds. This means that summer haying/mowing often occurs before the young birds have left the nest (fledged). Biologists have documented a 90 to100 percent failure rate of bobolink nests because of hayfield mowing (Bollinger et al. 1990). Postponing mowing until after July 15 allows the majority of fledglings to sustain flight and avoid being killed or injured during mowing.



Michael Morton

# Map 4: Bobolink Management Areas



# Bobolink Habitat

## Objectives

- Integrate agricultural management practices that support nesting habitat for bobolinks.

## Management Strategies

Adjust management by delaying mowing on a select number of hayfields until after bobolink fledging, July 15, unless otherwise determined by monitoring.

Establish/maintain four fields (267 acres) as Class A Bobolink Management Areas where mowing does not occur before July 15.

Establish/maintain 10.5 fields (or 223-316 acres) as Class B Bobolink Management Areas where mowing does not occur before July 15 in one out of three years.

Consider most current bobolink density data (Map 5) to identify areas with higher bobolink abundances or densities with good landscape context to provide larger contiguous habitat blocks.

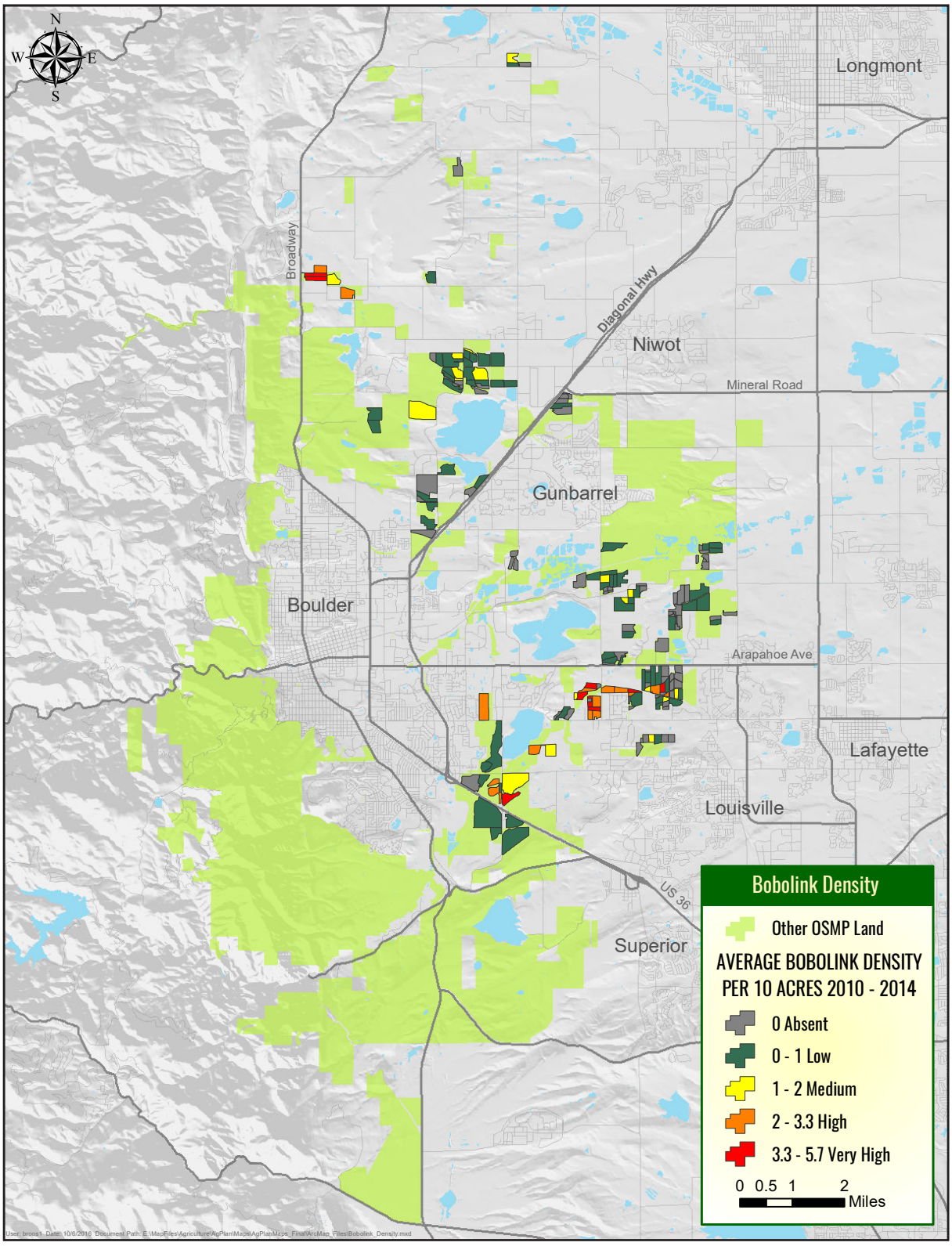
Hayfields are monitored annually for bobolinks. If/when applicable (i.e. many more acres exist with very high, or high densities and/or abundances with good landscape character than is necessary to meet the standards set in the Grassland Plan) staff will take lessee field preferences into consideration when choosing between fields.

When applicable, evaluate compensation strategies to mitigate the economic impact to lessees for decreased yields resulting from delayed mowing.

Evaluate new acquisitions for potential additional Bobolink Management Areas.

Dave Sutherland

# Map 5: Bobolink Density



# Bobolink Habitat

## Measures of Success

- Acres of Class A Bobolink Management Areas designated (267 acres to reach desired "Good" rating).
- Acres of Class B Bobolink Management Areas designated (223-316 acres to reach desired "Good" rating).
- Percent of Class A fields cut after July 15 every year (100 percent to reach desired "Good" rating).
- Percent of Class B fields cut after July 15 one year out of three (100 percent of 223-316 acres or 10 fields [written in the Grassland Plan as 75 percent of the 14 designated and candidate fields] to reach desired "Good" rating).

## Research Opportunities

- Nesting productivity research including: variability of nesting dates, productivity levels under a variety of management and mowing regimes, causes of nest failures.

## Estimated Implementation Costs

- There is no out of pocket cost to OSMP associated with delaying the mowing on select hayfields.

Michael Morton

# Ute Ladies'-Tresses Orchid Habitat


Thomas Wiberding

## Existing Policy Guidance

***Federal***

The **Endangered Species Act** lists and protects the Ute ladies'-tresses orchid as a threatened species. The **U.S. Fish and Wildlife Service's Ute ladies'-tresses** *(Spiranthes diluvialis)* **Recovery Plan** is currently in draft form and delineates actions to recover and/or protect the species.

***State***

The **Colorado Natural Heritage Program** ranks the Ute ladies'-tresses orchid as "S2" indicating it is a "rare and imperiled plant."

***County***

The **BCCP** identifies rare plant areas and species of concern in Boulder County, to be conserved and preserved. The Ute ladies'-tresses orchid is among the plant species of special concern.

***Local***

The **OSMP Charter** purpose of preservation or restoration of natural areas characterized by or including terrain, geological formations, flora or fauna that are unusual, spectacular, historically important, scientifically valuable or unique, or that represent outstanding or rare examples of native species.

**BVCP** Policy 3.03 states that the city and county will protect and restore significant native ecosystems on public lands and that the protection and enhancement of habitat for federally-listed threatened species will be emphasized.

The **Grassland Plan** establishes OSMP's conservation goals and measures of success for Ute ladies'-tresses orchids.

The **South Boulder Creek Area Management Plan** identifies as goals: the preservation and maintenance of native plant communities, protection of rare species and communities (including the Ute ladies'-tresses orchid) and restoration of native vegetation in suitable areas. This plan specifically calls for coordination between Open Space agricultural managers, plant ecologists and lessees to maintain and improve orchid habitat using compatible agricultural practices. The continuation of agricultural leasing, and adaptive haying and irrigation water management in orchid habitat contribute to the species' recovery.

# Ute Ladies'-Tresses Orchid Habitat

## Existing Conditions

Two populations of Ute ladies'-tresses orchid (ULTO) occur on OSMP land. The South Boulder Creek population consists of 20 sub-occurrences within the floodplain, riparian zone and irrigated stream terraces, and is one of the largest populations within the range of the species. The Boulder Creek population consists of two sub-occurrences in the floodplain and riparian zone. These populations support an estimated total of 10,000 plants.

Agricultural management practices are integral in supporting ULTO habitat, which is dependent on specific hydrologic conditions and disturbance regimes. The orchid's specific habitat requirements are largely maintained by traditional agricultural practices. Properly timed cattle grazing, irrigation and haying are key components of ULTO habitat management. Current and traditional grazing, irrigation and haying methods that support ULTO habitat are shown in Figure 30.

Key Components of ULTO Habitat Management

| | |
|---|---|
| Grazing | Prescriptive grazing fall, winter or spring and a prescribed burn the following spring or fall |
| Flood Irrigation | Spring and mid summer |
| Haying | Variable summer haying dates |

Figure 30

The Grassland Plan assessment of viability indicators for ULTO resulted in a "Good" rating, concluding that the species was being adequately conserved through existing agricultural practices. Periodic inventories of flowering individuals indicate variability in the stability of the sub-occurrences. Several invasive plant species pose a threat to potential and occupied habitat.

## Ute Ladies' - Tresses Orchid Natural History

The Ute ladies'-tresses orchid (*Spiranthes diluvialis*) is a long-lived perennial species that is well-adapted to floodplain and stream side ecosystems. This orchid is distributed east and west of the Rocky Mountains at lower elevations, and is a federally-listed, threatened species.

When flowering, ULTOs are eight to 20 inches tall with three to 15 white flowers arranged in a loose spiral. Flowering occurs from late July through August in the Boulder area. Bees are the primary pollinators.

Each flowering stalk produces a fine dust of up to 100,000 tiny seeds. Seeds are short-lived, remain dormant over the winter and germinate in the spring and summer after dispersal. Germination requires an association with a mycorrhizal soil fungus, and it can take 10 years or longer for a new plant to produce above ground growth. ULTO plants can remain dormant for several years in between flowering years and can live for many decades.

# Ute Ladies'-Tresses Orchid Habitat

## Objectives

**Integrate agricultural management practices that support ULTO habitat.**

**Maintain a "Good" viability ranking for ULTO indicators in the Grassland Plan.**

## Management Strategies

**Manage ULTO habitat according to BMPs.**

ULTO BMPs

| Agricultural Activity | Management Practice |
|---|---|
| Grazing | · Graze livestock outside of the most sensitive portion of the growing season (May 15 to Oct. 15)<br>· If summer cattle grazing is necessary to meet vegetation management objectives, avoid grazing more frequently than two successive summer seasons. If more frequent summer cattle grazing is deemed necessary, exclude cattle from occupied habitat during the flowering and fruiting peroid.<br>· Use prescriptive cattle grazing during the late fall, winter and/or early spring. |
| Flood Irrigation | · Maintain historic flood irrigation practices. Apply water in the spring (April to June) before haying and again after haying (August, September)<br>· Maintain hydrologic conditions that support ULTO habitat when irrigation infrastructure is maintained or improved. |
| Haying | · Omit haying orchid patches with high numbers of flowering individuals every three to five years. Identify specific fields where this practice will be used and determine an acreage range (e.g., five to 10 acres) to omit from haying in specified fields. |
| Prescribed Fire | · Conduct spring or fall prescribed burns in orchid habitat to improve vegetation structure and avoid sensitive life stages.<br>· Follow burns with prescriptive cattle grazing.<br>· Burn orchid habitat with a return interval that is not less than three years. (Adhere to Grassland Plan fire return interval standard for Mesic Bluestem Conservation Target.)<br>· Prioritize burning orchid habitat that is not hayed.<br>· Do not use foam fire retardant in orchid habitat. |
| Integrated Pest Management | · Avoid using herbicide in documented orchid occurrences. In the vicinity of orchid habitat, use only herbicide that does not affect the orchid plant family. Use wick application, or if broadcast spraying is used, provide a buffer of at least 50 feet around orchid occurrences.<br>· Conduct mechanical control of invasive non-native plant prior to early July to avoid damaging flowering stalks. |
| Other | · Improve and maintain bumble bee habitat in the vicinity of orchid habitat. |

Figure 31

# Ute Ladies'-Tresses Orchid Habitat

## Management Strategies

**When applicable, evaluate compensation strategies to mitigate financial impacts associated with implementation of ULTO BMPs to affected lessees.**

**Develop criteria for identifying potential ULTO habitat on existing properties or properties purchased in the future.**

## Measures of Success

- Percent of ULTO sub-occurrences managed in a manner that is consistent with BMPs.

- Percent of ULTO sub-occurrences:
  - -Prescriptively grazed only outside of most sensitive time (i.e. no grazing May 15 – Oct. 15).
  - -Prescriptively grazed following prescribed burning in ULTO habitat.
  - -Irrigated in the spring (April to June) before haying and again after haying (August, September).
  - -Omitted from haying every 3-5 years in selected areas within high density, hayfield sub-occurrences.

- Grassland Plan viability rating of "Good".

## Research Opportunities

- Investigate the effectiveness of cattle grazing treatments in reducing the prevalence of several invasive plant species that impact ULTO habitat.

- Research the palatability and preference for ULTO as forage by cattle.

## Estimated Implementation Cost

There are no additional costs identified at this time. The related fencing costs are estimated in the Grazing in Native Grasslands section of the plan.

Laurie Deiter

# Raptor Habitat

## Existing Policy Guidance

***Federal***

The **Migratory Bird Treaty Act (1918)** protects migratory birds and their nests. The **Bald and Golden Eagle Protection Act (1940)** protects Bald and Golden eagles, their habitat and their nests. The **US Fish and Wildlife Service's National Bald Eagle Management Guidelines (2007)** outline recommendations for protecting bald eagle habitat.

***State***

The **Colorado Division of Parks and Wildlife "Recommended Buffer Zones and Seasonal Restrictions for Colorado Raptors"** outlines management strategies for protecting raptor habitat in Colorado.

***Local***

The **BCCP** maps Critical Wildlife Habitat in Boulder County, which includes raptor habitat and a list of sensitive species, which includes all sensitive raptor species occurring on OSMP lands. The **Open Space LRMP** outline the Department's directives in protecting native animals, and more specifically, migratory animals. The **Grassland Plan** establishes OSMP's conservation goals and measures of success for grassland-nesting raptors.

## Existing Conditions

The city has been able to integrate its management of OSMP grasslands to provide opportunities for agricultural production while also providing high-quality habitat for grassland-nesting raptors. Known nest sites are monitored by volunteers and staff. The majority of raptor nests occur near or on lands that are currently leased for agricultural production (Figure 32).

Grassland-Nesting Raptors on OSMP (2010-2016)

| Raptor Species | Site | Nesting Attempts | Nesting Success* | Mean # of Fledglings/ Nesting Attempt |
|---|---|---|---|---|
| Bald Eagle | Coal Creek | 7 | 100% | 1.83 |
| | White Rocks | 7 | 42% | .42 |
| Burrowing Owl | Jafay/Lynch | 7 | 100% | 4.3 |
| | Superior Associates | 9 | 89% | 3.8 |
| | Yunker | 1 | 100% | 5 |
| | Knaus | 2 | 100% | 4.5 |
| | Mesa Sand & Gravel | 2 | 100% | 2.5 |
| Northern Harrier | Boulder Valley Ranch | 1 | 100% | 2 |
| Osprey | Axelson | 12 | 33% | .83 |
| | Ute Butte | 6 | 100% | 2 |

*Nesting attempts that fledge at least one nestling

Figure 32

In addition to grassland raptor species whose nests are monitored, there are other raptors nesting on OSMP whose nests are not monitored; these include Swainson's hawks, great horned owls and red-tailed hawks. OSMP does not collect breeding and nest site data for these species.

# Raptor Habitat

## Existing Conditions

Map 6 shows the Bald Eagle and Osprey seasonal closure areas on OSMP lands. OSMP enacts seasonal closures to protect these species from human-caused disturbances in accordance with federal and state guidelines. OSMP also protects nesting burrowing owls with seasonal closures. Burrowing owl nest sites are not depicted on Map 6 because the owls' nesting areas shift annually in response to prey abundance, prairie dog occupation and other factors.

The seasonal closures, habitat management guidelines and requirements for bald eagles are established on a case-by-case basis and often require consultation with the US Fish and Wildlife Service (USFWS) (Figure 33).

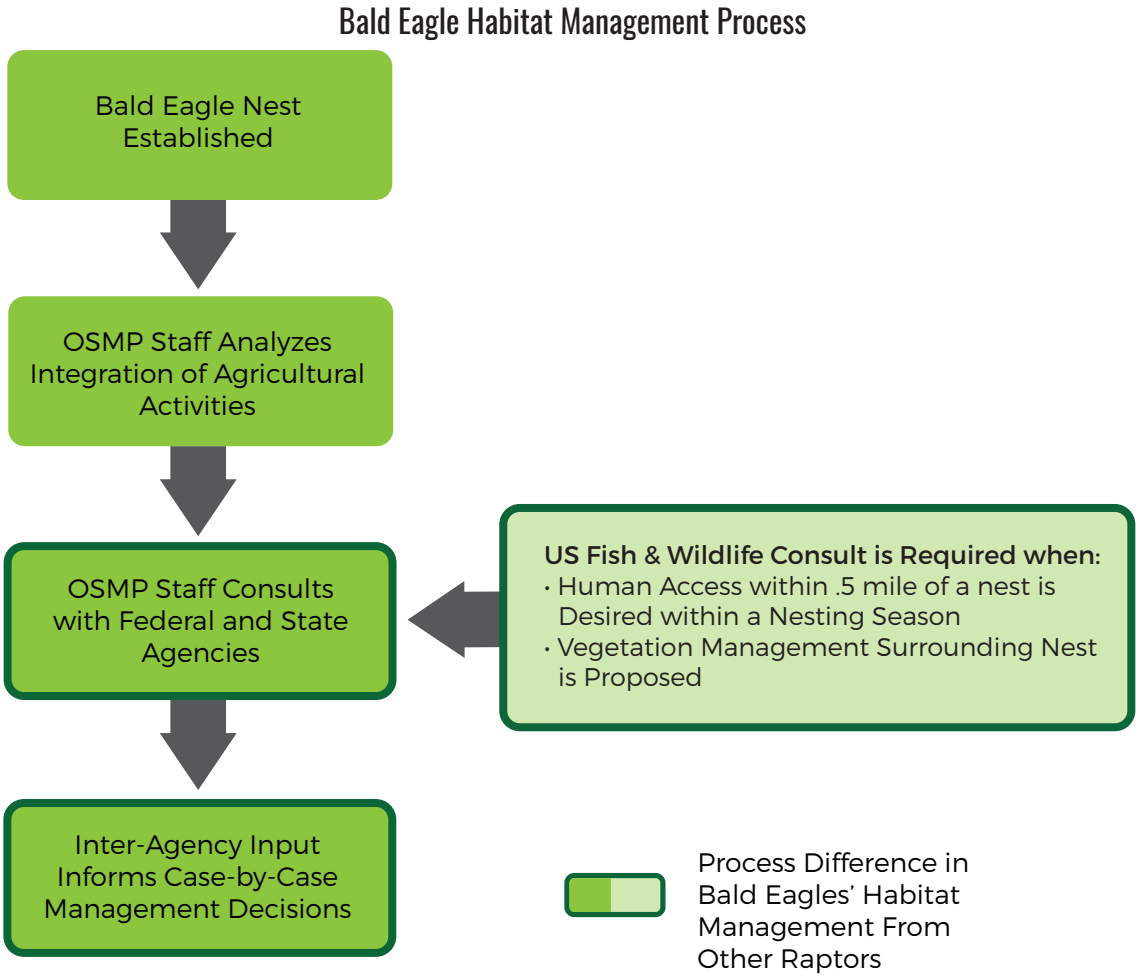
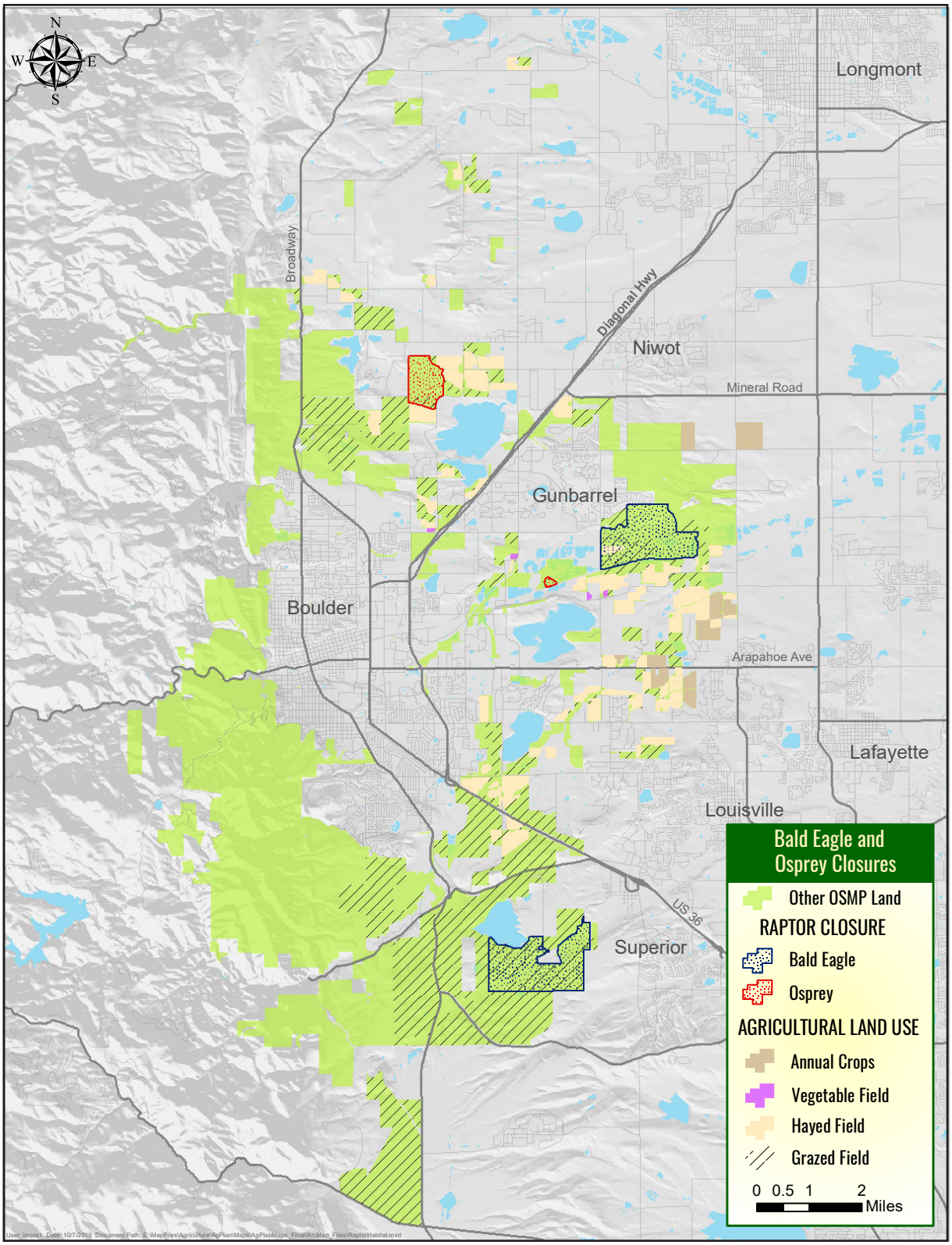



Figure 33

# Map 6: Bald Eagle and Osprey Closures



# Raptor Habitat

## Existing Conditions

An evaluation and description of agricultural activities, both existing and anticipated, is included in staff's consultation with USFWS. In the past, some agricultural activities, such as irrigation and maintenance of irrigation facilities and existing livestock grazing practices have been allowed by USFWS. OSMP establishes management guidelines, if necessary, for all other raptor species (Figure 34).

### Other Raptor Habitat Management Process

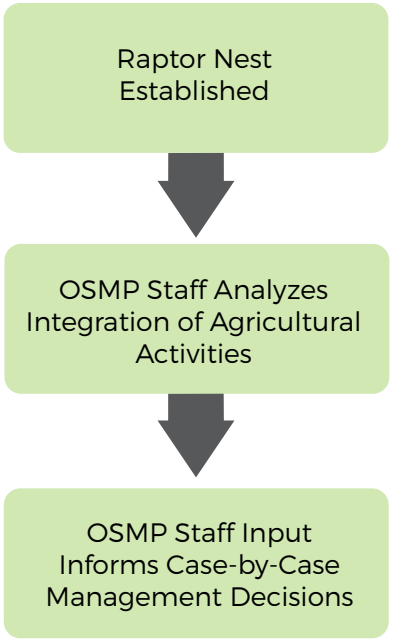



Figure 34

## Objectives

- **Integrate agricultural management practices that support effective habitat for nesting raptors.**

# Raptor Habitat


Dan Baldwin

## Management Strategies

**Continue to manage raptor nesting sites with agricultural activities on a case-by-case basis.**

Because of the uniqueness of each situation and differing federal and state guidelines for each raptor species, management decisions will be made on a case-by-case basis.

**Consider agricultural and water resources information and activities when establishing habitat management guidelines and requirements.**

If new nests are established, or new agricultural activities are proposed near an existing nest, the following will be considered when establishing raptor habitat management guidelines and requirements:

- The stage of raptor nesting cycles when activity is proposed to occur.
- Timing, type, duration and intensity of proposed agricultural activity.
- Amount and type of vegetation between proposed or existing agricultural activity and occupied raptor nest.
- Alternative opportunities for lessee or water-delivery.
- Lessee compensation.
- Existing or historic agricultural activity.

# Raptor Habitat

## Measures of Success

The measures of success for raptor habitat are established in the Grassland Plan and include:

- Number of prairie dog colonies with successful nesting attempts by burrowing owls.
  - Three to four prairie dog colonies surveyed to have successful burrowing owl nesting attempts signify a "Good" rating identified in the Grassland Plan.

- Number of successful bald eagle nesting attempts in the Grassland Planning Area.
  - Two or more successful bald eagle nesting attempts on OSMP signify a "Good" rating identified in the Grassland Plan.

## Research Opportunities

- Locate all stick nests to assess raptor use of agricultural properties.

- Collaborate with others to better understand the relationship of northern harrier breeding ecology with agricultural practices in Boulder County.

## Estimated Implementation Costs

- There are no additional costs identified at this time.

Claudia Van Wie

# Preble's Meadow Jumping Mouse Habitat

## Existing Policy Guidance

***Federal***

The **Endangered Species Act** lists and protects the Preble's meadow jumping mouse as a threatened species. The **Endangered Species Act** sets up recovery goals, identifies critical habitat and regulates activities that might negatively impact protected species such as the Preble's meadow jumping mouse. **Special rule 4(d)** provides certain exemptions from Section 9, or "takings", under the Endangered Species Act. The 4(d) rule provides guidance for certain activities associated with removal of non-native species and maintenance of ditches and other water infrastructure. Activities not covered by the 4(d) exemptions are required to complete consultation with the US Fish and Wildlife Service.

**4(d) Exemptions from Section 9 of the Endangered Species Act- Ditch operation and maintenance**

1. Normal and customary ditch maintenance activities that result in the annual loss of no more than 1/4 mile of riparian shrub habitat within any one linear mile of ditch within any calendar year. Riparian shrub habitat is defined as vegetation dominated by plants that generally have more than one woody stem that measures less than two inches in diameter and are typically less than 10 feet in height at maturity, put on new growth each season and have a bushy appearance. Examples of shrubs include, but are not limited to, willow, snowberry, wild plum and alder.
2. Included in 1. above is the burning of ditches that results in the annual loss of no more than 1/4 mile of riparian shrub habitat within any one linear mile of ditch within any calendar year and is conducted out-of-season (see BMPs).

**BMPs**

Avoiding impacts to shrubs—Persons engaged in ditch maintenance activities must, to the maximum extent practicable, avoid impacts to shrub vegetation. For example, if it is possible to access the ditch for maintenance or repair activities from an area containing no shrubs, then damage to adjacent shrub vegetation must be avoided.

Disposition of debris—Persons engaged in placing or sidecasting silt and debris removed during ditch cleaning, vegetation or mulch from mowing/cutting, or other material from ditch maintenance must, to the maximum extent practicable, avoid shrub habitat, and at no time disturb more than 1/4 mile of riparian shrub habitat within any one linear mile of ditch within any calendar year.

Timing of work—To the maximum extent practicable, all ditch maintenance will be carried out during the Preble's hibernation season, November through April. Any maintenance activities carried out during the Preble's active season, May through October, will be conducted during daylight hours only. This exemption includes maintenance of roads used to access ditches and related infrastructure. These maintenance activities

# Preble's Meadow Jumping Mouse Habitat

## Existing Policy Guidance

are limited to the historic footprint associated with the infrastructure and access roads.

Examples of activities that are covered by the 4(d) exemption include the following activities, each limited to the destruction of 1⁄4 mile of riparian shrub habitat within one linear mile of ditch within any calendar year:

a. Clearing trash, debris, vegetation and silt by either physical, mechanical, chemical or burning procedures—Examples include mowing or cutting grasses and weeds, removal of silt and debris from the ditch below the highwater line and control of shrubs that could result in ditch leakage.

b. Reconstruction, reinforcement, repair or replacement of existing infrastructure with components of substantially similar materials and design—Examples include replacement of a damaged headgate, grading or filling areas susceptible to ditch failure, patchwork on a concrete ditch liner or replacement of failed culvert with a new culvert of the same design and material.

**The following maintenance activities are not exempted from the take provisions of Section 9 of the Act:**
a. Replacement of existing infrastructure with components of substantially different materials and design—such as replacing an existing gravel access road with a permanently paved road.

b. Construction of new infrastructure or the movement of existing infrastructure to new locations—Examples include re-drilling a well in a new location, building a new access road, change in the location of a diversion structure or installation of new diversion works where none previously existed.

***County***
The **BCCP** identifies critical wildlife habitat in Boulder County, which includes Preble's meadow jumping mouse habitat, especially around South Boulder Creek and associated tributaries. The Preble's meadow jumping mouse is identified as a sensitive species to be conserved and protected.

***Local***
The **OSMP Charter** purpose of preservation or restoration of natural areas characterized by or including terrain, geologic formations, flora or fauna that are unusual, spectacular, historically important, scientifically valuable or unique, or that represent outstanding or rare examples of native species.

The **Open Space LRMPs** outline the Department's directives in protecting native animals.

The **Grassland Plan** identifies the need to develop an indicator for Animal Species Composition that tracks the Preble's meadow jumping mouse (Preble's) and indicates its viability.

# Preble's Meadow Jumping Mouse Habitat

## Existing Conditions

Preble's occupy both riparian habitat and habitat along ditches in many areas on OSMP. Under the Endangered Species Act, Preble's habitat within 120 meters on either side of the South Boulder Creek on OSMP property is designated as Critical Habitat. Other areas on OSMP land may be considered occupied or potential habitat. (Map 7)

Figure 35 shows the ways in which agriculture supports Preble's habitat.

How Agriculture Supports Preble's Habitat

| | |
|---|---|
| Ditches | ·Provide high-quality shrub habitat<br>·Provide movement corridors |
| Irrigated Fields Near Riparian Areas | ·Provide foraging and resting areas |
| Grazing | ·Prescriptive grazing in riparian areas |

Figure 35

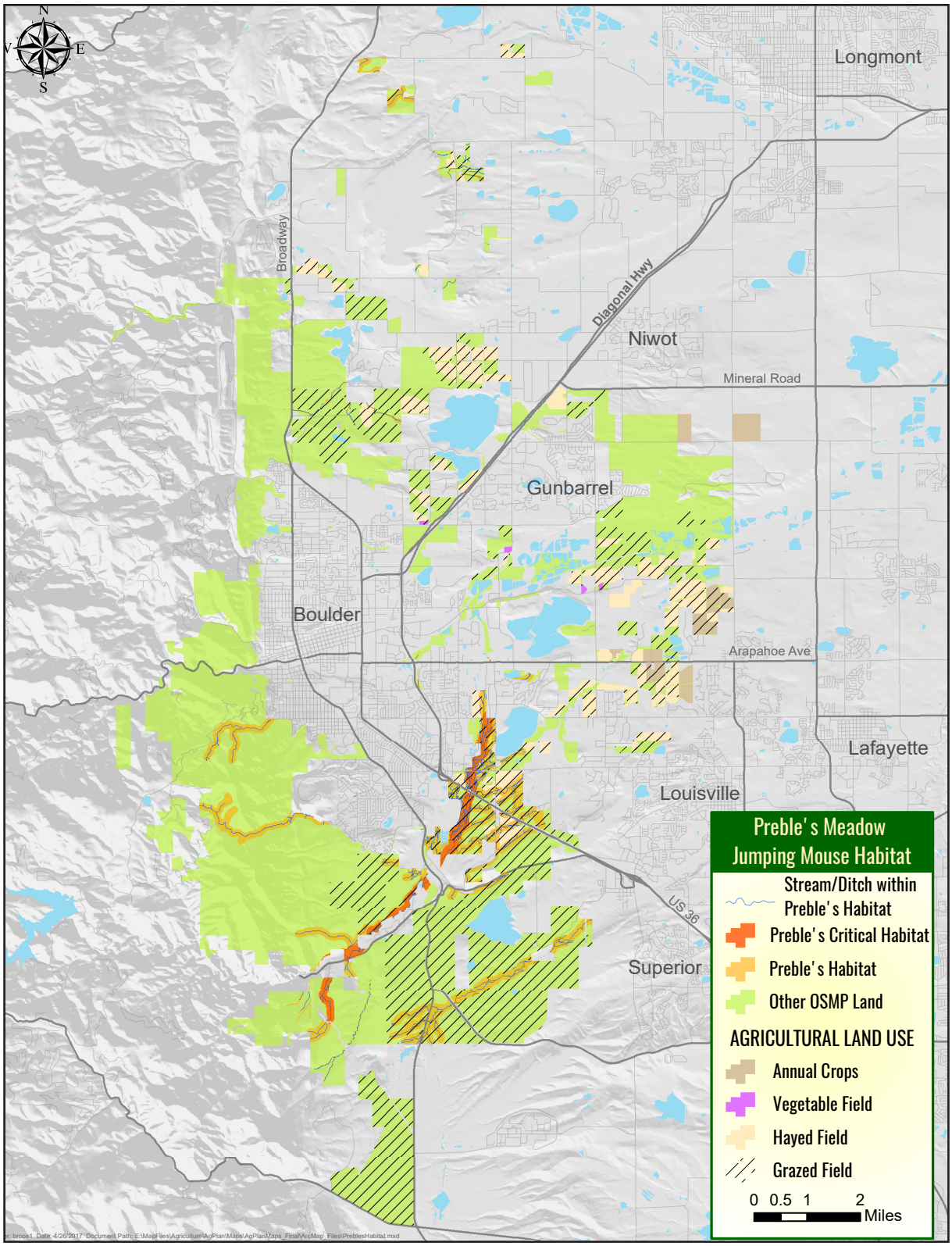
While water-delivery infrastructure and agricultural areas can support Preble's habitat, some maintenance activities associated with water delivery and agricultural operations can also adversely impact Preble's habitat (Figure 36). The removal of shrubs from ditches and ditch banks may remove hibernation habitat for the winter (August – May) and habitat used for nesting, resting and foraging during the active portion of the year (May - November). Ditch maintenance work completed during times of activity for Preble's may have direct impacts to the species. Thus, all work (not requiring removal of shrub roots) is done while the mice are hibernating, thus reducing the risk of impacting a mouse on the surface. Shrub removal including removal of roots during times of hibernation may result in mortality to hibernating mice. As a result, work that requires removal of root material from shrubs and trees is timed to avoid being done during the hibernation season whenever possible. Placement of spoils from ditch cleaning in shrub or other habitat areas may degrade or destroy Preble's habitat.

How Agriculture Impacts Preble's Habitat

| | |
|---|---|
| Ditch Maintenance | ·Removal of shrubs (habitat)<br>·Work during Preble's time of activity<br>·Ditch cleaning spoils placed in shrubs |
| Grazing | ·Shrub regeneration prevented<br>·Non-native pasture grasses are low quality habitat |

Figure 36

# Map 7: Preble's Meadow Jumping Mouse Habitat



# Preble's Meadow Jumping Mouse Habitat

## Existing Conditions

Often work can be completed on ditches that allows continued, efficient use of the water resource while minimizing potential impacts to Preble's mouse and its habitat. Staff work to ensure that ditch maintenance under the direction of OSMP is completed consistent with the BMPs as outlined in the 4(d) exemption detailed previously. This is accomplished by minimizing the vegetation removal to only what is necessary- often this can be managed by restricting vegetation removal only to that below the high water line of the ditch, rather than the top of the banks; managing access to reduce impact to adjacent shrub communities; working to avoid impacts that will affect hibernating mice during the winter, or active mice during the summer.

Many ditches on OSMP continue to provide high quality Preble's habitat while maintaining their functionality to carry water for agricultural use. Examples of this are evident throughout the South Boulder Creek floodplain where ditches are maintained vegetation free below the high water line, but substantial shrub communities exist on the ditch banks and outside the ditch where they do not impede water flow and provide valuable habitat.

Unmanaged grazing along riparian areas or ditches can also remove or reduce the quality of Preble's habitat. Shrub regeneration can be prevented by unmanaged grazing. Non-native pasture grasses that often dominate these areas are low quality habitat.

Grazing is managed by fencing riparian corridors in Preble's habitat. Approximately 73 percent of riparian corridors in Preble's habitat on OSMP properties (approximately 60 percent within Federally Designated Critical Habitat) are fenced and currently exclude cattle except for water gaps[7] or prescriptive grazing. These fenced areas along sections of South Boulder Creek and along ditches and irrigated fields in its floodplain support large populations of Preble's. Conversely, unfenced sections of South Boulder Creek in Federally Designated Critical Habitat where grazing had prevented shrub growth did not support Preble's when surveyed in 2014.

## Objectives

- **Integrate agricultural management practices that support and minimize adverse impacts to high quality Preble's habitat.**
- **Adhere to Federal regulations in agricultural operations to avoid "take" as defined under the Endangered Species Act, including working within stipulations of 4(d) rule for non-native species management and ditch management activities.**

## Management Strategies

**Increase outreach to and awareness of lessees and ditch operators surrounding the importance of ditch and stream habitat for Preble's, and applicable regulations and management practices.**

[7]Places where livestock are provided access to water along the creeks.

# Preble's Meadow Jumping Mouse Habitat

## Management Strategies

This includes the Endangered Species Act regulations, 4(d) exemptions, and BMPs to allow continued agricultural operations while minimizing habitat impacts.

Collaborate with ditch operators, lateral users and lessees to perform maintenance and activities in ways that minimize habitat impacts whenever possible.

**When applicable, evaluate strategies and partnerships with ditch companies to mitigate financial impacts associated with implementation of BMPs.**

**Adhere to BMPs and limitations included in the special rule 4(d) exemptions when maintaining water delivery infrastructure and ditches on OSMP.**

**Maintain existing fencing and examine opportunities for additional fencing or water gaps** to provide continuous high quality habitat and allow restoration of mature willow or other shrub regeneration in areas of low shrub cover along occupied stream corridors. Integrate consideration of ULTO habitat management and restoration when examining opportunities for additional fencing.

## Measures of Success

- Extent of high-quality Preble's habitat along ditches and creeks in occupied areas of the system.
- Adherence to Federal regulations in agricultural operations to avoid "take" as defined under the Endangered Species Act.
- Adherence to BMPs as outlined in 4(d) rule.
- Percent of riparian corridors fenced in Preble's habitat.

## Research Opportunities

- System-wide Preble's habitat characterization on agricultural lands and along ditches.
- Preble's surveys along ditch corridors.
- Evaluation of existing ditch maintenance practices to look for opportunities to improve protection of Preble's.

## Estimated Implementation Costs

- $$ for fencing, debris removal (instead of sidecasting), additional labor costs for BMP implementation and cost sharing initiatives with ditch companies to encourage compliance with BMPs.

Tamara Gorel

# Native Plant Propagation

## Existing Policy Guidance

General guidance surrounding the perpetuation and restoration of native plants as part of natural ecosystems can be found in the **City Charter, Grassland Plan, Forest Ecosystem Management Plan** and **Open Space LRMP.**

OSMP

## Existing Conditions

Other OSMP plans call for ecosystem restoration of disturbed areas. In addition, there are disturbances from a variety of unplanned events that occur on OSMP lands. In almost all cases, revegetation is needed for restoration. Revegetation typically requires seeds or starts of native vegetation.

The city, in partnership with BCPOS, currently purchases the seeds or starts and/or contracts out the propagation of native plant materials to several government and commercial operations; no restoration materials are currently propagated on OSMP lands. OSMP spent approximately $40,000 on seeds from 2013-2016. Currently, all seeds provided to OSMP are neonicotinoid-free. Unfortunately, the desired native species, especially the local genotypes of those species, are often unavailable and/or the propagation is cost prohibitive.

## Objectives

- **Establish a native plant propagation program to grow native plant materials for ecosystem restoration and other reclamation needs.**
- **Increase the availability of materials currently not commercially available or cost prohibitive for use by OSMP and potentially other landowners in the Boulder Valley.**
- **Make high-quality plant materials available that are neonicotinoid-free and locally adapted to conditions in the Boulder Valley.**

# Native Plant Propagation

## Management Strategies

### Identify BOAs for native plant propagation.

Figure 37 lists the evaluation criteria that will be used to evaluate sites for native plant propagation on OSMP lands. A single site with multiple fields as well as multiple sites will be considered.

Structures, such as hoophouses, may be desirable for starting plants from seed. The process of evaluating new structures is described in the Infrastructure-Structures section of the Agricultural Management chapter.

### Explore and pursue partnerships.

Collaborate with the newly formed Southern Rockies Seed Network and other partners to increase regional native plant propagation capacity and increase cost efficiencies. Evaluate the potential for partner specialization to decrease costs.

BOAs for Native Plant Propagation

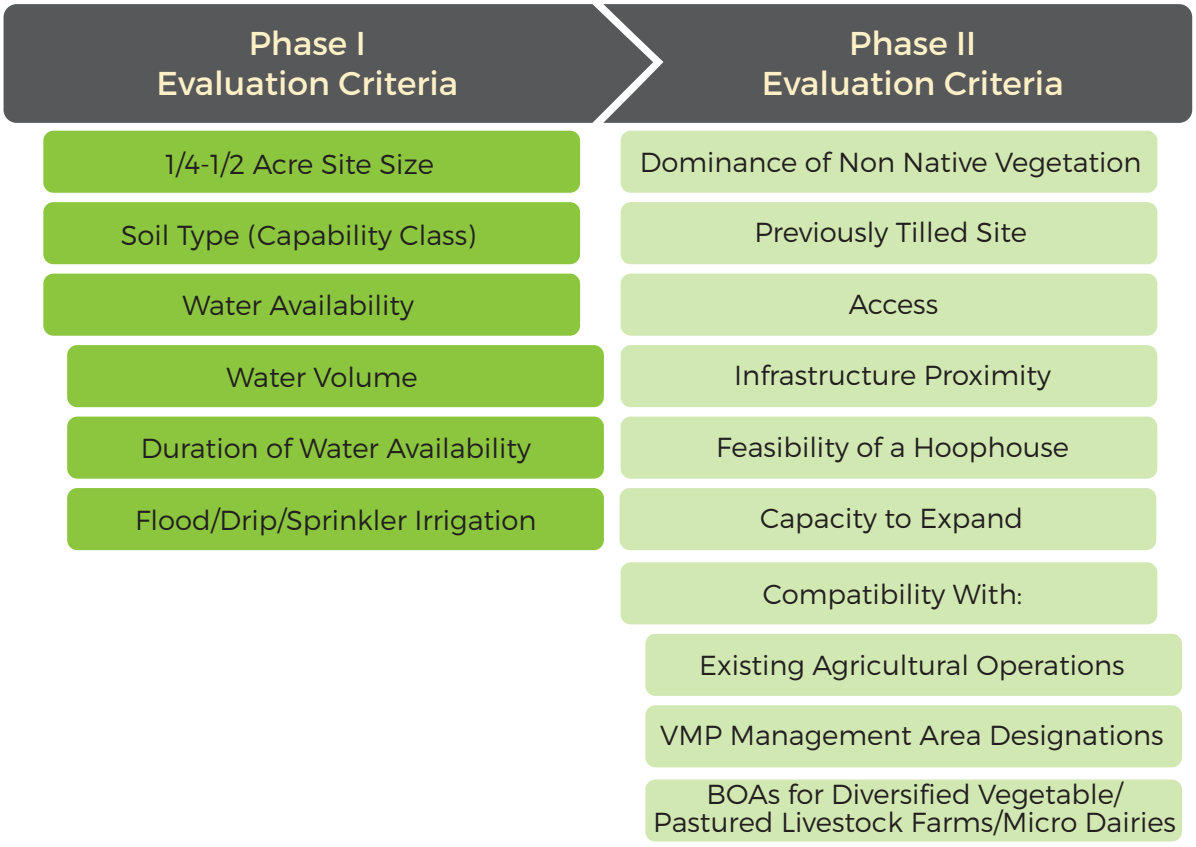



Figure 37

# Native Plant Propagation

## Measures of Success

- Increase of number of new plant species/local genotypes grown by OSMP-led propagation program (Species/local genotypes that aren't otherwise available).
- Total acres in native plant propagation.
- Increase in plant diversity of ecological restoration projects.
- Amount of native plant materials supplied to local governmental agencies and others.
- Amount of native plant materials provided by partners (e.g. Southern Rockies Seed Network).

## Research Opportunities

- Identification of BMPs for wild collection, storage and agricultural harvest methods as well as quantitative research on best production and harvest techniques.

## Estimated Implementation Costs

$-$$ - Field improvements/establishment
- Includes acquisition of infrastructure

Operations and maintenance
- $$ - Lessee or other contractor (if not undertaken by staff)

# Native Plant Propagation

Jeff Holland

# Pollinator Habitat

## Existing Policy Guidance

**City of Boulder IPM Policy**
Pesticides must be reduced or eliminated (See IPM Policy Guidance section of this plan).

**Resolution No. 1159 (Neonicotinoid Ordinance)**
The city will not apply neonicotinoid-active ingredients for any purpose on Open Space lands or along watersheds and ditches. With exceptions only being allowed under a rigorous and transparent exemption process for the application of neonicotinoids for the purposes of (1) a well-defined research study; or (2) when the life or health of a valuable or significant tree is threatened and neonicotinoid application is the least environmentally impactful option. The city encourages sourcing seeds and plants that have not been treated with neonicotinoids.

## Existing Conditions

Pollinators are responsible for fruit and seed production of 60 to 70 percent of flowering plants (Richards 1986). Many rare and sensitive plant species, including Ute ladies'-tresses orchid, a federally-listed plant species with significant populations on OSMP land, are largely dependent on native insects for pollination.

Information from a relatively recent study (2001-2005) on native bee diversity in the grasslands of Boulder County contributed to the conclusion that the bees of Boulder County have largely been conserved due to the large amount of preserved habitat (Kearns and Oliveras 2009a). The study recorded 110 different bee species which was close to the 116 different insect pollinators observed in 1907, with several species recorded that were not present in the 1907 observation.

In 2014 and 2015, volunteers participated in a pilot partnership between OSMP and the University of Colorado Museum of Natural History, monitoring 40 bee block houses at 30 trailheads from May-October. The data collected through the "Bee's Needs" program will provide much needed information about the abundance, diversity and biology of these insects in order to better understand nesting patterns in the context of the local landscape.

Nationwide, there has been extensive pollinator habitat loss due to urbanization and farming. Extensive monocultures in agricultural areas result in the loss of resources (e.g., water, pollen, nectar and nesting sites) necessary for pollinator survival (Kearns and Oliveras 2009b). Non-target effects of pesticide use, in both residential and agricultural areas, can also kill native pollinators.

During the summer, there is a lack of diversity in flowering species on non-native agricultural lands on OSMP lands. Grass hayfields have limited populations of forbs and the frequency of cutting does not allow for prolonged flowering. Herbicide use in commodity crops (e.g., corn, barley) to reduce agricultural weeds also eliminates flowering forb populations in these fields. To address this lack of plant diversity, OSMP restoration efforts center on planting native flowering plants into areas previously dominated by invasive monotypic plant stands.

# Pollinator Habitat

## Existing Conditions

Plant stock for these projects is sourced locally whenever possible (see Native Plant Propagation section of the plan).

To limit non-target effects of insecticide usage on native and honey bees, OSMP has adopted the BMPs shown in Figure 38.

### OSMP BMPs for Insecticide Application

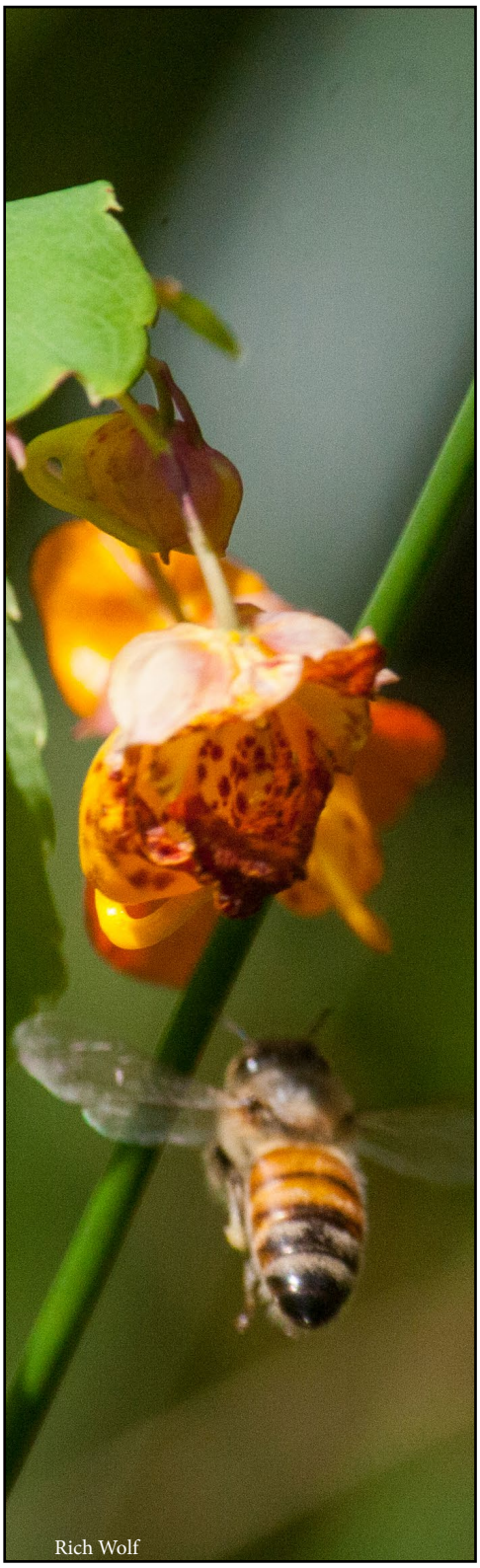
- Notification posted
- OSMP bee keepers notified
- Early morning or late evening application
- No application when flowers are blooming

Figure 38

Other efforts related to the preservation of pollinators or their habitat include a pollinator garden at the Teller South Trailhead and a native plant garden at the Chautauqua Ranger Cottage. Two OSMP lessees manage European honeybee colonies for honey production, also conferring pollination benefits.

Dave Sutherland

# Pollinator Habitat


Rich Wolf

## Objectives

- **Integrate/establish agricultural management practices that support native pollinators.**

## Management Strategies

**Establish pollinator-friendly habitat.**
Collaborate with lessees in the identification of potential pollinator habitat (Figure 39).

Contributors to Pollinator-Friendly Habitat

| |
|---|
| ·Lower-producing agricultural areas (due to slope, aspect, irrigation, soil quality) |
| ·Unirrigated corners of fields |
| ·Areas along irrigation ditches/laterals |
| ·Cropping and property buffers |
| ·Field edges |
| ·Areas where drifting pesticides present little risk |

Figure 39

**Explore adoption of no- and/or reduced-till practices since most pollinators are ground-nesting bees and tillage can destroy their nests.**

**Develop plant mixes based on hydrology, pedology, bloom season, ease of establishment and maintenance, and compatibility with existing farming practices.**

**Increase lessee and public understanding of pollinator habitat.**
Develop more education and outreach on the importance of pollinators and pollinator habitat conservation.

# Pollinator Habitat

## Measures of Success

- Native pollinator number and diversity.
  (Desired condition = increased number and diversity)
- Proportion of agricultural fields with established pollinator habitat.
  (Desired condition = increase in habitat)

## Research Opportunities

- Density and diversity of ground nesting bees in hayfields.
- Determine prevalence/incidence of Colony Collapse Disorder on OSMP.
- Comparison of bee populations across a gradient of grassland habitat quality.
- Population dynamics of native bees/pollinators on OSMP.
- Best ways of establishing and maintaining pollinator strips:
  -Along irrigation laterals
  -Into brome and other competitive, perennial vegetation
  -In unirrigated sections
- Best species mixes for season-long nectar source.
- Additional benefits of pollinator strip establishment (regarding beneficial insect insectaries).
- Investigate relationship between agriculture and native butterfly and skipper habitat.

## Estimated Implementation Costs

- $$ - pollinator strip establishment and maintenance, cost-share on reduced-risk chemicals.

# Prairie Dog Habitat

## Existing Policy Guidance

**Grassland Plan**
Provides guidance for conservation and management of black-tailed prairie dogs including management designations of prairie dog colonies, criteria for relocation and strategies to address conflicts with agricultural use.

***Prairie Dog Management Areas***
Grassland Preserves are areas where prairie dogs and their associated species are part of large ecologically diverse grassland habitat blocks. These areas are considered the best opportunities to conserve prairie dogs and their associated species. In most cases, prairie dogs will be allowed to persist without removal. However, removal will be allowed for the purposes of maintaining existing irrigation facilities (e.g. headgates, ditches, laterals, reservoirs, irrigated fields). The need for limited removal will be assessed if prairie dogs occupy more than 26 percent of the Grassland Preserve and indicators of vegetation composition fall below the established thresholds. Inactive, previously occupied colonies could serve as relocation receiving sites if the area meets the relocation criteria. Prairie dogs will not be relocated into irrigated fields.

Prairie Dog Conservation Areas are areas where the conservation of the prairie dog is the primary management objective and are managed opportunistically for associated species. Prairie dogs will be allowed to persist without removal except for the purposes of maintaining existing irrigation facilities. These areas would serve as receiving sites for relocation, except into irrigated fields.

Multiple Objective Areas are areas where the preservation of prairie dogs and their associated species is one of several management objectives. Prairie dogs will be allowed to persist without removal except for the purposes of maintaining existing irrigation facilities. Multiple Objective Areas will not be used as receiving sites for relocation. Exclusion of prairie dogs attempting to re-colonize could occur in order to pursue other objectives.

Transition Areas are areas where other objectives or resources rather than the prairie dog and associated community take precedence. Prairie dogs may inhabit transition areas, but will be relocated when a relocation receiving site is available. Following relocation or die-off, re-colonization could be prevented or discouraged using barriers, re-seeding, grading and/or burrow destruction. Removal would be allowed at any time for maintenance of existing irrigation facilities. Continued irrigation will also be allowed in irrigated fields regardless of prairie dog occupancy.

Removal Areas are areas where prairie dogs are incompatible with OSMP management objectives. Prairie dogs will be relocated when a relocation site is available. Following removal, efforts will occur to prevent re-colonization including restoration or irrigation, destruction of burrow system and exclusion of structures. Continued irrigation will be allowed in irrigated fields regardless of prairie dog occupancy.

# Prairie Dog Habitat

## Existing Conditions

In 2015, 685 acres of occupied prairie dog habitat were designated as removal or transition areas (Map 8), 315 (46 percent) of which are irrigated agricultural lands. Approximately 175 acres that could have otherwise been leased are not due to the limitations on agricultural production resulting from prairie dog occupation.

Irrigated parcels with associated water rights are OSMP's best opportunity to support agricultural activities and make up approximately 20 percent of OSMP land. The most widespread impacts from prairie dog occupation on irrigated lands are reduced agricultural productivity and changes to the type of agricultural use. The typical transformation can be described as follows: Initially, irrigated hayfields are switched to irrigated grazing land as prairie dog occupation makes the operation of haying equipment difficult or impossible. As populations increase and the area of prairie dog occupation increases, irrigation becomes too difficult or impossible. If prairie dogs fully occupy an irrigated field there is typically no benefit to continue agricultural operations and the property is taken out of agricultural production and often removed from the agricultural lease program.

Tilled lands used for growing annual crops are also impacted. City regulations prohibit disturbance to occupied burrows, thereby precluding tilling and crop production. Agricultural activity is essentially stopped until the burrows are no longer occupied. Unless natural factors such as plague event cause prairie dogs to leave the area, relocation is required to resume annual cropping on the areas. In addition, prairie dog burrows can cause hazardous conditions for cattle.

Lands removed from agricultural production and/or agricultural leases are a management challenge for the lessee and OSMP. These areas are highly susceptible to weed invasion, erosion and the soils can also become less productive and more difficult to restore because of the mixing of lower soil horizons with the topsoil that takes place as prairie dogs burrow.

In the five years following the approval of the Grassland Plan in 2010, prairie dogs occupying approximately 65 acres, including 12 agricultural acres, were relocated from designated transition and removal areas.

## Existing Policy Guidance

**City of Boulder Urban Wildlife Management Plan**
Establishes the framework for prairie dog management within the City of Boulder including strategies to limit the use of lethal control.

**City of Boulder Wildlife Protection Ordinance**
Sets requirements for land owners seeking to use lethal control to manage prairie dogs as well as protecting active prairie dog burrows from disturbance or destruction.

**Prairie Dog Working Group**
An advisory group is currently working on developing consensus based recommendations on the city's prairie dog management effort. The prairie dog working group will make recommendations regarding management of prairie dogs and their habitats on city managed public lands.

Perry Conway

# Prairie Dog Habitat

## Existing Conditions

Despite approximately 4,000 acres being designated to receive prairie dogs, the availability of receiving sites is limited for a number of reasons (Figure 40). These include high levels of occupation of potential receiving sites, degraded vegetative conditions on these sites, slow revegetation (several years) following occupation and the presence of plague. In addition to biological conditions, there has been a lack of neighbor support, which has prevented OSMP staff from acquiring the state permit necessary for relocation and direction to address relocation of prairie dogs from non-OSMP properties.

There are also challenges associated with restoring a property to conditions suitable to support agricultural activities after long-term prairie dog occupation. The efforts needed to restore a property post occupation are directly correlated to the density of prairie dogs and the length of time the site was occupied with some sites likely permanently degraded. However, all sites require either grading or tilling the field to level the mounds of soil created by burrowing activities. Sites that have been occupied at low densities and/or for short periods of time can usually adequately recover by flattening burrow mounds or returning irrigation to the site. Seeding can shorten the recovery period. Densely occupied sites and/or sites that have been long occupied will generally require tilling, some form of contour leveling to accommodate surface irrigation, and potentially the reconstruction of irrigation laterals. Due to soil loss from vegetation loss and wind erosion and the mixing of soil from lower soil horizons from burrowing activities, rebuilding soil organic matter through soil amendments or cover cropping may be required. Current staff capacity often limits OSMP's ability to undertake such restoration before prairie dogs reoccupy a site.

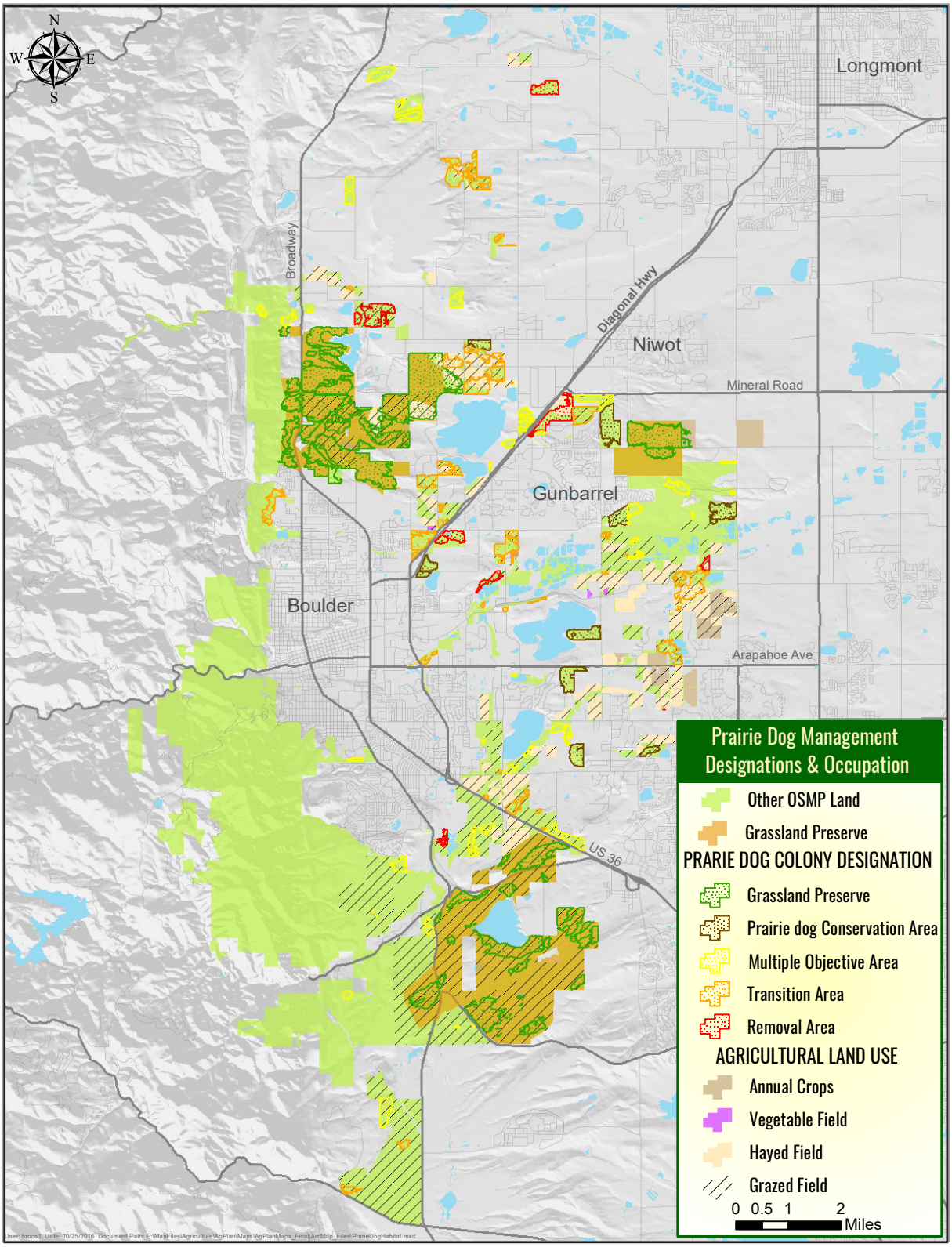
In 2015, according to the Grassland Plan's indicator for assessing prairie dogs and associated species, the percent of occupied land in Grassland Preserves, Multiple Objective Areas or Prairie Dog Conservation Areas indicated a "Good" ranking. However, as indicated above, almost 685 acres in Transition and Removal Areas are currently occupied by prairie dogs.

Reasons for Limited Relocation Opportunities

- High prairie dog occupation of receiving sites
- Slow recovery of vegetation following long term occupation/plague
- State permitting requirement of neighbor support
- Accomodating other city relocation requests
- Accomodating other private property relocation requests

Figure 40

# Map 8: Prairie Dog Management Designations & Occupation



# Prairie Dog Habitat

## Objectives

- **Decrease impacts to agricultural production from prairie dog occupation.**

## Management Strategies

**Evaluate options to better manage prairie dogs and agricultural conflicts.**

Evaluate a range of strategies beginning with those available within the existing policy framework that can be implemented in the short-term. Consider long range strategies that would require policy changes as later actions (Figure 41).

### Prairie Dog and Agricultural Conflict Management Strategies

| **Short Term:** Evaluate Options within Existing Policy | **Within 2 Years:** Evaluate Additional Options | **During City-Wide Effort to Evaluate Relocation:** Address CC Interest in Prairie Dog Protection | **Future Updates to Grassland Plan:** Consider Modifications |
|---|---|---|---|
| Re-apply Management Area Criteria to Agricultural Lands to Help Inform Prioritization | Innovative Solutions | Discuss Agricultural Production Needs | Habitat Suitability Modeling Re-Analysis |
| Rapid Response Restoration | Additional Prairie Dog Conservation Areas | Tours to Illustrate Agriculture and Prairie Dog Interface | Re-Examine Prairie Dog Conservation Area Criteria |
| Vegetation Recovery Strategies | | Establish Fee System | Vegetation Relocation Criteria Modifications |
| | | Citizen Work Group | Include Agricultural Prioritization Criteria |

Figure 41

# Prairie Dog Habitat

## Management Strategies

Strategies available for implementation within the existing policy framework include:

**Re-apply the prairie dog colony management area designation criteria to agricultural lands to help evaluate and prioritize properties for removal.**

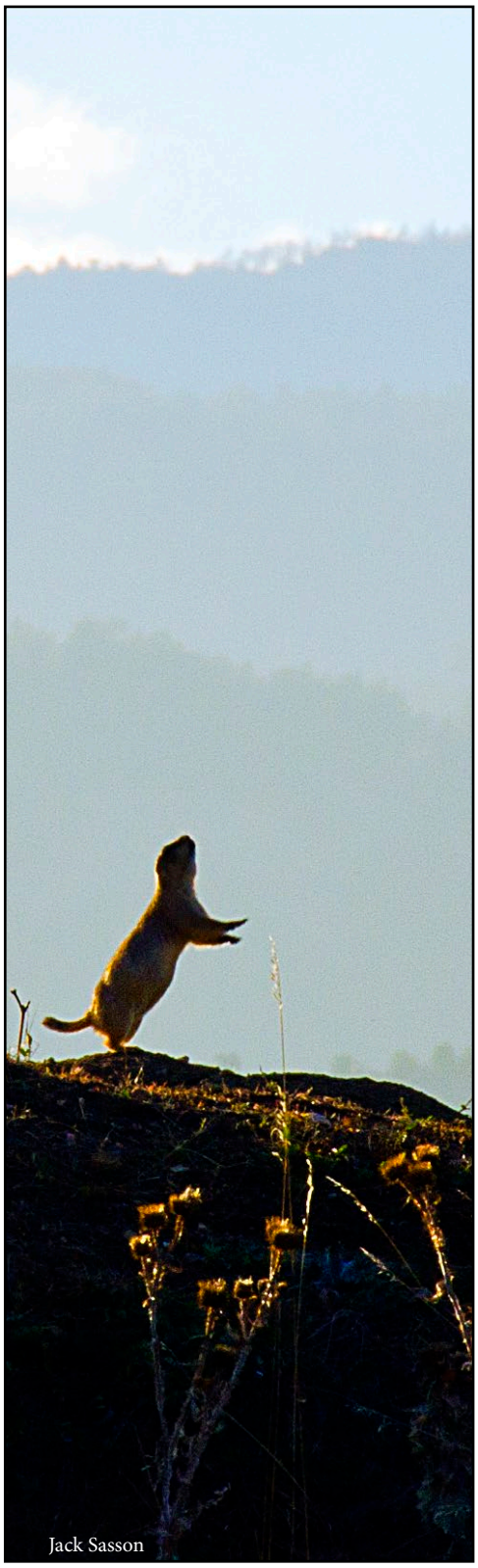
**Identify process for rapid response restoration and re-colonization prevention of agricultural properties when prairie dogs are removed, die off or are reduced in spatial extent.**

**Explore changes to grazing regimes, vegetation restoration and non-native vegetation management techniques to encourage faster recovery of vegetation in potential relocation sites.**

Additional strategies to investigate within the next two years include exploring other innovative solutions and re-applying the Grassland Plan criteria to identify additional Prairie Dog Conservation Areas that could potentially serve as relocation sites.

OSMP will continue to participate in city-wide prairie dog protection and relocation projects. OSMP will provide information describing the effects of prairie dogs upon agricultural production in conversations with the community, city-wide staff and decision makers. Staff will explore offering tours of agricultural properties affected by prairie dogs as a way to improve and broaden understanding of the situation.

In an update to the Grassland Plan, consider a re-analysis of habitat suitability modeling and a re-examination of the criteria for identifying Prairie Dog Conservation Areas, vegetation relocation, and for identifying transition and removal areas to focus management on highest priority or agricultural properties.



Jack Sasson

# Prairie Dog Habitat

## Partner Agency Prairie Dog Management on Agricultural Properties

In the Northern Front Range, the most closely analogous land management agency with agricultural lands and prairie dogs is BCPOS. Other similar agencies either do not have occupied prairie dog habitat, or do not manage their properties for agriculture.

BCPOS, similar to OSMP, manages for both the conservation of black-tailed prairie dogs and the preservation of working agricultural lands. Their prairie dog colony management designations include Habitat Conservation Areas, Multiple Objective Areas and No Prairie Dog Areas. Irrigated agriculture and dryland crops are generally identified as No Prairie Dog Areas. Grazed lands are generally designated as Habitat Conservation Areas or Multiple Objective Areas.

Similar to OSMP, changes to the cattle grazing regime are made as necessary in response to prairie dog occupation. In occupied No Prairie Dog Areas, BCPOS employs a number of management techniques including relocation when possible, lethal control involving capture and donation to wildlife programs (including raptor rehabilitation or black-footed ferret recovery), or in burrow lethal control. Lethal control may also be completed by lessees, with training from BCPOS.

Christian Nunes

# Prairie Dog Habitat

## Measures of Success

- Reduction in acres of prairie dog occupation in transition or removal areas. (Desired conditon = zero agricultural acres degraded by prairie dogs)
- Acres of transition or removal areas from which prairie dogs have been relocated.
- Acres of agriculturally managed land (or previously agriculturally managed land) restored following occupation by prairie dogs.
- Other measures of success related to prairie dog conservation are established in the Grassland Plan and include:
  - Percent of occupied land in Grassland Preserves, Multiple Objective Areas or Prairie Dog Conservation Areas. (Desired condition = 70-85 percent)
  - Grassland Preserves with occupancy between 10-26 percent
  - Number of prairie dog colonies with successful nesting attempts by burrowing owls. (Desired condition = 3-4 colonies)
  - Percent of colonies with territorial horned larks. (Desired condition = 50-75 percent)
  - Predator community composition/abundance. (Desired condition = at least one generalist predator species present at 50 percent of colonies and at least one sensitive predator species present on 25 percent of colonies and breeding by either badger, ferruginous hawks or northern harrier)
  - Acres of active prairie dog colonies. (Desired condition = 800-3,137 acres)

## Research Opportunities

- Investigate innovative solutions to prairie dog management such as:
  - Containment or exclusion technology.
  - Agricultural production techniques that can be done in the presence of prairie dogs.
  - Restoration following prairie dog occupation.
  - Evaluation of opportunities for OSMP lands to contribute to the recovery of black-footed ferrets.

## Estimated Implementation Costs

- $$$-$$$$$ Removal and restoration

# Grazing in Native Grasslands

## Existing Policy Guidance

The **Grassland Plan** establishes OSMP's conservation goals and measures of success for native grasslands. The Grassland Plan calls for enhancing OSMP's prescribed grazing program through improvements to fencing, livestock watering facilities, stocking rate and seasonal use adjustments, as well as the establishment of one or more grass banks. Additional information about the Grassland Plan's specific guidance can be found under "Measures of Success" within this section of this plan.

## Existing Conditions

Native grasslands play an important role in the preservation of agricultural activities, specifically ranching or livestock operations. Grazing occurs on approximately 13,500 acres including both native and semi-native grasslands and irrigated fields (Map 9).

Prescriptive grazing is used for invasive species management and as an alternative management practice to herbicides or other more labor-intensive management. On native grasslands, grazing strategies have been developed to improve the vegetation community composition. Grazing has been particularly beneficial in mesic tallgrass vegetation communities for the control of introduced pasture grasses that can otherwise dominate.

The Grassland Plan provides guidance on the desired native grassland conditions. According to the standards outlined in the Grassland Plan, OSMP grasslands are currently in "fair" to "good" condition (Figure 42). While grazing and agricultural management contribute to these conditions, there are additional factors.

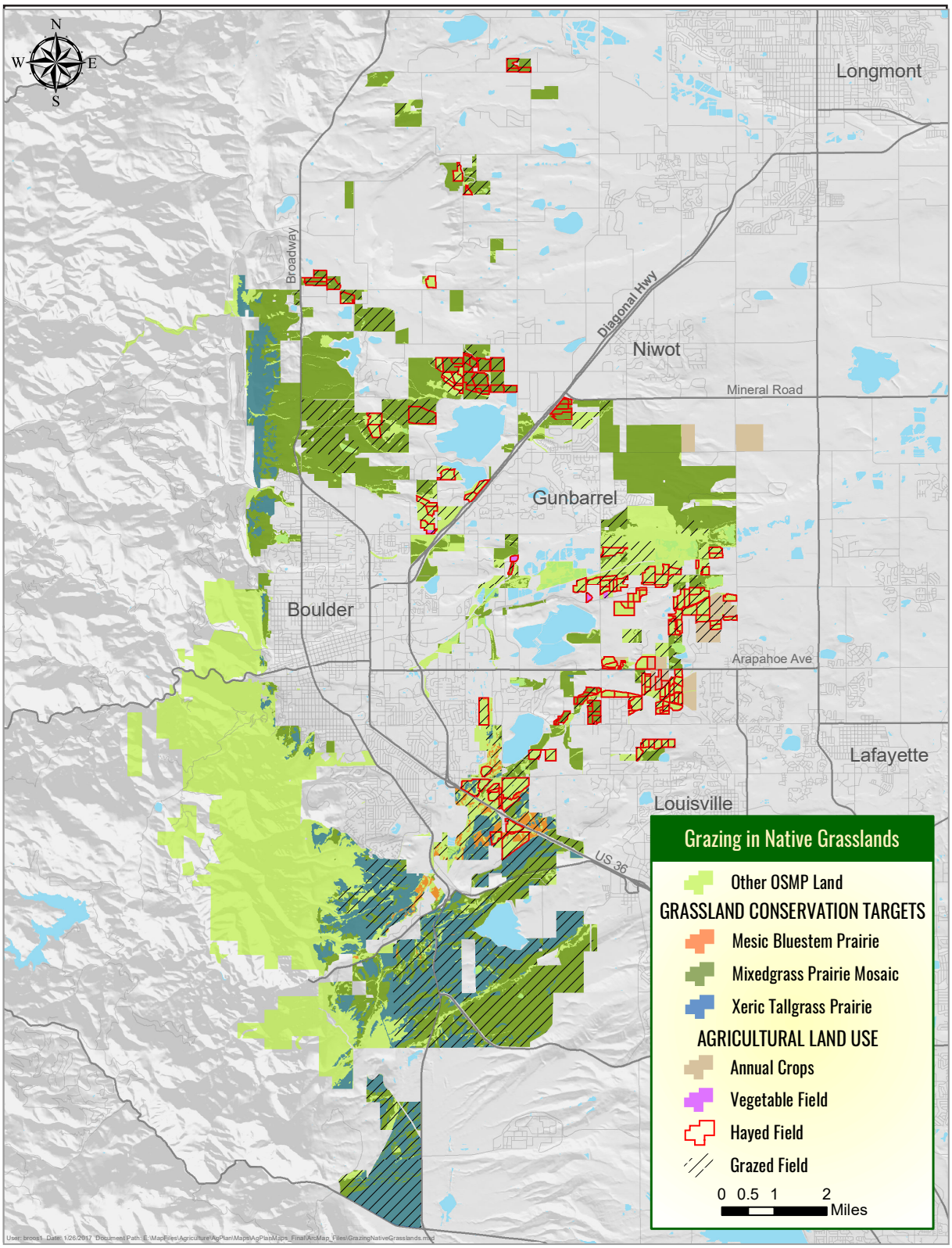
Current Grassland Conditions

| Grassland Type | Overall Rating |
|---|---|
| Mixedgrass Prairie Mosaic | Fair |
| Xeric Tallgrass Prairie | Good |
| Mesic Bluestem Prairie | Fair |

Figure 42

The Grassland Plan also provides guidance on grassland nesting bird conservation targets. The Grassland Plan bird conservation score is currently rated as "fair." Recent data shows there is a greater grassland bird conservation score in leased grasslands than in unleased grasslands, indicating that existing grazing practices are generally compatible with grassland bird conservation.

# Map 9: Grazing in Native Grasslands



# Grazing in Native Grasslands

## Objectives

- **Support livestock grazing on native grasslands that supports achieving Grassland Plan management objectives (on leased and unleased lands).**

## Management Strategies

**Continue the practice of incorporating native grasslands in agricultural leases as appropriate to support livestock grazing operations.**
Develop annual or multi-year grazing plans informed by current and desired future conditions of native grasslands.

**Prescriptively graze some unleased native grasslands.**
Identify unleased lands that could be prescriptively grazed to reduce forage demand on leased lands, thereby allowing for strategic rest or destocking in times of drought.

**Develop a grazing condition assessment and procedure to evaluate the condition of grazed fields and inform grazing plans and infrastructure development.**
Grazing condition assessments will serve as an indicator of the effects of grazing on native grasslands and provide early warning of the need for grazing management changes. These changes may include modifying the timing and duration of grazing or infrastructure changes or improvements to enhance livestock distribution. The Grassland Plan monitoring indicators and standards for mixedgrass prairie mosaic, xeric tallgrass and mesic bluestem prairie as well as grassland bird habitat conditions will be linked to the grazing condition assessment.

**Create and maintain an agricultural database and information management system to accurately monitor and manage livestock grazing timing and locations.**
Knowing the number of animals, timing and duration of grazing activities are necessary to inform adjustments to grazing plans.

**Maintain and/or improve agricultural infrastructure to enhance the prescribed grazing program and assist meeting native grassland management objectives.**
This strategy includes making improvements or re-alignments to fencing as well as re-locating or improving livestock watering facilities. Such improvements may include escape ramps on livestock tanks to reduce accidental mortality of birds.

**Evaluate compost applications to grazed grasslands and holistic range management for their potential to improve native grasslands and to help grasslands adapt to climate changes.**

# Grazing in Native Grasslands

## Management Strategies

**Evaluate and develop drought management strategies (e.g. identification of grass banks), and destocking guidelines for native grasslands included in agricultural leases (Figure 43).**

Possible Drought Management Strategies

| Drought Rating | Possible Management Strategies |
|---|---|
| "Abnormally dry" - early warning indicator | ·Begin location specific/site planning for drought conditions with lessees |
| "Moderate" or "Severe" | ·Use irrigated pastures or convert hayfields to pasture<br>·Early weaning (if age appropriate)<br>·Evaluate number of replacement stock<br>·Strategic culling of livestock based on age or productivity |

Figure 43

## Measures of Success

- Proportion of native grassland parcels that have adequate infrastructure maintained in "good" condition to support prescriptive grazing.
- Percent of rangeland in "good' condition as identified by the grazing condition assessments. ("Good" condition to be defined during assessment protocol development.)
- Percent of grazed native grasslands that meet the Grassland Plan vegetation composition and structure and animal species composition desired "good" rating:
  - Mixedgrass Prairie Mosaic Vegetation Composition
    - Native species relative cover- at least 75 percent of the samples have a native relative cover ≥ 86 percent for the Western Wheatgrass Herbaceous Alliance and 88 percent for the Needle-and-Thread/Blue Grama Herbaceous Alliance.
    - Native species richness - at least 75 percent of the samples have a native species richness ≥ 33 for the Needle-and-Thread/Blue Grama Herbaceous Alliance and 31 for the Western Wheatgrass Herbaceous Alliance
    - Non-native species – 1-<3 percent domination by non-native species, 3- <9 percent prevalence of non-native species
    - Richness of selected conservative plant species – At least 75 percent of samples >17
    - Size of Bell's twinpod populations – 100 percent of sub-occurrences are stable or increasing in area and/or number of individuals
  - Mixedgrass Prairie Mosaic Vegetation Structure
    - Absolute cover bare ground – Needle-and-Thread/Blue Grama Herbaceous Alliance at least 75 percent of samples ≤25 percent and >10 percent; Western Wheatgrass Herbaceous Alliance at least 75 percent of samples ≤10 percent

# Grazing in Native Grasslands

## Measures of Success

- Mixedgrass Prairie Mosaic Animal Species Composition
  - Percent occurrence of Colorado Natural Heritage Program (CNHP)-tracked grassland dependent butterflies and skipper species – 10-25 percent
  - Percent occurrence of grassland dependent butterflies and skipper species – 51-75 percent
  - Percent of target with acceptable bird conservation score – at least 75 percent of transects with a derived score of 3.9
- Xeric Tallgrass Prairie Vegetation Composition
  - Native species relative cover – at least 75 percent of samples have a Native Relative Cover >90 percent
  - Native species richness – at least 75 percent of samples have a native species richness ≥22
  - Non-native species – 1-<3 percent domination by non-native species, 3- <9 percent prevalence of non-native species
  - Richness of selected conservative plant species – at least 75 percent of samples >12
  - Size of dwarf leadplant populations – 90 – 99 percent of sub-occurrences are stable or increasing in areal extent and/or number of individuals
  - Size of grassyslope sedge populations –100 percent of occurrences are stable or increasing in areal extent and/or stem density
  - Size of Prairie violet/bird's foot violet populations – 90 – 99 percent of sub-occurrences are stable or increasing in areal extent and/or number of individuals
- Xeric Tallgrass Vegetation Structure
  - Absolute cover bare ground – at least 75 percent of samples <26 percent
- Xeric Tallgrass Animal Species Composition
  - Percent occurrence of CNHP-tracked grassland dependent butterflies and skipper species – 10-25 percent
  - Percent occurrence of grassland dependent butterflies and skipper species – 51-75 percent
  - Percent of target with acceptable bird conservation score – at least 75 percent of transects with a derived score of 3.9
  - Relative cover of host plants for skipper/butterfly species of concern (big bluestem and little bluestem) – at least 75 percent of samples ≥ 8
- Mesic Bluestem Prairie Vegetation Composition
  - Native species relative cover – at least 75 percent of samples have a Native Relative Cover >85 percent
  - Native species richness – at least 75 percent of samples >23
  - Non-native species – 1-<3 percent domination by non-native species, 3- <9 percent prevalence of non-native species
  - Presence of populations of Ute ladies'-tresses orchid
  - Richness of selected conservative plant species – at least 75 percent of samples >11

# Grazing in Native Grasslands

## Measures of Success

- Mesic Bluestem Prairie Vegetation Structure
  - Absolute cover bare ground – at least 75 percent of samples <13 percent
- Mesic Bluestem Prairie Animal Species Composition
  - Percent occurrence of CNHP-tracked grassland dependent butterflies and skipper species – 10-25 percent
  - Percent occurrence of grassland dependent butterflies and skipper species – 51-75 percent
  - Relative cover of host plants for skipper/butterfly species of concern (big bluestem and little bluestem) – at least 75 percent of samples ≥ 8 percent
  - Species richness of sensitive breeding birds – successful breeding by all indicator species

## Research Opportunities

- Better understand how existing grazing practices affect grassland bird and butterfly habitat conditions. Staff has recently established visual obstruction transects and is collecting data on vegetation height and density in native grasslands. These measurements will allow staff to better evaluate habitat conditions for grassland birds.

- Better understand how controlled burns with prescriptive grazing can be effective in managing vegetation.

## Estimated Implementation Costs

- $$$$ to construct and/or repair fencing and livestock watering infrastructure.

Phil Yates

# Riparian Areas - Creeks

## Existing Policy Guidance

***Federal***
The **Clean Water Act (CWA)** provides federal protection to creeks and some riparian areas.

***State***
**Colorado Water Law** includes an in-stream flow program to support and protect creeks and riparian areas by dedicating water rights to maintain in-stream flow.

***Local***
**BCCP** specifically designates Riparian Areas as an environmental resource to be protected. General policies articulated in the BCCP direct the county to formulate plans and regulations to protect environmental resources (ER 1.01) and work with federal, state, municipal and other public or quasi-public entities that have a jurisdictional or property interest in unincorporated lands within or surrounding any designated environmental resources to achieve their protection (ER 1.06).

**City Charter ARTICLE XII. OPEN SPACE**
Sec. 176 Open Space Purposes – Open space land
- Preservation of water resources in their natural or traditional state, scenic areas or vistas, wildlife habitats, or fragile ecosystems.

**BVCP** recognizes the importance and value of riparian areas and directs the city and county to continue to develop programs to protect and enhance wetlands and riparian areas in the Boulder Valley with the city striving for no net loss of wetlands and riparian areas by discouraging their destruction or requiring the creation and restoration of wetland and riparian areas in the rare cases when development is permitted and the filling of wetlands or destruction of riparian areas cannot be avoided. The BVCP also states that comprehensive planning and management of floodplain lands will promote the preservation of natural and beneficial functions of floodplains whenever possible.

**City of Boulder and Boulder County administer floodplain protection programs** to comply with federal laws.

**City of Boulder Stream, Wetland and Water Body Ordinance** regulates specific activities in creeks and riparian areas that could lead to the impairment or loss of the creek or riparian area. The Ordinance contains some exemptions for continuing agricultural practices (harvesting of hay, pasturing of livestock).

The **Grassland Plan** provides specific objectives and strategies to conserve riparian areas on OSMP-managed land.

# Riparian Areas- Creeks

## Existing Conditions

OSMP lands support approximately 1,500 acres of riparian habitat (Map 10). Historically, most of the riparian areas in the Boulder Valley lay along the floodplains of the larger creeks—Boulder Creek, South Boulder Creek and Coal Creek. Currently, riparian areas outside of floodplains are also often associated with agricultural irrigation ditches, which have increased the total length and connectivity of riparian corridors.

Agricultural management of the landscape has both enhanced and impaired the condition of riparian areas (Figures 44 and 45). Prescriptive grazing is used to improve the riparian vegetative composition and help manage non-native vegetation. On the other hand, riparian areas can be impaired by the agricultural practice of diverting water from creeks which alters the hydrologic regime that many riparian species depend on. OSMP mitigates the effects of grazing in riparian areas by fencing, excluding cattle except for water gaps and prescriptive grazing. Approximately 36 percent of creeks with surrounding agricultural use are fenced.

### How Agriculture Enhances Riparian Areas

| | |
|---|---|
| Ditches | ·Increase length of riparian corridors<br>·Increase connectivity |
| Flood Irrigated Fields | ·Enhance adjacent wetlands |
| Prescriptive Grazing | ·Improves vegetative composition |

Figure 44

### How Agriculture Impacts Riparian Areas

| | |
|---|---|
| Ditches | ·Divert water from creeks which alters hydrologic regime |
| Grazing | ·Unfenced/unmanaged grazing impacts vegetative composition and stream bank stability |

Figure 45

# Riparian Areas - Creeks

## Existing Conditions

The Grassland Plan assessed the condition of riparian areas on OSMP lands as "poor" because indicators of plant and animal composition (species), habitat structure, connectivity and hydrologic regime were estimated to fall outside the acceptable range of variability in the plan (Figure 46). However, there are a variety of major contributing factors such as gravel mining, road construction, and development, as well as flood management and water development projects. Data collected since the development of the Grassland Plan suggests that adjustments in agricultural operations have improved the condition of OSMP's riparian areas. Additional fencing has improved the condition of vegetation composition, animal composition and habitat structure of riparian areas. Adjustments to agricultural irrigation can benefit stream flows, that provide habitat for fish and aquatic macroinvertebrates.

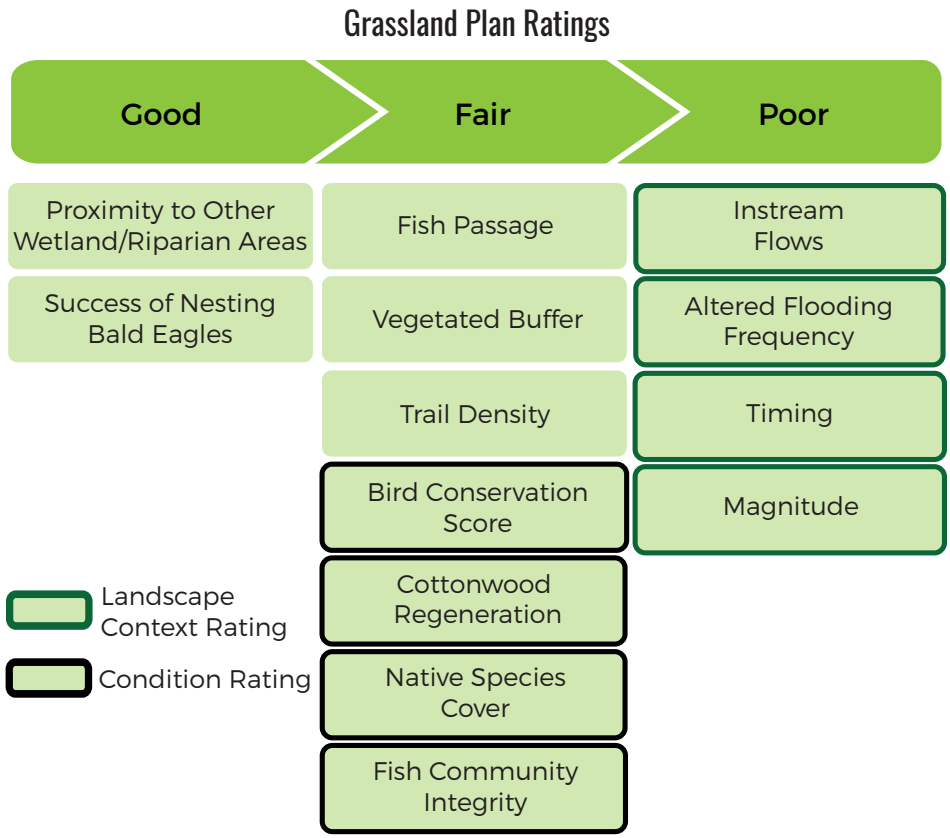
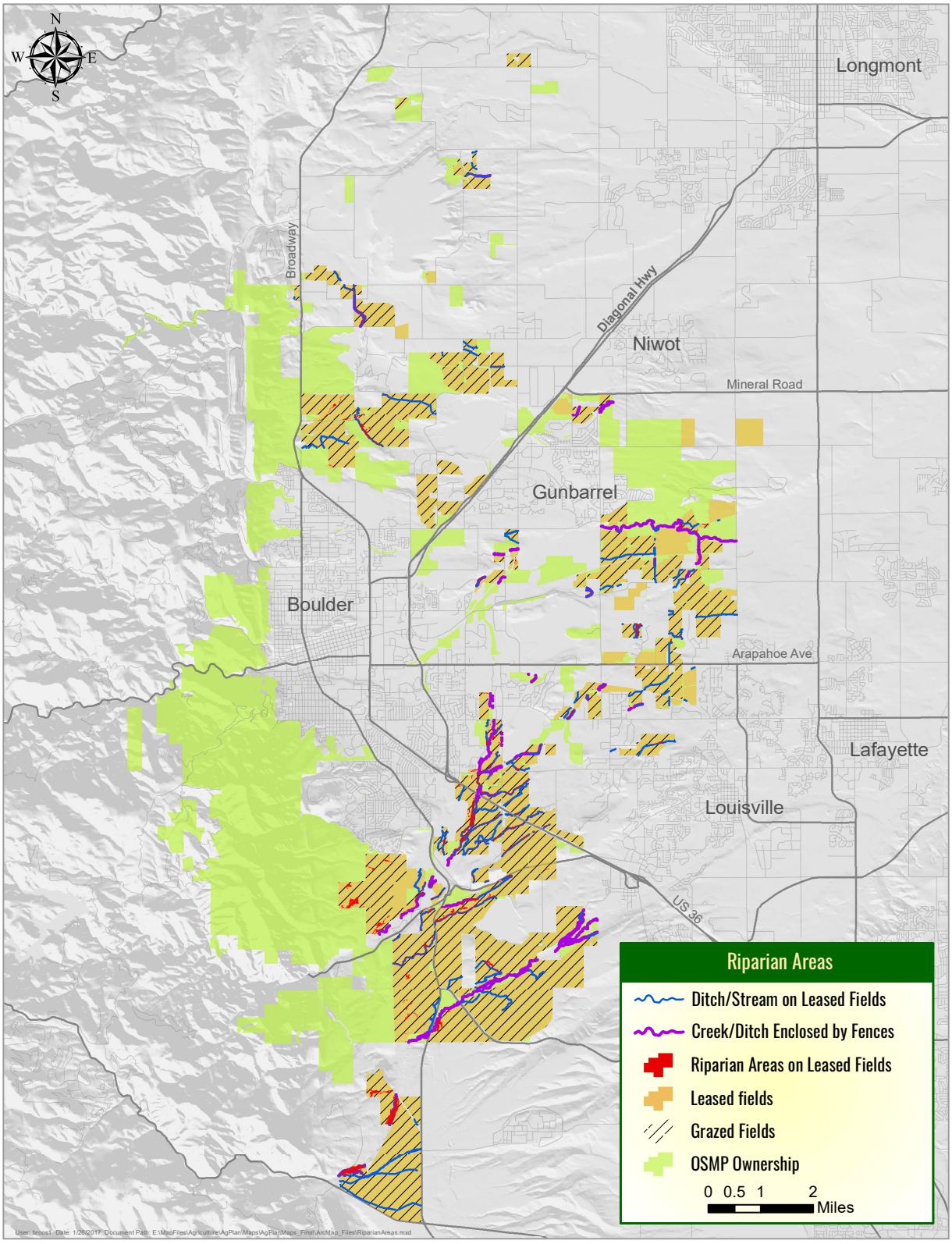



Figure 46

# Map 10: Riparian Areas



# Riparian Areas - Creeks

## Objectives

- **Integrate agricultural management practices to support and improve riparian hydrology. Restore riparian hydrology to a more natural flow regime to the extent practicable. A more natural flow regime would consider the frequency, timing and magnitude of creek discharge.**
- **Integrate agricultural management practices to support and improve riparian habitat.**

## Management Strategies

**Evaluate modifications to the timing and quantity of agricultural water use (Figure 47).**

Agricultural Water Use Evaluation Considerations

- Existing water rights and their transferability
- Water rights owners and their agricultural operations
- Quality and functionality of riparian area to be supported by proposed improvement

Figure 47

**Evaluate modifications to grazing management to support and restore riparian corridors (Figure 48).**

Grazing Management Evaluation Considerations

- Maintaining existing fencing and examining opportunities for additional fencing or water gaps
- Developing prescriptive grazing recommendations for fenced areas
- Increasing buffer zones around creeks to minimize agricultural runoff
- Alternative water sources for livestock

Figure 48

**Address impediments to fish passage at irrigation ditch diversion points (Figure 49).**

Fish Passage Options

- Engineered options such as sculpted concrete fish ladder
- Bioengineered options such as cross vanes and constructed riffles
- Options that use engineered and bioengineered components

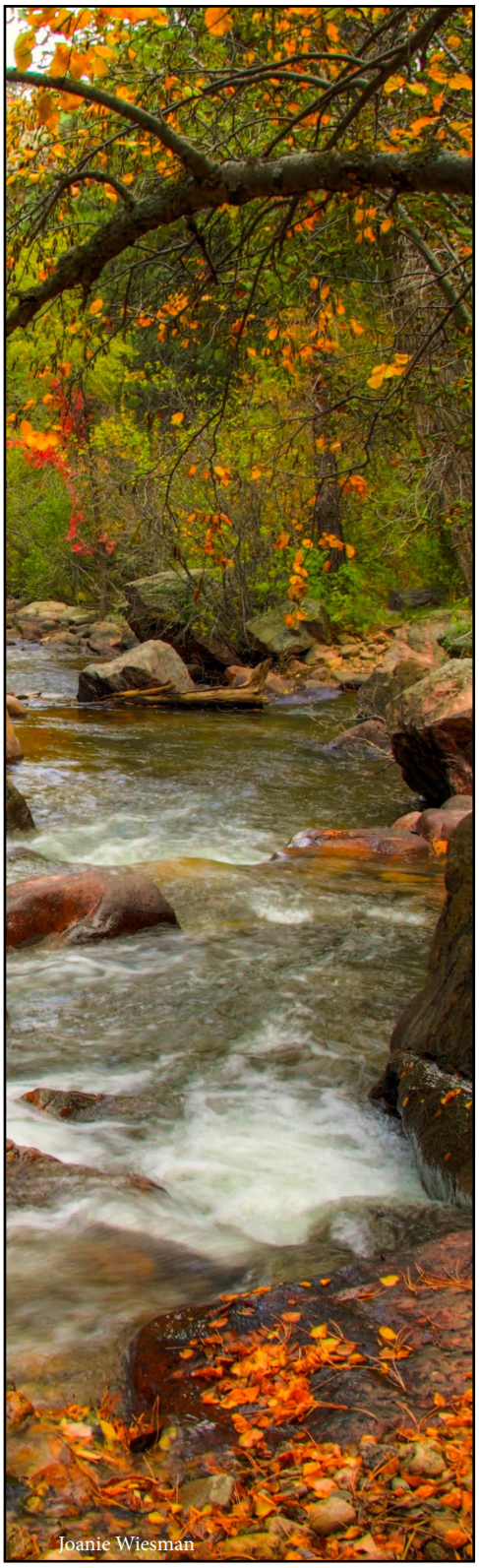
Figure 49

**Identify and obtain or transfer existing agricultural water rights for instream flow.**

# Riparian Areas - Creeks

Heather Diamond Ryan

# Riparian Areas - Creeks


Joanie Wiesman

## Measures of Success

The measures of success for riparian areas- creeks are established in the Grassland Plan.

- Native plant species cover (at least 75 percent of riparian areas exhibit a relative cover of native species > 67 percent)
- Percent of wetland acreage dominated by non-native species (< 3 percent of riparian acreage dominated by non-native species)
- Percent of wetland acreage with prevalence of non-native species (< 9 percent of wetland acreage with prevalence of non-native species)
- Cottonwood regeneration (at least 50 percent of recruitment sites have cottonwood seedlings)
- Distance to nearest wetland or riparian area (at least 75 percent of wetland/riparian complexes are < 200 m from the nearest wetland/riparian complex)
- Impediments to fish passage (no impediments to fish passage)
- Instream flows (standard varies by creek – see Grassland Plan)
- Fish index of biotic integrity (IBI) (75 percent of sites have a IBI score > 44)
- Macroinvertebrate IBI (75 percent of sites have a IBI score > 50)
- Percent of target with acceptable bird conservation score (at least 75 percent of target with a derived score >19)
- Physical instream and riparian habitat (75 percent of sites have an average score > 10)
- Creek dimensions, plan, and profile (at least 75 percent of the length of creeks match reference conditions as determined by regional curves)

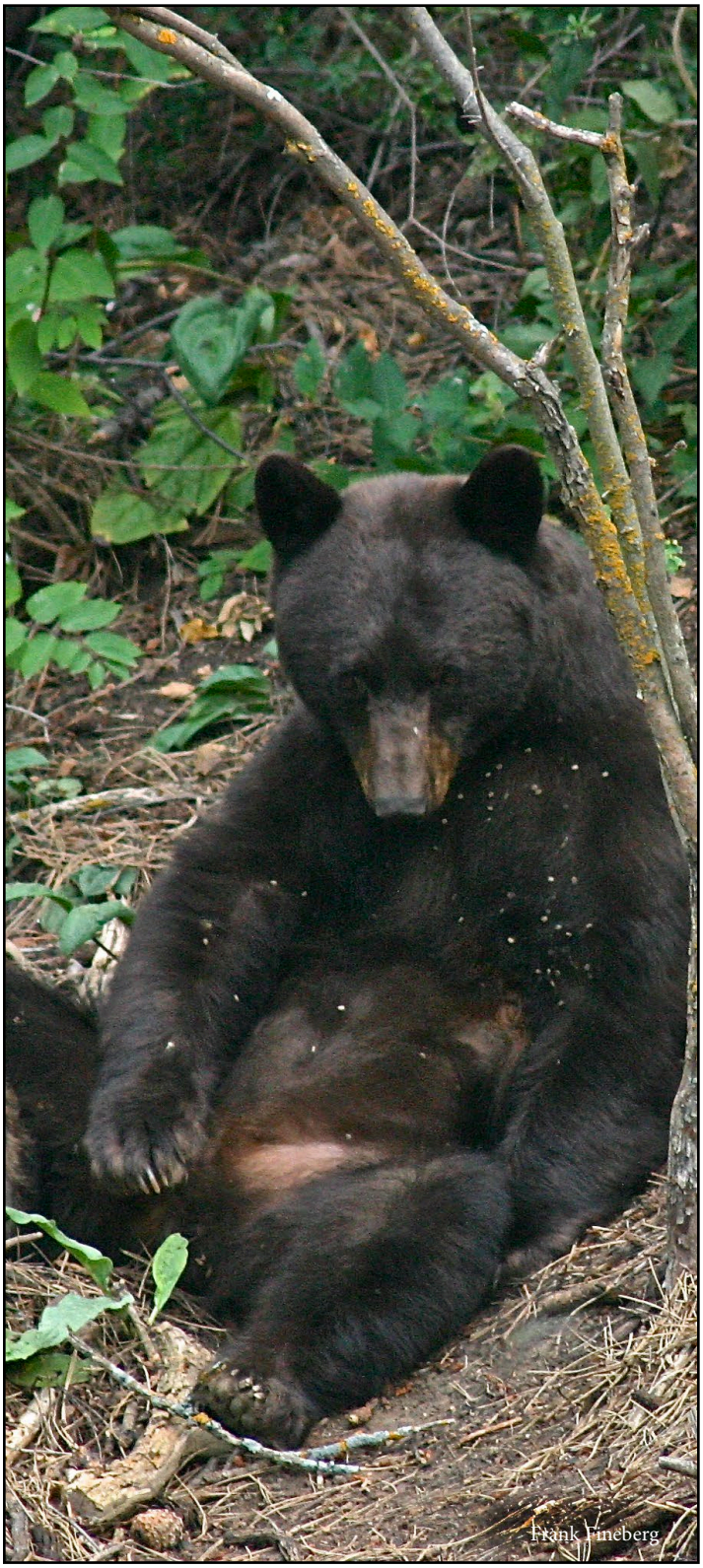
# Riparian Areas - Creeks

## Research Opportunities

- Evaluate nutrient content (primarily nitrogen and phosphorus) of tail-water from flood irrigated hayfields and methods to reduce agriculturally related nutrients from reaching riparian areas.
- Evaluate the number of animal units in riparian areas to minimize creek bank erosion. Take into account soil type and stream morphologies.
- Evaluate size and spacing of water gaps to protect or enhance riparian habitat, water quality and stream geomorphology.
- Evaluate the time period creek banks need to rest between periods of grazing to minimize erosion and maximize vegetation growth.
- Evaluate the timing, frequency and magnitude of grazing to manage target non-native species, including teasel.

## Estimated Implementation Costs

- Fence riparian areas and creeks; establish alternative water sources ($$$ per project)
- Water gap/fence improvements for better riparian habitat/water quality ($ per project)



# Wetlands - Ponds

## Existing Policy Guidance

***Federal***
The **CWA** provides federal protection to some wetlands and ponds.

***Local***
**BCCP** specifically designates wetlands as an environmental resource to be protected. General policies articulated in the BCCP direct the county to formulate plans and regulations to protect environmental resources (ER 1.01) and work with federal, state, municipal and other public or quasi-public entities that have a jurisdictional or property interest in unincorporated lands within or surrounding any designated environmental resources to achieve their protection (ER 1.06).

**City Charter ARTICLE XII. OPEN SPACE**
Sec. 176 Open Space Purposes – Open space land

- Preservation of water resources in their natural or traditional state, scenic areas or vistas, wildlife habitats, or fragile ecosystems.

**BVCP** recognizes the importance and value of wetlands and directs the city and county to continue to develop programs to protect and enhance wetlands and riparian areas in the Boulder Valley with the city striving for no net loss of wetlands and riparian areas by discouraging their destruction or requiring the creation and restoration of wetland and riparian areas in the rare cases when development is permitted and the filling of wetlands or destruction of riparian areas cannot be avoided. The BVCP also states that comprehensive planning and management of floodplain lands will promote the preservation of natural and beneficial functions of floodplains whenever possible.

**City of Boulder and Boulder County administer floodplain protection programs** to comply with federal laws.

**City of Boulder Stream, Wetland and Water Body Ordinance** regulates specific activities in wetlands, ponds, and other bodies of water that could lead to the impairment or loss of the wetland or pond. The Ordinance contains some exemptions for continuing agricultural practices (harvesting of hay, pasturing of livestock) and some exemptions for the delivery of water.

The **Grassland Plan** provides specific objectives and strategies to conserve wetlands on OSMP-managed land.

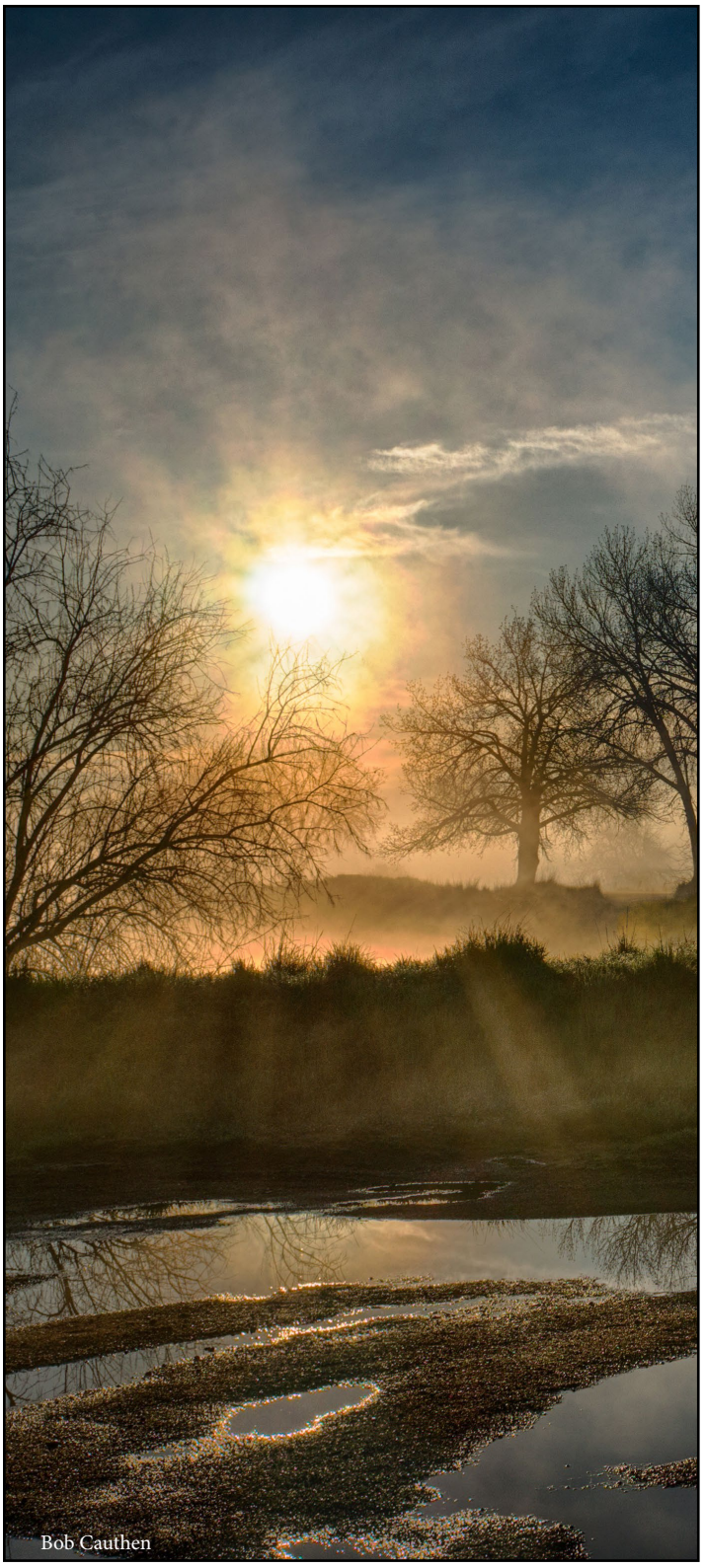
# Wetlands - Ponds

## Existing Conditions

OSMP-managed lands support approximately 1,700 acres of wetland habitat (Map 11). Wetlands occur where soil is inundated or saturated periodically during the growing season. The most common wetland types found on OSMP are marshes, wet meadows and riparian wetlands. Agricultural management of the landscape has both enhanced and impaired the condition of wetland areas. A large proportion of the wetlands on OSMP are created and enhanced by agricultural flood irrigation practices while water diversion for agricultural use has resulted in the loss of some wetland habitat. OSMP uses prescriptive grazing to improve the vegetative composition and help manage non-native vegetation.

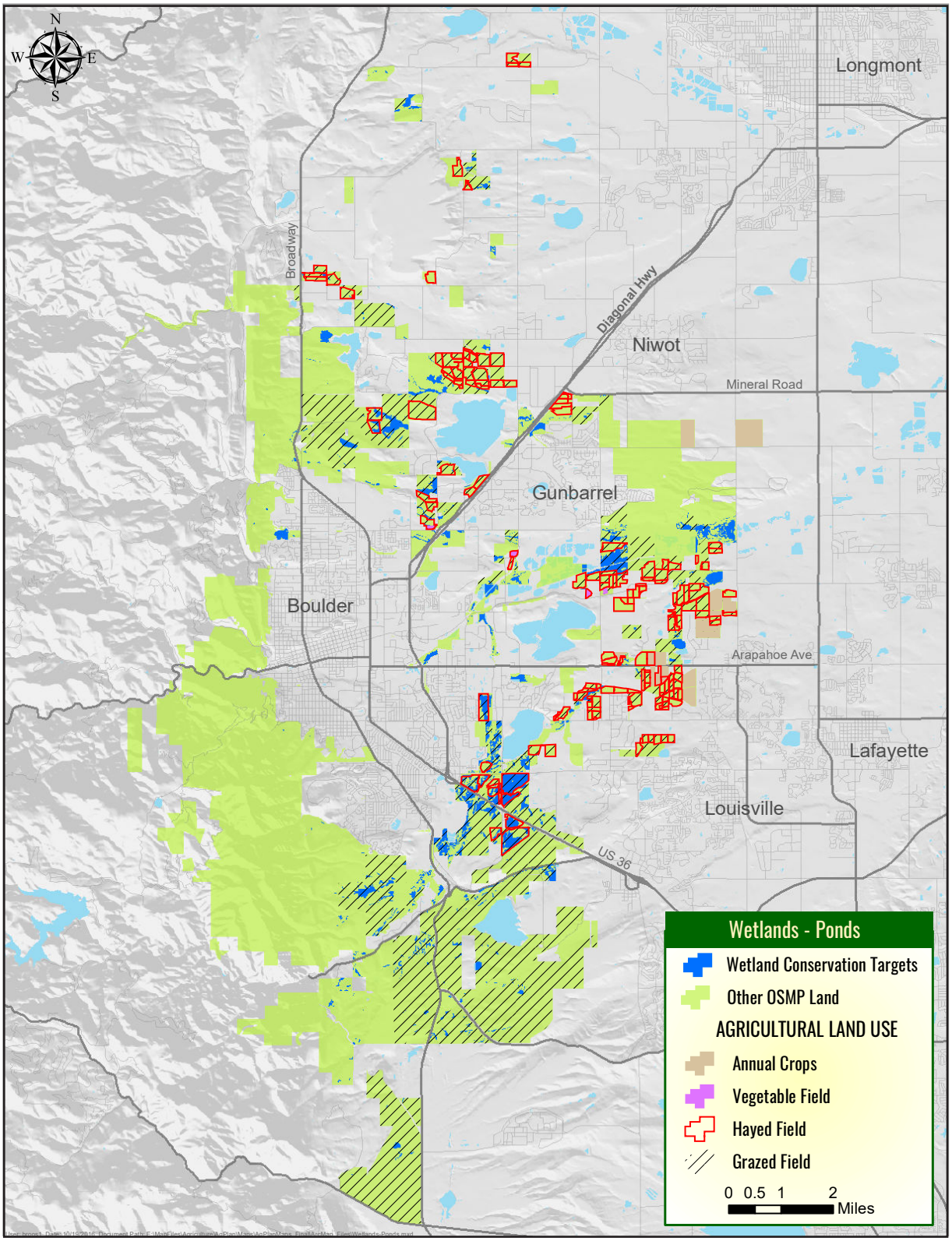
Wetlands support habitat for several sensitive species, including the Ute ladies'-tresses orchid, a federally listed threatened species and northern leopard frog, a species of special concern in Colorado. More information on the Ute ladies'-tresses orchid can be found in that section of the plan.

The Grassland Plan assessed the condition of wetlands on OSMP lands as "poor," with indicators for vegetation composition, animal composition and connectivity outside the acceptable range of variability established in the plan. Despite the Grassland Plan's "poor" rating, two indicators for which agricultural management has played an important role, the presence/sustainability of the Ute ladies'-tresses orchid and proximity of wetlands and riparian areas to one another, are in "good" condition.



Bob Cauthen

# Map 11: Wetlands - Ponds



# Wetlands - Ponds

## Objectives

- **Integrate agricultural management practices to support wetland hydrology.**
- **Integrate agricultural management practices to support wetland habitat, including northern leopard frog habitat.**

## Management Strategies

**Evaluate modifications to the timing and quantity of agricultural water use (Figure 50).**

Agricultural Water Use Evaluation Considerations

- Existing water rights and their transferability
- Water rights owners and their agricultural operations
- Quality and functionality of wetlands supported by agricultural operations

Figure 50

**Evaluate modifications to grazing management to support and restore wetland habitat (Figure 51).**

Grazing Management Evaluation Considerations

- Opportunities to strategically fence wetlands and ponds
- Prescriptive grazing recommendations for wetlands, including fenced areas
- Alternate water sources for livestock
- Increasing buffer zones around wetlands and ponds to minimize agricultural runoff to ponds

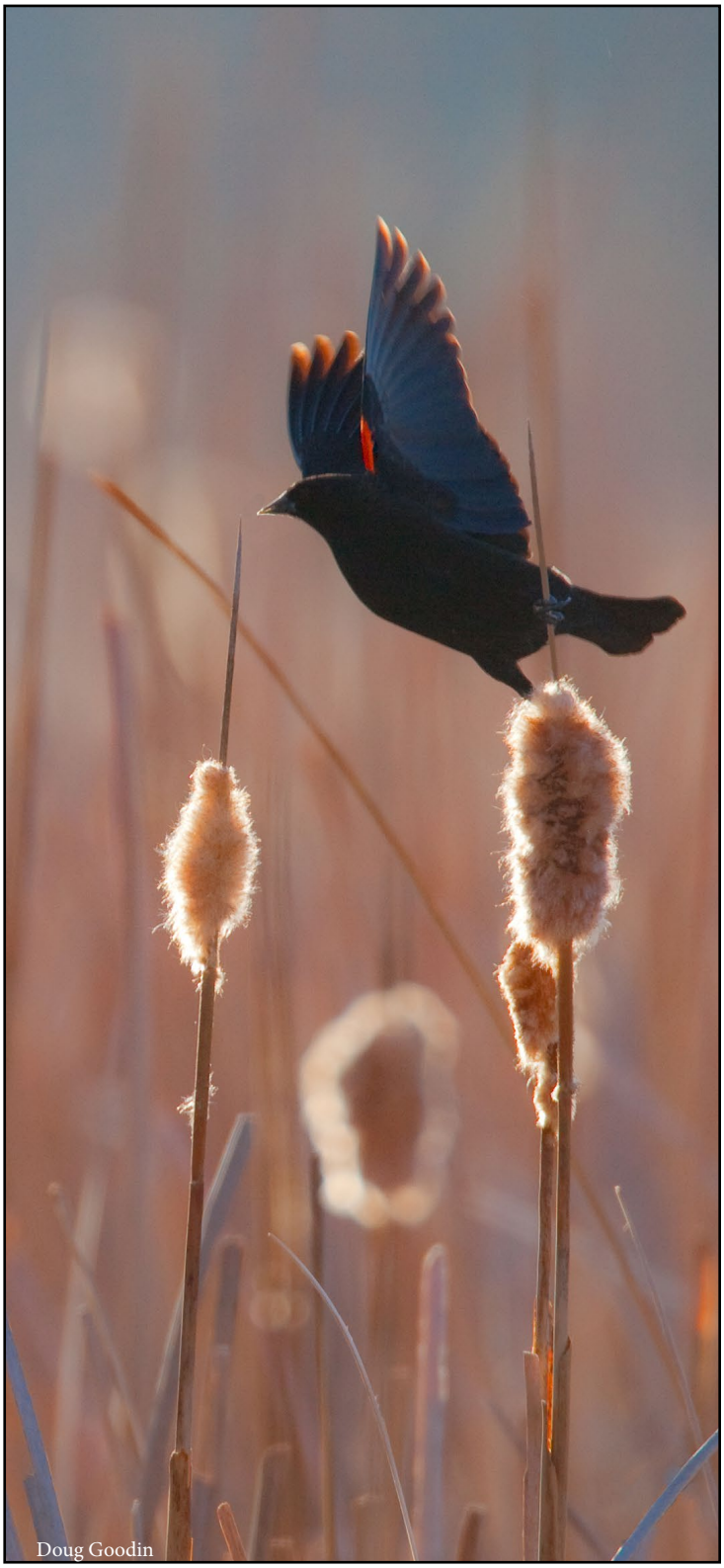
Figure 51

**Manage wetland habitat through compatible haying and irrigation practices.**

**Manage Ute ladies'-tresses orchid habitat through compatible haying, grazing and irrigation practices.**
See the Ute ladies'-tresses orchid section of the plan.

**Evaluate ponds initially established or currently used for agricultural purposes for northern leopard frog habitat and/or native fish refugia.**

# Wetlands - Ponds


Doug Goodin

## Measures of Success

The measures of success for wetlands - ponds are established in the Grassland Plan and include:

- Native plant species cover (at least 75 percent of wetlands exhibit a relative cover of native species > 66 percent)
- Percent of wetland acreage dominated by non-native species (< 3 percent of wetland acreage dominated by non-native species)
- Percent of wetland acreage with prevalence of non-native species (< 9 percent of wetland acreage with prevalence of non-native species)
- Distance to nearest wetland or riparian area (at least 75 percent of wetland/riparian complexes are < 200 m from the nearest wetland/riparian complex)
- Native frog presence in suitable habitat (at least 50 percent of suitable sites contain only native frogs)

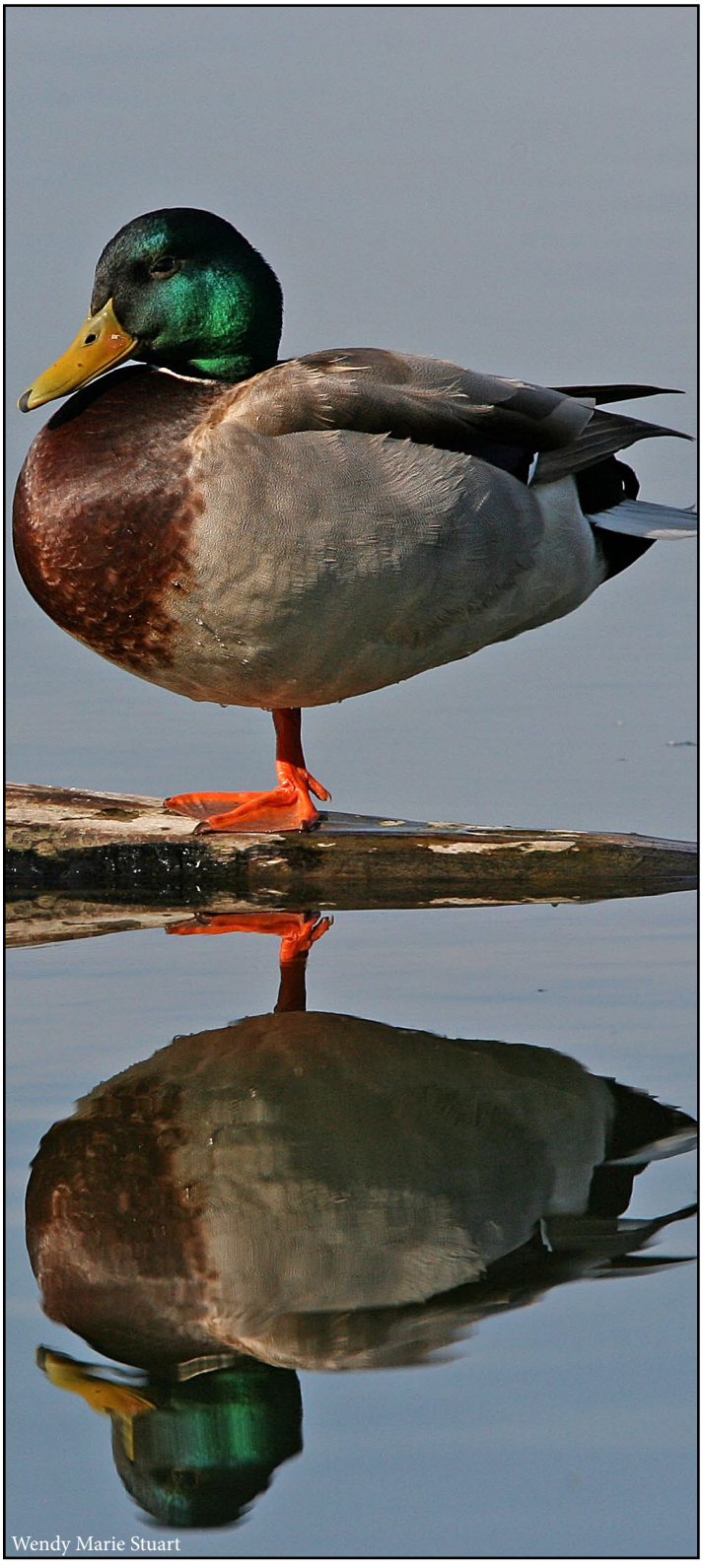
# Wetlands - Ponds

## Research Opportunities

- Evaluation of nutrient (primarily nitrogen and phosphorus) tailwater from flood-irrigated hay fields and methods to reduce nutrients from reaching receiving creeks and water bodies.
- Evaluation of the timing, frequency and magnitude of grazing to manage target non-native species, including teasel.
- Evaluation of IPM practices available to OSMP that best address specific non-native species.
- Evaluation of wetland hydrology that best supports native plant and animal communities.

## Estimated Implementation Costs

- Fence wetlands and ponds; establish alternative water sources ($$$ per project)
- Water gap/fence improvements for improved wetland habitat/water quality ($ per project)



Wendy Marie Stuart

# Water Quality

## Existing Policy Guidance

***Federal***

The **CWA** establishes the basic structure for regulating pollutant discharges into the waters of the United States.

***State***

The **Colorado Department of Public Health and Environment, Water Quality Control Commission** sets the state water quality standards. The state is responsible for implementing non-point source, such as agricultural runoff, regulations. The state is required by the CWA to identify water bodies that don't meet state water quality standards and develop a plan to bring them up to standards.

***Local***

**BVCP**

Water resource planning efforts will be regional in nature and incorporate the goals of water quality protection, and surface and ground water conservation. The city will continue to obtain additional municipal water supplies to insure adequate drinking water, maintain instream flows and preserve agricultural uses. The city will seek to minimize or mitigate the environmental, agricultural and economic impacts to other jurisdictions in its acquisition of additional municipal water supply to further the goals of maintaining instream flows and preventing the permanent removal of land from agricultural production elsewhere in the state.

The Open Space program will seek to restore, maintain, or enhance the quality of all surface and ground waters on Open Space lands consistent with the CWA, the **City of Boulder Drainageway Master Plan**, and other applicable federal, state, and local laws and regulations.

**City of Boulder IPM Policy**

States that the type, method and timing of chemical application shall be determined after considering protection of water quality.

## Existing Conditions

The effects of agricultural operations on water quality in OSMP water bodies has not been quantified. It is generally understood that unmanaged or improper agricultural management can negatively impact water quality through increased concentrations of fecal coliforms, sediment loads, and nutrients like phosphorous and nitrogen, which are present in animal manures and fertilizer. Increased nutrient loading from animal waste can lead to eutrophication of water bodies, which is harmful to aquatic ecosystems. Decreased water clarity, caused by livestock accessing bodies of water and/or destabilizing creek banks, can negatively affect aquatic and semi-aquatic organisms. In order to protect both water quality and riparian and wetland habitats, OSMP has mitigated the effects of grazing by fencing and excluding cattle from riparian and wetland habitats except for water gaps. Approximately 36 percent of creeks with surrounding agricultural use are fenced. OSMP staff and lessees comply with the City's IPM policy which states that the type, method and timing of chemical application shall be determined after considering protection of water quality.

Limited water quality data for OSMP water bodies has been collected by the City of Boulder's Utilities Department. This monitoring is focused on water chemistry and biological indicators.

## Objectives

- **Minimize the impact of agricultural activities on water quality.**

# Water Quality

## Management Strategies

**Identify agricultural activities that have the potential to impact ground and surface water quality.**
Work with the City's Utilities Department, Boulder County Public Health, and other appropriate agencies, to identify the locations and practices of current agricultural activities that impact, or have the potential to impact ground and surface waters.

**Assess water quality on OSMP lands.**
Coordinate and collaborate with the City's Utilities Department on water quality monitoring focusing on water chemistry, biological indicators and fecal coliforms.

**Evaluate modifications to grazing management to maintain or improve water quality.**
Examine opportunities to strategically fence creeks and wetlands. Develop prescriptive grazing recommendations for riparian areas and wetlands, including fenced areas. Evaluate alternative water sources for livestock. Increase buffer zones around bodies of water to minimize agricultural runoff into water.

**Explore other irrigation approaches to improve water use efficiency and minimize runoff and discharges from agricultural land to surfaces waters.**

**Manage IPM activities to mitigate their effects on water quality.**
Adhere to the City's IPM policy on chemical applications adjacent to water sources.

**Develop BMPs to manage agricultural activities to maintain or improve water quality.**
(Figure 52)

Water Quality BMPs

- Grazing in riparian areas
- Buffers for chemical applications
- Vegetated buffers at field edges
- Fertilizer application
- Tailwater management
- Ditch and lateral maintenance and management (sidecasting of dredged materials)
- Water gap placement
- Livestock watering facilities

Figure 52

# Water Quality

## Measures of Success

- Percent of operators implementing BMPs to minimize the impact of agricultural uses on water quality.
- Partner with city utilities staff to monitor water quality before and after implementation to measure effectiveness of the BMPs and potential improvements in water quality.
- Compliance with state water quality standards.
- The following measures of success related to water quality were established in the Grassland Plan:
  - -At least 75 percent of the sites exceed the state water quality standards for dissolved oxygen. For coldwater streams the standard is 7.0 mg/L during spawning season; 6.0 mg/L outside of spawning season. For warmwater streams the standard is 5.0 mg/L. (the state standards are set by the Colorado Department of Public Health and Environment.)
  - -For total phosphorus – lotic, at least 75 percent of the sites exhibit a TP concentration < 0.007 mg/L in coldwater streams and < 0.06 mg/L in warmwater streams
  - -For total phosphorus – lentic, at least 75 percent of the ponds exhibit a TP concentration < 0.02 mg/L
  - -For water clarity, at least 75 percent of the sites have a Secchi disk depth > 1.5 m

## Research Opportunities

- Evaluate the effects of nutrient loading (primarily nitrogen and phosphorus) in tailwater from flood irrigated hay and crop fields and methods to reduce nutrients from reaching receiving creeks and water bodies.
- Determine the influence of herd size, soil type and creek bank morphology on creek bank erosion.
- Partner with city utilities staff to evaluate fertilizer application and timing with the Boulder Reservior Watershed to minimize potential runoff impacts to the drinking water supply and the public beach.

## Estimated Implementation Costs

- The costs are associated with the management strategies described and estimated in the Grazing in Native Grasslands, Riparian Areas – Creeks, and Wetlands – Ponds sections of the plan.

# Water Quality


Phil Yates

# Community and Visitor Integration

# Scenic Resources

## Existing Policy Guidance

**City Charter ARTICLE XII. OPEN SPACE**

Sec. 176 Open Space Purposes – Open space land

- *Preservation of* water resources in their natural or traditional state, *scenic areas or vistas,* wildlife habitats, or fragile ecosystems;
- *Preservation of land for its aesthetic* or passive recreational *value and its contribution to the quality of life of the community.*

**Open Space LRMP**

Inventories of plants, animals, soils, natural and artificial disturbance, and other elements will be completed and iteratively updated, based on field studies, anecdotal information and research.

A historic landscape may be converted to other uses if it cannot adequately serve an appropriate use in its present condition. An obliterated historic landscape will not be restored except to preserve an agricultural use.

General guidance surrounding the preservation of scenic resources is included in the **BVCP.**

## Existing Conditions

Scenic, or visual resources are landscape patterns or features which are visually or aesthetically pleasing and which therefore contribute to the character of a place and the quality of life for the community. According to the community questionnaire (Appendix C), scenic vistas and the character of working landscapes were what many respondents valued most about OSMP agricultural land.

Scenic resources vary by location and the condition of these resources is dependent on a variety of features including terrain, geology, landforms and human modifications to the landscape. Ranchland for grazing and farmland flank the City of Boulder to the north, south and east. The diversity of agricultural uses on OSMP has created a variety of agriculturally related viewsheds. The landscape character of current working landscapes still needs to be assessed for its scenic qualities.

Although no baseline surveys of existing conditions exist, anecdotal information indicates scenic views are in a variety of conditions, providing excellent to fair viewsheds.

## Objectives

- **Maintain integrity of agriculturally related viewsheds and ameliorate views which impact landscape character.**
- **In the context of a larger scenic resources management program, identify scenic resources and support improvements that advance the Ag Plan objectives.**

# Scenic Resources

## Management Strategies

**Conduct baseline inventory and condition assessment of agriculturally related viewsheds.**

**Identify major landscape types that define the character of the working landscape in order to develop a scenic management tool that protects the qualities of the setting the community values.**

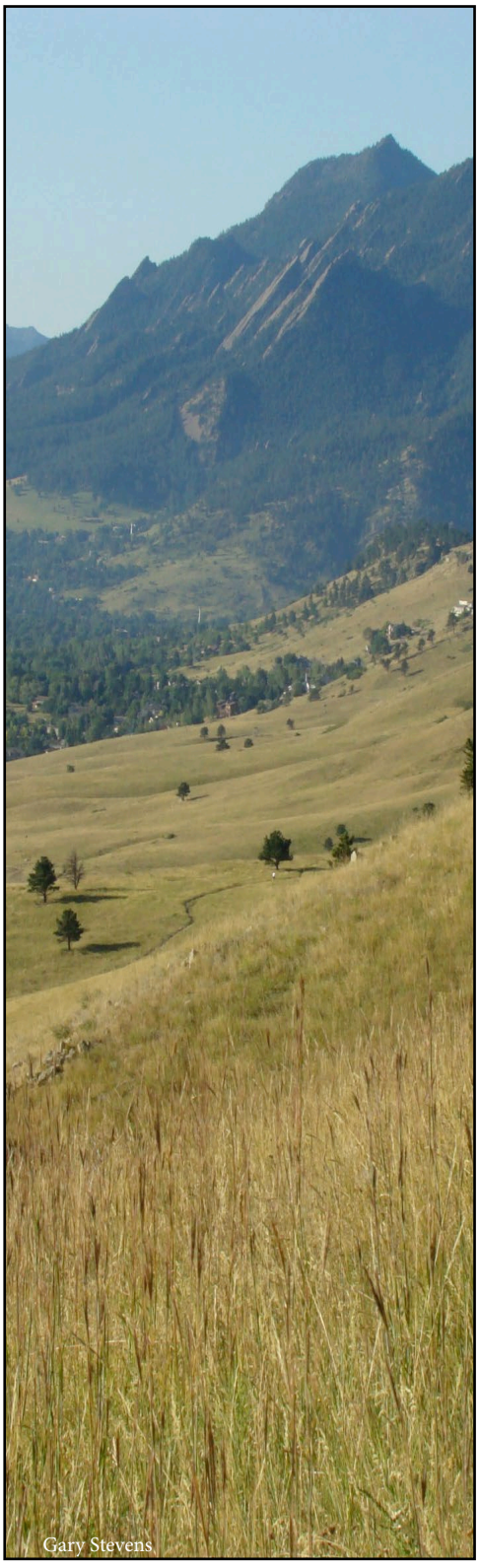
**Categorize and prioritize (for protection and maintenance) agriculturally related viewsheds.**

## Measures of Success

- Percent of agricultural landscape inventoried for viewsheds.
- Percent of agriculturally related viewsheds in acceptable condition.

## Estimated Implementation Costs

- $$ For contracted services to complete scenic resource baseline survey.



Gary Stevens

# Cultural Resources

## Existing Policy Guidance

**BVCP**
The city and county will permanently preserve lands with open space values. Open space values include use of land for urban shaping and preservation of natural areas, environmental and cultural resources, critical ecosystems, water resources, agricultural land, scenic vistas, and land for passive recreational use.

**Open Space LRMP**
Cultural resource surveys will be conducted, as appropriate, before the ground is disturbed in culturally significant areas.

Structures may be removed from Open Space if they cannot practically be preserved on their present sites or if the move provides better opportunities for preservation of the structure but will not significantly impact Open Space natural or agricultural resources.

Historic agricultural facilities or historic residences that are occupied will be managed so as to preserve their historic content.

General guidance surrounding the long-term protection of cultural resources is included in the **City Charter, Visitor Master Plan (VMP) and Open Space Cultural Resource Guidelines.**

## Existing Conditions

Cultural resources fall into two major categories:

- Prehistoric: includes paleontological sites and features, aboriginal archaeological sites and artifacts. A prehistoric resource defined by the Code of Federal Regulations (Title 37, Chapter II, Part 261, Subpart A, Section 261.2) is any structural, architectural, archaeological, artifactual or other material remains of past human life or activity generally prior to the advent of written records and of anthropological interest, and the physical site, location, or context in which they are found.

- Historic: includes cultural landscapes, historic sites, historic buildings, structures and objects, as well as historic archaeological sites. A historic resource defined by the Code of Federal Regulations (Title 36, Chapter II, Part 261, Subpart A, Section 261.2) is any structural, architectural, archaeological, artifactual or other material remains of past human life or activities which are of historical interest and are at least 50 years of age, and the physical site, location or context in which they are found.

The most common types of historic resources found on OSMP agricultural lands are houses, barns, loafing sheds, corn cribs, corrals, wells, cellars, water tanks, mills and agricultural equipment. The structural resources vary in condition, from good to poor, with some occupied; however, many are vacant. More specific information on the location, number and condition of historic structures on OSMP lands has recently been inventoried and assessed as part of a system-wide survey of all OSMP facilities and structures.

Cultural resource assessments and surveys provide information on the prehistoric and historic integrity

# Cultural Resources

## Existing Conditions

and significance of a place. Adequate cultural resource assessment and survey information exists for some OSMP working agricultural lands; 15 of 22 cultural resource surveys of agricultural infrastructure provide adequate information to inform agricultural use.

## Objectives

- **Develop cultural resource management practices relating to agriculture that consider how to preserve the working landscape and associated cultural traditions.**
- **Ensure agricultural activities are compatible with protecting archaeological and prehistoric sites according to Federal and State regulations.**
- **In the context of a larger cultural resource management plan, identify structures, sites, and landscapes with cultural or historical significance and integrity that could confer eligibility for recognition at the federal, state or local level that will support improvements that advance the Ag Plan objectives.**

## Management Strategies

**When possible, use structural cultural resources for their intended agriculturally related use.** In historic preservation theory, the highest and best use, as well as the best form of preservation, is for a historic structure to be used for its intended purpose. For example, barns would be maintained to a level of integrity that would make them available for use by farmers and ranchers while historic farmhouses would be used as residences.

**Conduct cultural resource surveys on all agricultural lands not adequately surveyed.**

**Develop criteria to prioritize the infrastructure and maintenance needs for the protection and use of historic structures.**

Katy Waechter

# Cultural Resources


Jack Sasson

## Management Strategies

**Prioritize archaeological and prehistoric assessments on the Diversified Vegetable/Pastured Livestock Farm/Micro Dairy BOAs.** Archaeological assessments are important for lands under consideration to be tilled as the soil disturbance has the potential to damage archaeological sites. Adequate cultural resource assessment and survey information exists for all but one of the Diversified Vegetable/Pastured Livestock Farm/Micro Dairy BOAs.

Cultural Resource Surveys for Diversified Vegetable/ Pastured Livestock Farm/Micro Dairy BOAs

| Diversified Vegetable/ Pastured Livestock Farm/Micro Dairy BOA | Survey |
|---|---|
| Johnson South | ✓ |
| Kolb | ✓ |
| Hartnagle | ✓ |
| Bell II | ✓ |
| King Hodgson | ✓ |
| Hunter Kolb | ✓ |
| Stengel King | ✓ |
| St. Wallburga | ✓ |
| Isenhart-Jones | ✗ |

Figure 53

# Cultural Resources

## Measures of Success

- Percent of agriculturally related cultural resources integrated into the working landscape.
- Percent of cultural assessments complete.
- Percent of structural cultural resources in good condition.

## Estimated Implementation Costs

- $$ for cultural assessments
- $$$$$ for improvements to maintain structural cultural resources in good condition. The OSMP facilities assessment project will provide more detailed cost estimates.
- This cost estimate includes the structural improvements to cultural structures on the Diversified Vegetable/Pastured Livestock Farm/Micro Dairy BOAs. The specific estimates for those areas alone are found in the Diversity of Agriculture and Local Foods section of the Agricultural Management chapter.

Katy Waechter

# Public Access/Passive Recreation

## Existing Policy Guidance

**City Charter ARTICLE XII. OPEN SPACE**
Sec. 176 Open Space Purposes- Preservation of land for passive recreational use
Preservation of land for passive recreational use, such as hiking, photography or nature studies, and, if specifically designated, bicycling, horseback riding, or fishing.

**VMP**

- Enjoy and Protect. Ensure that passive recreational activities and facilities are compatible with long-term protection of natural, agricultural, and cultural resources.
- Protection of Sensitive Areas. Direct visitor use to appropriate areas and away from sensitive areas. Some uses or levels of visitor use may need to be limited or not allowed, in order to protect natural, agricultural, and cultural resources.
- Livestock and Visitors. Provide for safe interactions between livestock and visitors. This strategy primarily involves segregating bulls and cows with calves from trails where appropriate, but may also involve closing trails at times. Signs provide warnings to visitors. The need for caution is publicized through media and outreach contacts.
- Agricultural Area Designation Goals.
  -Manage agricultural production and operation to ensure safety for operators and visitors in the vicinity.
  -Provide, where appropriate, public access and passive recreational opportunities that have minimal impacts on agricultural production and operation or other resources.
  -Manage visitor access in areas of intensive agricultural production or operation to ensure visitor safety.
  -Eliminate undesignated trails when they are redundant or damaging to resources.

**Open Space LRMP** contain general guidance on public access, passive recreation and visitor safety.

## Existing Conditions

The opportunities provided to the community to connect with agricultural lands have primarily been focused on a sensitive approach to passive recreation, providing visitors the opportunity to travel through working lands while respecting the needs of lessees. There are approximately 40 miles of mostly multi-use trails through working agricultural landscapes on OSMP lands. The trail system takes visitors through working landscapes of primarily rangeland and hayfields (Map 12). The trails provide opportunities for horseback riding, biking, dog walking, hiking and running. There are also opportunities for off trail experiences; off-leash dog experiences, on-leash dog walking, and opportunities for horseback riding, hiking and running.

Agricultural lands without visitor infrastructure are also open to the public. However, sometimes visitors may not perceive that an area is open to the public due to the fencing that is required for the agricultural operation. In general, OSMP encourages public access where there is visitor infrastructure to support passive recreational activities.

OSMP visitors generally enjoy sharing the land with livestock and enjoy the pastoral landscapes, watching farm animals, farming machinery, and ranchers and farmers in action. According to the questionnaire (Appendix C), the majority of visitors stay on the trail when near pastures, hayfields, and crops and make sure that gates are closed behind them. When visitors do not close gates, there can be disruptions to the agricultural operations and livestock, people, and other property are potentially put at risk. Damage to crops by incompatible recreation is a very infrequently occurring problem.

# Public Access/Passive Recreation

## Existing Conditions

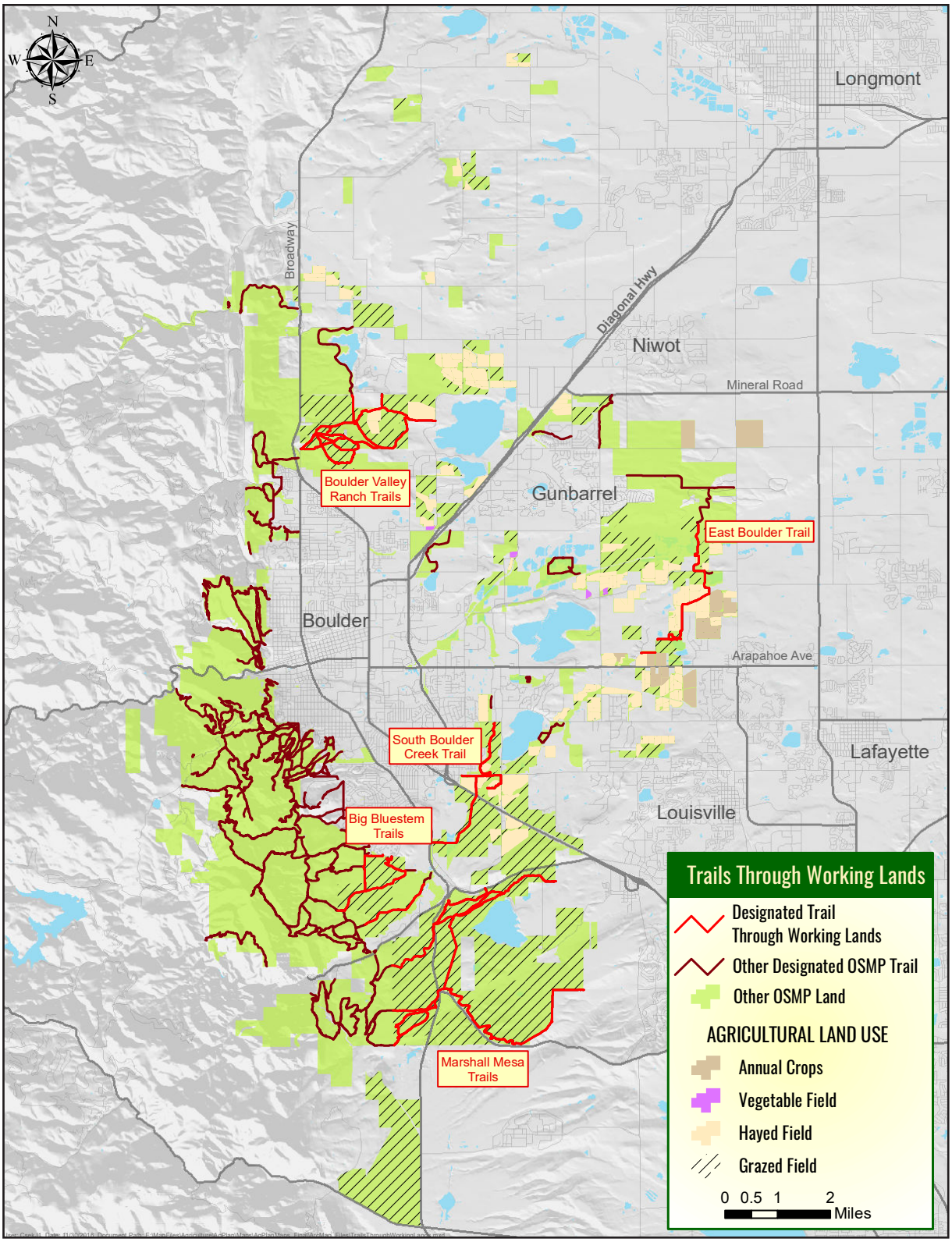
OSMP has temporarily closed or limited access to agricultural properties, through the use of temporary signs, on a very limited basis (once or twice in the last decade) due to crop damage or visitor safety concerns. For example, hayfields have been temporarily closed when off trail visitation was causing damage to the hay crop before it was harvested.

## Objectives

- **Continue to integrate compatible recreation activities on agricultural working lands to provide opportunities for high-quality visitor experiences and learning about Boulder's agricultural heritage.**
- **Maintain existing and develop new visitor facilities that support both a high-quality visitor experience and efficient agricultural operations.**
- **Recognizing the historic connection between equestrianism and agriculture, pursue and preserve reasonable equestrian access across agricultural lands.**

Paul Muus

# Map 12: Trails Through Working Lands



# Public Access/Passive Recreation

## Management Strategies

**Work to better understand the community's desires surrounding access to, learning about, and recreating on working agricultural lands.**
Decisions on recreational opportunities/access will be made through a community planning process, such as Trail Study Area (TSA) Plans.

**Consider providing new, inclusive recreation and access opportunities that connect the community to agricultural working lands.**

**Develop Visitor BMPs to provide visitors with information on how to safely and respectfully enjoy recreation opportunities on agricultural lands.**
Include information on the types of opportunities available to the community and provide information that will continue the good relations developed with lessees including closing gates, keeping pets under control around livestock, and off-trail protocols to avoid crop and other resource damage.

**Support agricultural lessees with technical advice, planning and design to minimize and mitigate impacts or perceived impacts from recreational use.**

**Minimize possibility for human and livestock conflict.**
Follow existing lessee BMPs to minimize visitor and livestock interactions during calving season and for livestock scheduling (rotation into fields). The following are focus areas for improved visitor and livestock integration.

- South Boulder Creek Trail
- East Boulder Trail through Teller
- Community Ditch Trail
- Marshall Mesa

**Continue the practice of temporarily closing or limiting access to agricultural properties when crop damage has occurred or for visitor safety concerns if other deterrence methods or access designs have proven ineffective.**

**Incorporate the visitor experience considerations when developing fence alignments and designing fence and gate related infrastructure.**
Fencing and gates are important elements on active agricultural lands. The number of agricultural gates could be reduced when developing and/or reconfiguring fence alignments. Opening and closing gates, while a key part of retaining good relationships between the community and lessees, can interrupt a visitor's movement and experience. Recent design improvements such as cattle guards can improve some visitors' experiences by allowing bikers or runners to continue riding or running through as opposed to stopping to open and close gates. Design must also take equestrians into consideration by installing cattle guards in a specific configuration that allows the equestrians to still utilize the gates. Fenced trail corridors, such as the White Rocks Trail may also be considered.

# Public Access/Passive Recreation

## Management Strategies

**Maintain and enhance agricultural landscapes to provide high-quality experiences and connections to agriculture for the community passing by or through working lands.**

**Evaluate the effectiveness of signing agricultural properties to:**

- Inform visitors and passers-by about crops, agricultural practices and considerate behaviors.
- Clearly indicate preferred access points and areas.
- Suggest ways that visitors can support local agriculture.

## Measures of Success

- Types and amount of recreational activities and access opportunities integrated into working agricultural lands.
  - Accessible trails that meet the needs of community members experiencing disabilities.

    (Desired condition = variety of activities and access opportunities)
- Development of visitor BMPs.
  - Education and outreach efforts to inform people about visitor BMPs.
- Number of reports of damage to crops/livestock from recreation per year.

  (Desired condition = none)
- Percent of lessees implementing BMPs to minimize the possibility of visitor and livestock conflict.

  (Desired condition = all applicable lessees)
- Number of recreation-related, agricultural gates.

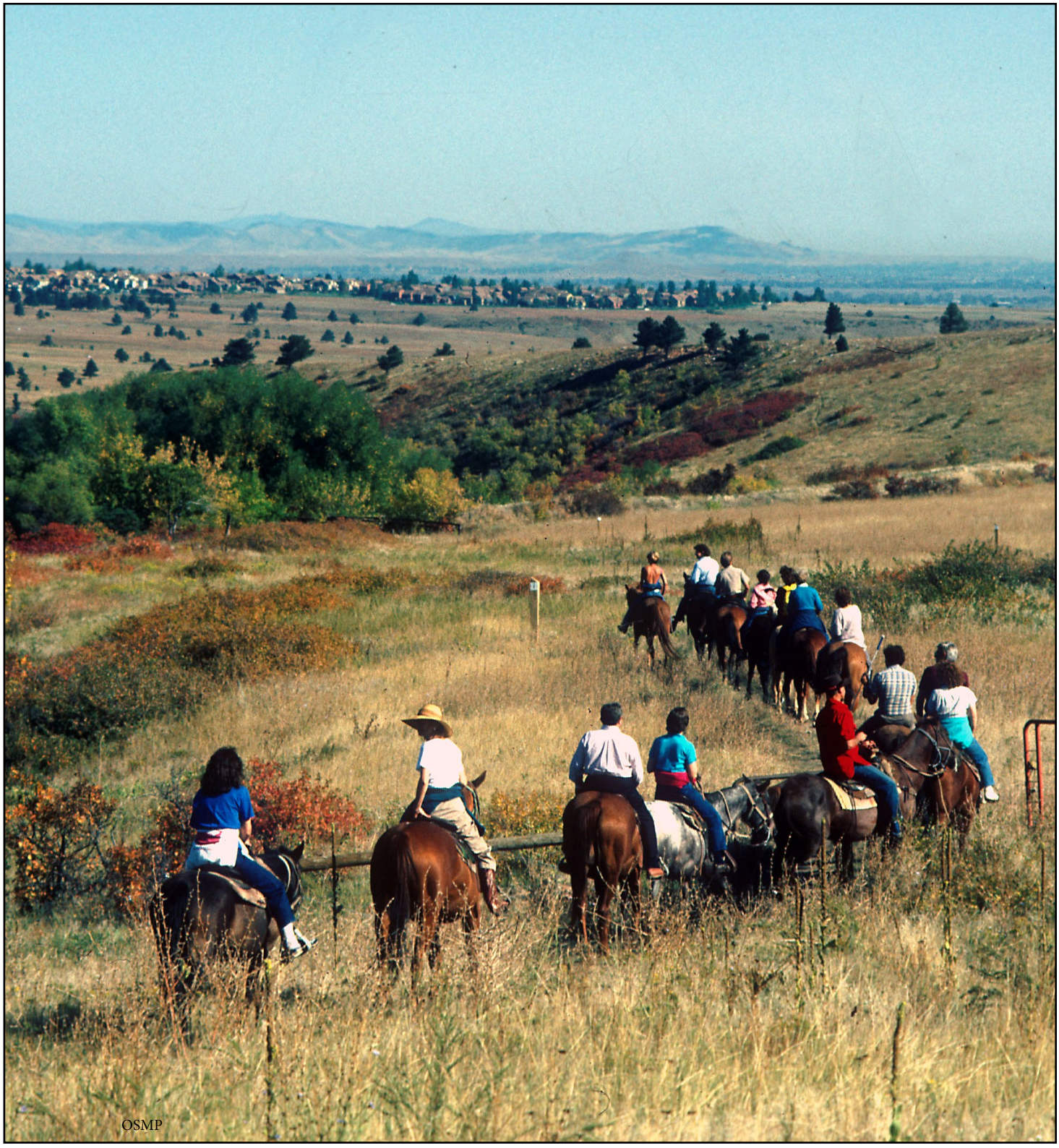
  (Desired condition = decrease in trail and agricultural fence intersections)
- Percentage of gates with bike, runner and equestrian friendly designs.

  (Desired condition = all applicable gates)

## Estimated Implementation Costs

- $$ for visitor friendly infrastructure/cattle guards (An estimated 24 new cattle guards are needed/desired. The cost estimate for a new cattle guard and associated infrastructure is approximately $1,400.)
- $$ for fencing - reconfiguring fencing alignments

# Public Access/Passive Recreation



OSMP

# Community Connections and Partnerships

## Existing Policy Guidance

**Open Space LRMP**

Agricultural Management

The Department may encourage the development of relationships or agreements with other agencies, such as the USDA Soil Conservation Service, Colorado State Forest Service, academic institutions, public or private entities, or qualified individuals to accomplish Open Space goals.

The Open Space staff will offer opportunities for public education about agricultural practices to foster appreciation for, and community commitment to, sustainable agriculture. The staff will also work with lessees, permittees, contractors, land managers, affected individuals and neighborhoods to mitigate undesirable effects of activities where possible.

**VMP**

Provide a range of volunteer opportunities that allow visitors to help take care of OSMP lands and better appreciate its resources.

Provide education and outreach services that build personal and community connections with the land, enable visitors to use low-impact educational and recreational techniques, and promote partnerships in the stewardship of our lands. Encourage productive collaboration between OSMP and community groups - from exchanging ideas to combining hands-on and financial resources to improving low-impact visitor behaviors.

Seek partnerships with community groups to develop support for management policies and programs, infrastructure investment and resource protection - all aimed at improving the quality of the visitor experience and resource conditions.

**BVCP**

9.02 Urban Gardening and Food Production

- The city encourages community and private gardens to be integrated in the city. City incentives include allowing flexibility and/or helping to remove restrictions for food production and sales on private lands and in shared open spaces and public areas.

# Community Connections and Partnerships

## Existing Conditions

With a focus on agricultural production over the past 50 years, the opportunities provided to the community to connect with agricultural lands, farmers and ranchers have focused on a sensitive approach to passive recreation, providing visitors the opportunity to travel through working lands while respecting the needs of lessees. In addition, OSMP has also developed programs for community engagement. OSMP has created service learning programs, provided volunteer opportunities in collaboration with farmers and ranchers, and offered education and outreach opportunities. More on these opportunities can be found in the Passive Recreation/Public Access, Service Learning and Volunteers, and Education and Outreach sections of the plan.

Other experiences or types of agriculturally related activities related to connecting the community to agriculture, such as farm events and community farming, have either not been permitted or are not currently a focus on OSMP lands. These agriculturally related experiences and activities have been increasing in popularity nationwide as people are seeking ways to enjoy the outdoors and connect with local agricultural lands and producers.


Kristin Weinberger

## Objectives

- **Offer a range of experiences and opportunities for the community to connect, learn about, discover and enjoy agricultural lands and their associated operations.**

# Community Connections and Partnerships

## Management Strategies

**Consider offering experiences or types of agriculturally related activities related to connecting the community to agriculture.**

Evaluate activities for which there is a recognized demand, that are established as an emerging trend, fit a community desire and meet the charter purpose for open space. This includes activities in the following four categories:

| | |
|---|---|
| **Farm Stores**<br>·Farm stands<br>·Seasonal markets | **Agritourism**<br>(aka "Agritainment")<br>·Pumpkin patches<br>·U-Pick activities<br>·Petting zoos<br>·Hay rides |
| **Farm Events**<br>·Farm-to-table dinners<br>·Family events | **Community Farming**<br>·Demonstration farms<br>·Community gardens<br>·Food forests |

Examples of Agritourism or Agritainment are pumpkin patches, u-pick activities, petting zoos and hay rides. Farm events include farm-to-table dinners and weddings. Examples of community farming include demonstration farms, food forests and community gardens. These experiences or types of agriculturally related activities have been increasing in popularity nationwide increasing their relevance for OSMP lands. They also provide opportunities for the community to connect with local agricultural lands and producers.

Developing these opportunities on OSMP lands will require a new process and criteria to evaluate them. The criteria identified in the VMP Passive Recreation Activity Assessment (Appendix B) was initially used to evaluate passive recreation activities in a natural setting on OSMP lands and provide a starting point or phase one criteria for considering whether and how these activities can be integrated into OSMP.

The development of new criteria to assess community connections and the development of partnerships in relation to agricultural and food related activities will consider a wider spectrum considering additional criteria including, but not limited to, city-wide local food policy, community desires and needs, ability to engage youth and underserved communities, service learning and volunteer benefits, and ability to provide the community with connections to working landscapes.

# Community Connections and Partnerships

## Management Strategies

**Explore offering new opportunities and experiences related to agriculture.**
Because these types of activities are new to OSMP lands, incrementally phase in the new activities as pilot projects (Figure 54) to allow opportunities for OSMP and lessees to gain experiences and adaptively manage. After evaluation with the phase one passive recreation activity assessment criteria, the following activities were found to be suitable for future pilot projects: u-pick opportunities, farm-to-table dinners, farm stands and demonstration farming.

Pilot Project Process

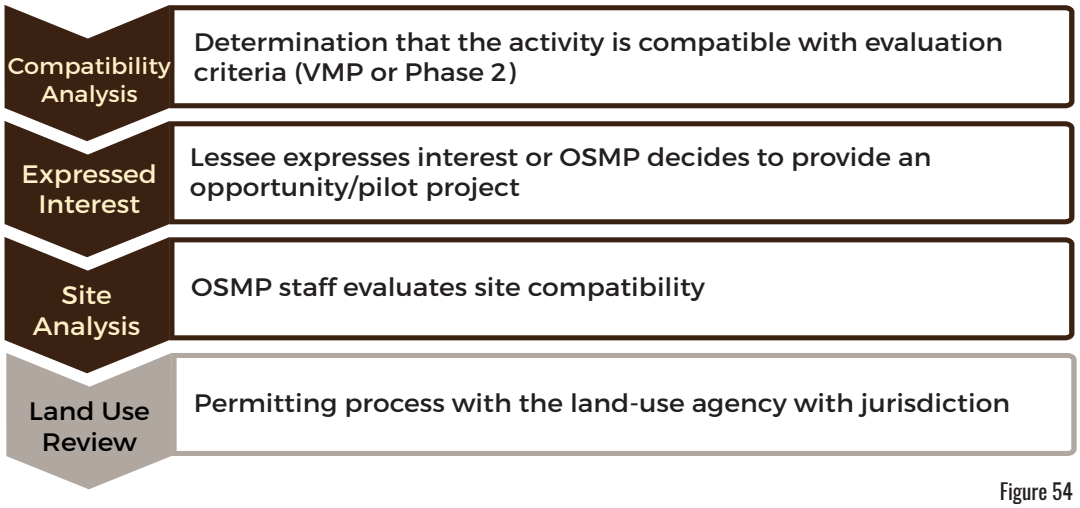



Figure 54

(Note: If activities or events are provided by a lessee they must remain an accessory use. Agricultural production must remain the primary use).

**Explore and create partnerships to develop opportunities and offer activities related to agriculture.**
Evaluate potential partnerships with lessees, Boulder County, other city departments and efforts (e.g. Market Hall), local businesses and organizations.

# Community Connections and Partnerships

## Measures of Success

- Variety/types of experiences or agriculturally related activities occurring on OSMP lands.
- Increased number of experiences or agriculturally related events occurring on OSMP lands.
- Increased number of lessees offering new agriculturally related experiences/activities.
- Effectiveness of experiences and activities to connect the community with agricultural lands, farmers and ranchers.
- Ability of OSMP to accommodate emerging trends and meet community desires.

## Estimated Implementation Costs

- $-$$$$$ - Cost is dependent upon the opportunities provided and the infrastructure needed in support.

# Community Connections and Partnerships

Beau Clark

# Education and Outreach

## Existing Policy Guidance

### Open Space LRMP

The Open Space staff will offer opportunities for public education about agricultural practices to foster appreciation for, and community commitment to, sustainable agriculture.

The Department will conduct educational and interpretive programs to:
Disseminate information concerning the goals, projects and operations of the Open Space Program;
Disseminate information about the conflicts that arise when humans interact with the natural systems, and about ways of lessening or eliminating the impact of those conflicts.

### VMP

Education and Outreach Initiative

Emphasize education and interpretation as tools to create public understanding and support for maintenance and enhancement of the quality of visitor experience and the protection of natural, agricultural and cultural resources.

Provide education and outreach services that build personal and community connections with the land, enable visitors to use low-impact educational and recreational techniques and promote partnerships in the stewardship of our lands.

## Existing Conditions

Education programming specifically focused on OSMP agriculture and the working landscape have yet to be developed as a strategically coordinated program. OSMP has created programs as the opportunity arises, developing agricultural specific events and hikes as needed. Agriculture has also been regularly featured as a topic within existing public programs describing the OSMP system.

OSMP offers public hikes to the community through a program known as Natural Selections. Natural Selections hikes that have focused on agriculture include the "Amazing Grazing" hike focusing on grazing practices and the history of ranching in the Boulder Valley. The "Riches of Ditches" was a bike tour of local irrigation ditches and focused on the importance of ditches to local agriculture, ecosystems and history. Other hikes, focused on local history or natural resources, including "Introduction to OSMP", "OSMP 101" or hikes requested by school groups, often include references to the historical and on-going importance of agriculture (e.g., as a livelihood for pioneer families or a management tool to control weeds) and include information about the central role of agriculture as one of the City of Boulder charter purposes of open space.

OSMP also leads a variety of outreach efforts aimed at raising the community's awareness of agricultural practices on OSMP. These include outreach at OSMP's booth at the farmers' market where lambs from one of OSMP's lessees have been on display. OSMP has worked with farmers leasing city open space to create signs identifying vendors as OSMP lessees. OSMP also features the role of agriculture in several local parades. Interpretive signs at trailheads and elsewhere highlight agricultural practices on OSMP lands.

# Education and Outreach

## Existing Conditions

Other agriculturally related education efforts aimed at raising the community's awareness of agricultural practices and outreach include speaking at symposia and conferences, an interpretive display and small-scale agricultural garden at the Ranger Cottage, an apple cider pressing event, and tour of a local bee keeping operation. Children participating in OSMP's "Passport to Adventure" are required to eat locally-grown organic food to earn a patch for this children's activity.

## Objectives

- **Offer a variety of educational opportunities to the community to learn about, connect with and enjoy agricultural lands.**

## Management Strategies

**Develop an education and outreach program specific to agriculture on OSMP lands and that promotes the City of Boulder food policy (Figure 55).**

Topics of Interest to Explore for Education and Outreach Programs

- The farm to table food cycle - from tilling to table
- The roles farming and ranching play in our community and in shaping the landscape
- The integral and critical role of water resources in agriculture
- How community members can support local farmers
- A day in the life of a local farmer
- "Respectfully crossing working lands" (this topic is explored further in the Public Access/Passive Recreation section of the plan)

Figure 55

Explore additional outreach opportunities (Figure 56).

Additional Outreach Opportunities

- Signs identifying OSMP agricultural properties visible from roads or trails
- Temporary signs to interpret agricultural practices such as prescriptive grazing

Figure 56

# Education and Outreach

## Management Strategies

Continue and expand existing services/programs shown in Figure 57.

### Existing Services/Programs

- Natural Selections hikes
- Requested hikes
- Outreach efforts at the Boulder Farmers' Market, Fall Fest, Creek Fest, parades and other venues

Figure 57

**Explore offering experiential programs connecting the Boulder community to local food production and working landscapes (Figure 58).**
Note: Many experiential educational activities relate to agritourism, farm events and community farming. These types of activities are described in the Community Connections and Partnerships section of this chapter.

Explore ways to connect youth, families and the community to working landscapes through education, events and creating hands on places for the production of food and related activities.

### Potential Experimental Programs and Events

- A demonstration farm offering hands-on education events and/or community farming opportunities (identified as a potential pilot program in the Community Connections and Partnerships section of this chapter)
- Harvest festivals and related events
- U-pick events (identified as a potential pilot program in the Community Connections and Partnerships section of this chapter)
- Farm camps
- Community gardens
- Farm tours
- Planting, harvesting, processing and preparing locally made foods and meals
- Internships and other training opportunities for community members to gain hands-on farming experience
- Guided/interpretive equestrian trail rides

Figure 58

# Education and Outreach

## Management Strategies

**Explore and create partnerships to develop opportunities and programmatic components** (i.e., contract for educational services). Determine what educational offerings can be provided with existing staff, additional staff, by partnering and/or by contracting for educational services. Look for partner opportunities with other agencies. Invite policy makers to educational programs.

## Measures of Success

- Types/diversity of agriculture specific educational opportunities.
- Increased number of agriculture specific educational opportunities offered.
- Effectiveness of education and outreach programs.
  - A strong community connection to local food in terms of understanding food production and working landscapes.
  - Community participation in the production of food and associated activities through hands-on practices, events.
  - Increase in Boulder youth understanding of agriculture, food production and employment opportunities in agriculture.

## Estimated Implementation Costs

- $$ - $$$ for increased staffing, additional outreach – depending on level of additional outreach
- $ for outreach materials, such as signs, print or electronic materials

Kristin Weinberger

# Service Learning and Volunteers

## Existing Policy Guidance

**Open Space LRMP**
Through the OSMP volunteer programs, the public will be encouraged to participate in the accomplishment of the purposes of OSMP as stated in the City Charter. The department will encourage and create opportunities for the involvement of volunteers at all levels of the department within appropriate individual and group programs and research activities.

The department will make a planned and organized effort to provide volunteer work that is meaningful, productive and satisfying both for volunteers and OSMP staff.

**VMP**
Involve the public in managing OSMP lands by providing varied ways to give input to decisions and volunteer opportunities that foster learning and stewardship.

Provide a range of volunteer opportunities that allow visitors to help take care of OSMP lands and better appreciate its resources.

Provide volunteer opportunities for community members to deepen their commitment and formalize their relationship to OSMP lands.

## Existing Conditions

OSMP staff across the department, including Agriculture Resources, Volunteer Services and Junior Rangers, are dedicated to organizing and offering agriculturally related service learning volunteer projects to the community.

The purpose of service learning and volunteer opportunities is to deepen the community's connection to local agriculture and agricultural producers (lessees), cultivate a hands-on connection to the land, and broaden the community's knowledge of the history of farming and ranching on OSMP. Service learning and volunteer opportunities provide participants with new and meaningful ways to experience one of the OSMP Charter purposes, and gain insight into what it takes to grow food or raise livestock, and experience up close and personal interactions with farmers, ranchers and farm animals.

These opportunities have the added benefit of providing assistance to OSMP farmers and ranchers. They also serve to support farmers and ranchers by showcasing sustainable agricultural practices and potentially increasing their local customer base and support.

Outreach efforts for volunteer projects are conducted at the Boulder Farmers' Market, on OSMP's volunteer services website, as well as by distributing and posting handouts throughout the city. Opportunities are open to all ages, including families, individuals, businesses/organizations, schools, Junior Rangers and OSMP staff. Past participants include Mile High Youth Corps, Junior Rangers, AmeriCorps National Civilian Conservation Corps and Bridge House Ready to Work (a local transitional work program for homeless men and women).

# Service Learning and Volunteers

## Existing Conditions

The scope of agricultural service learning and volunteer opportunities varies from single-day projects to multiple day programs and projects (e.g. lamb feeding). Projects (as shown in Figure 59) are planned considering staff and lessee needs, community interest and focus on innovation and collaboration.

### OSMP Agricultural Service Learning and Volunteer Projects

- Market farm projects - planting, weeding and harvesting
- Fence repair and construction
- Wildlife-friendly fence installation
- Ditch maintenance - clearing vegetation, maintaining the ditch structure and liner installation
- Agricultural property cleanup - removing trash and unusable materials and equipment
- Agricultural structure (farm houses and outbuildings) deconstruction, clean up or restoration
- Lamb feeding (bottle-feeding orphaned lambs)
- Orchard planting
- Bee pollinator garden projects - planting pollinator attractant plants/shrubs/bushes/grasses
- Interdisciplinary projects (e.g. grazing and IPM) - installation of temporary fences
- Flood restoration projects - debris and trash removal, fence clean up, removal and/or repair
- Cattle guard installation to improve the recreational (primarily biking) experience

Figure 59

# Service Learning and Volunteers


## Objectives

- **Retain existing service learning and volunteer opportunities to encourage the community to learn about, connect with and enjoy agricultural lands.**
- **Develop new and innovative opportunities for service learning and volunteer activities related to agriculture.**

## Management Strategies

**Continue offering service learning and volunteer activities related to agriculture.** Service learning and volunteer opportunities will be available based on the availability and need of agricultural operators (lessees) and/or OSMP staff and community interest.

**Explore offering new and innovative opportunities for service learning and volunteer activities related to agriculture.** Explore service learning and volunteer activities related to stacking hay, animal care opportunities, bee keeping, farm stands, and other ranching and vegetable farm activities. Investigate what other agriculturally based volunteer projects are offered by peer agencies both regionally and nationally. Explore the ideas of a Fund a Future Farmer program and Junior Ranger Farmer program.

**Continue offering volunteer activites related to enhancing recreational infrastructure on shared agricultural lands.**

**Explore service learning and volunteer activities related to maintaining and/or enhancing visitor infrastructure and providing new recreational opportunities.**

# Service Learning and Volunteers

## Measures of Success

- Types of service learning and volunteer opportunities offered.
- Increased number of service learning and volunteer opportunities offered.
- Increased number of lessees participating in the offering of volunteer or service learning opportunities.
- Effectiveness of service learning and volunteer opportunities offered.

## Estimated Implementation Costs

- No additional costs have been identified.

Beau Clark

Dave Sutherland

# Acquisitions

# Land and Water Acquisitions

## Existing Policy Guidance

### City Charter ARTICLE XII. OPEN SPACE

Sec. 176. Open Space Purposes – Open Space land

- Preservation of agricultural uses and land suitable for agricultural production.
- Preservation of water resources in their natural or traditional state, scenic areas or vistas, wildlife habitats, or fragile ecosystems.
- Preservation of land for its aesthetic or passive recreational value and its contribution to the quality of life of the community.

### 2013-2019 OSMP Acquisition Update

The acquisition update frequently references the priorities and implementation of the Grassland Plan, which provides high-level direction regarding not only the management of OSMP's agricultural properties, but the importance of identifying, acquiring and preserving agricultural properties.

- OSMP water rights are most related to implementation of the Grassland Plan initiatives, including agricultural management and ecological restoration.
- The department will attempt to acquire mineral and water rights associated with or of benefit to its land interest if financially feasible, and if such purchase is consistent with the objectives and priorities of the Open Space program.

### City of Boulder Sustainability Framework

Safety and Community Well-Being

- Identify and acquire lands (and waters) suitable for local food production.

Community Character

- Consider the acquisition of properties farther from the city to address increasing demand for open space visitor services and when properties are especially well-suited for desired community services (e.g. local organic agriculture).

## Existing Conditions

OSMP's early acquisitions of land for agricultural uses largely coincided with the approval of the 1967 sales tax intended to limit urban sprawl. OSMP currently owns (in fee) approximately 36,000 acres of land, of which approximately 15,000 acres are leased or managed for a diversity of agricultural uses (Map 2). OSMP owns water rights in more than 50 separate water entities, with full ownership of more than 30 irrigation ditches.

OSMP has an acquisition Capital Improvements Program (CIP) as well as bonding authority to acquire important properties and water rights. A separate CIP allows OSMP to make immediate capital improvements on recently acquired properties to help support agricultural management, use and overall viability. Another CIP provides for OSMP's acquisition of important water rights.

## Objectives

- **Strategically acquire properties and water resources with agricultural value.**

# Land and Water Acquisitions

## Management Strategies

**Identify and pursue strategic acquisition of land and water resources that will help OSMP meet the objectives and management strategies identified in this plan, that meet multiple objectives, or are at risk of loss.**

Examples include properties with potential for:

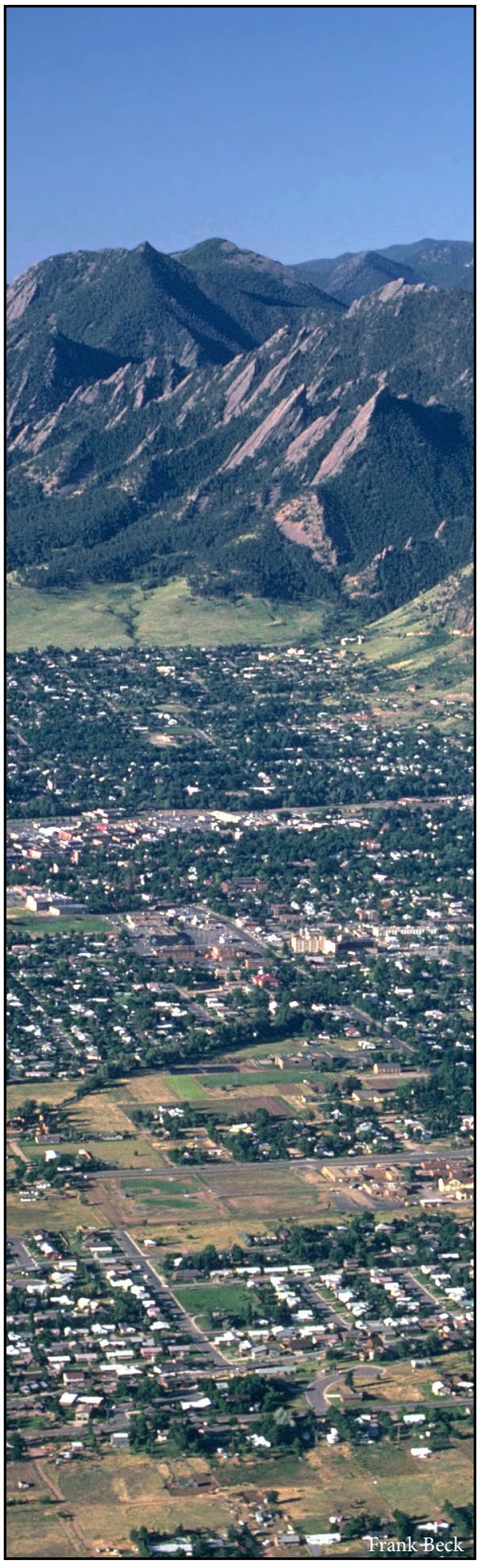
- Diversified Vegetable/Pastured Livestock Farming.
  - Good quality soils and topography, water availability, infrastructure, proximity to other properties.
- Direct, on-site sales or other agriculturally related activities related to connecting farmers to local markets.
- Providing services/resources to farmers and ranchers.
- Integrating agricultural management with ecological goals. (e.g. prairie dog relocation sites, bobolink habitat)
- Agricultural activities related to connecting the community to agriculture.

## Measures of Success

- Properties/acres acquired that support agricultural operations.
- Water rights acquired that support agricultural operations.

## Estimated Implementation Costs

- Costs are calculated based on the property and/or water rights being acquired. Location, infrastructure, building rights, agricultural productivity (including irrigable lands) and water rights all influence the market valuation of properties.



Frank Beck


# Plan Implementation

# Plan Implementation

The purpose of the Ag Plan is to maintain and enhance agricultural values of the community by ensuring the long-term sustainability of agricultural operations, taking a conservation approach that supports the ecological health of OSMP lands, and fostering key connections between the community and its agricultural lands. The plan identifies a range of strategies including on the ground management, technical analyses, business practice improvements and future planning efforts necessary to achieve this purpose.

These strategies will be prioritized, phased and implemented through integration with the OSMP Capital Improvement Program (CIP) and the development of annual operating budgets. This process will take into consideration the relative contribution of each strategy to improve agricultural and ecological sustainability as well as building and maintaining strong community connections with OSMP's agricultural programs. Strategies with widespread and long-lasting benefits across multiple objectives will typically be given higher priority.

During CIP and operating budget development, staff will also consider and integrate additional factors as appropriate, including:

- cost, available staffing and other capacity constraints
- timing requirements (coordination with other related or nearby projects)
- sequencing based upon the need to complete precursor projects ahead of dependents
- prior commitments to the community
- the level of community support and expectation for projects that are otherwise equal
- the need or desire to establish and cultivate partnerships, and the readiness of potential partners to engage

**Capital Improvements Program**
The CIP is a six-year plan for physical improvements to deliver open space services to the community and identifies all planned capital improvement projects and their estimated costs over the six-year period. The intent of the CIP is to lay out a schedule of capital projects to address current facility deficiencies and enhance the level of open space service delivery.

The CIP includes projects that result in the construction of major facilities typically costing $50,000 or more. To provide more transparency, capital projects estimated at less than $50,000 are identified because they have been or may be of interest to the public and decision-makers and may be aggregated into a single project. In addition, capital projects have the following characteristics:

- **Durable,** with a useful life of at least 15 years
- **Facility-based** rather than consumable items or short-lived equipment or services
- **Temporally Discrete (i.e., one-time**)—not recurring items
- **Spatially Discrete** rather than many unrelated projects spread out over a large area

CIP projects include capital maintenance, capital enhancement, property acquisition (e.g., land, water and mineral rights) and capital planning studies.

**Operating Budget**
The operating budget is designed to provide funding for all ongoing city operations, as well as one-time, non-capital projects and work efforts, and to provide general support of the city and council work plan. Personnel costs, materials and supplies, and general operational overhead are included in the operating budget.

# Plan Implementation

## Plan Implementation Costs

The plan identifies 112 strategies with a total estimated ten year cost from $12.9- $21.3 million. This estimate reflects the total cost of capital improvements, current operations funding and additional operations funding needs (Figures 60 and 61).

From an operations perspective, staff recognizes that it may not be possible to fully implement the entire set of investments because of limitations in funding and the needs of other OSMP programs outside of this plan. Strategies can be scaled down, value engineered or implementation phased to allow for progress within budget constraints.

OSMP will also look for additional opportunities to fund plan implementation through grants, partnerships and working with community volunteers.

### Budget Categorization and Level of Investment for Plan Strategies

| Type of Cost | Estimated 10-year Level of Investment | Number of Strategies/Implementation Actions |
|---|---|---|
| Existing Operations Budget | $9,000,000 | 74 |
| New Operating Expenses | $400,000 - $2,700,000 | 13 |
| Total Capital Improvements | $3,500,000 - $9,600,000 | 25 |
| **TOTAL** | **$12,900,000 - $21,300,000** | **112** |

Figure 60

### Capital Costs and Additional Operating Costs by Plan Focus Area

| Focus Area | Estimated 10-year Level of Investment | Number of Strategies/Implementation Actions |
|---|---|---|
| Agricultural Management | $3,300,000 - $9,100,000 | 43 |
| Ecological Integration | $400,000 - $2,000,000 | 47 |
| Community & Visitor Integration | $200,000 - $1,200,000 | 20 |
| Acquisitions | $ * | 1 |
| Research | $ ** | 1 |
| **TOTAL** | **$3,900,000 - $12,300,000** | **112** |

Figure 61

*OSMP Acquisitions are typically undertaken to deliver as broad a range of open space services as practical. Although land and water acquisitions will be an important strategy for this plan, no specific funding levels have been identified.

**Research topics identified in this plan will be integrated into the existing OSMP Research Program as appropriate.

# Plan Implementation

Many of the plan's strategies represent practices, projects and actions that have been, or could be accomplished within the constraints of the current operating budget. These include on-going aspects of agricultural management such as "Lease land to agricultural producers" and "Continue the practice of incorporating native grasslands in agriculture leases", as well as improvements such as "Transition existing lessees into new lease and renewal process." These strategies are listed in Appendix F.

The plan also identifies 13 strategies that would require additional operating funding. These include the development of lease-specific stewardship plans, new agricultural community engagement programs and developing a program to assist operators with succession planning (Appendix G). This operating funding estimate includes funding needed for seasonal, temporary or standard staffing. Between two and five additional fulltime equivalents would be needed for restoration, facility maintenance, project management, monitoring and technical support to operators. Additional staffing will be most important for the development of stewardship plans and prairie dog management. Stewardship plans are integral to the planned innovations in OSMP's agricultural leasing program. Additional capacity for prairie dog management will improve the degree to which OSMP can address a significant issue affecting the sustainability of agricultural operations.

There are 25 strategies identified for funding through the OSMP CIP. These include the enhancements and maintenance of water delivery and facility infrastructure that support sustainable agriculture on OSMP lands as well as capital planning projects to support those projects, Figure 62 (Appendix H).

CIP Funding by Category

| CIP Category | Estimated Investment |
|---|---|
| Capital Enhancement | $1,860,000 - $5,635,000 |
| Capital Maintenance | $1,630,000 - $3,750,000 |
| Capital Planning Studies | $45,000 - $180,000 |

Figure 62

The OSMP CIP currently includes $200,000 each year for the acquisitions of water rights. These acquisitions have been mostly to support agricultural operations; but OSMP has also acquired water rights to support instream flows.

The estimated cost of projects will change as additional evaluation and planning occurs for project implementation and as staff integrates the outcomes from recently completed work products such as the OSMP Facilities Inventory and Assessment and the Water Rights Portfolio Assessment.

# Plan Implementation

Phil Yates

Klaus Girk

# Appendices

# Appendix A: Acronym List and Glossary

## ACRONYMS

**Ag Plan** = Agricultural Resources Management Plan

**ATV** = All-Terrain Vehicle

**AUM** = Animal Unit Month

**BCCP** = Boulder County Comprehensive Plan

**BCPOS** = Boulder County Parks and Open Space

**BMPs** = Best Management Practices

**BOAs** = Best Opportunity Areas

**BVCP** = Boulder Valley Comprehensive Plan

**BVSD** = Boulder Valley School District

**CAO** = City Attorney's Office

**CIP** = Capital Improvement Program

**CSA** = Community Supported Agriculture

**CSU** = Colorado State University

**CWA** = Clean Water Act

**EPA** = Environmental Protection Agency

**FIFRA** = Federal Insecticide, Fungicide, and Rodenticide Act

**GMOs** = Genetically Modified Organisms

**Grassland Plan** = Grassland Ecosystem Management Plan

**HCAs** = Habitat Conservation Areas

**IBI** = Index of Biological Integrity

**IPM** = Integrated Pest Management

**NRCS** = Natural Resource Conservation Service

**OMRI** = Organic Materials Review Institute

**OSMP** = Open Space and Mountain Parks

**Open Space LRMP** = Open Space Long Range Management Policies

**Preble's** = Preble's Meadow Jumping Mouse

**SARE** = Sustainable Agriculture Research Education

**TSA** = Trail Study Area

**ULTO** = Ute ladies'-tresses orchid

**USDA** = United States Department of Agriculture

**USFWS** = United States Fish and Wildlife Service

**VMP** = Visitor Master Plan

## GLOSSARY

**Agribusiness:** An industry engaged in the producing operations of a farm, the manufacture and distribution of farm equipment and supplies, and the processing, storage, and distribution of farm commodities

**Agritourism (aka Agritainment):** An agriculturally-based commercial enterprise that brings visitors to a farm or ranch for activities, events or services. This includes pumpkin patches, corn mazes, hay rides, petting zoos and u-pick crops.

**Agronomy:** The science of land management, including crop production and soil management.

**Animal Unit Month (AUM):** Amount of forage needed to provide for a 1,000 lb. cow and her suckling calf grazing for one month.

**Best Opportunity Areas (BOAs):** Identified areas that are best for conserving or restoring conditions or implementing identified objectives and/or management strategies.

**Bioengineering:** The application of engineering principles and techniques to biological systems.

**Brome:** An introduced cool-season grass used predominately in the Boulder Valley for pasture and hay,

**Carbon Sequestration:** The capture and storage of carbon dioxide in plants, animals and soil using natural ecosystem processes.

**Certified Organic:** A label applied to food or other agricultural products that comply with standards set by the USDA's National Organic Program and have passed inspection by an accredited certifying agent. Certified organic products are free from synthetic fertilizers and pesticides, sewage sludge, genetically modified organisms, and ionizing radiation.

**Climate Change:** Any significant change in the measures of climate, such as temperature, precipitation, or wind patterns, among other effects, lasting for an extended period of time and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossils fuels.

**Community Farming:** Includes farming on a small scale with opportunities for local communities to invest directly in their food system, help create sources of healthy, locally-produced food, and enjoy social, economic, environmental and agricultural benefits. Examples of community farming efforts include demonstration farms, community gardens and food forests.

**Co-operative:** An organization of farmers for marketing their products or buying supplies.

**Cross Vanes:** A cross vane is made up of a set of upstream angled lines of boulders, connected by a section of smaller rocks upstream. Water flow is diverted over the rock walls and concentrated down the center of the channel. The scouring associated with high flow velocities in the center of the channel and the "waterfalling" over the structure itself creates a deep, elongated pool.

**Demonstration Farming**: A farm which is used primarily to educate, through demonstrations of agricultural methods, practices and crops.

**Direct Sales Opportunities:** Opportunities to market and sell products directly to consumers.

**Diversified Vegetable/Pastured Livestock Farm:** A farm that produces a variety of vegetable crops and cultivars. These farms frequently integrate animals into their vegetable operation, most commonly pigs or chickens, to better cycle nutrients, rest fields, and use waste vegetables as a feedstock.

**Easement:** An easement granted by a landowner to a public or private entity (as a land trust) in which the landowner agrees to restrictions on use of the land (as from development) and the holder agrees to enforce the restrictions.

**Ecology**: A branch of science concerned with the interrelationship of organisms and their environments.

**Ecosystem:** The dynamic complex of organisms and their environment contained within a specified area during a specified time. Systemic elements include interactions and feedbacks between components.

**Erosion:** Natural processes (weathering, dissolution, abrasion, corrosion and transportation) by which material is worn away from the earth's surface.

**Eutrophication:** A type of pollution caused by the over enrichment of nutrients like nitrogen and phosphorous in a water body. Excessive nutrients can stimulate excessive algae growth that creates hypoxic and anoxic conditions in the water when the algae die and are decomposed by bacteria. Eutrophication can be a natural process, but human activities can accelerate the rate at which nutrients enter water bodies, through development, pollution, sewers and septic, and agriculture.

**Farm Events:** Activities, such as farm-to-table dinners and family events, that are being evaluated by staff to determine whether they are suitable for OSMP lands as an additional source of revenue for lessees and an opportunity for community members to connect more closely with OSMP agricultural lands.

**Farm Stand:** A location for the sale of agricultural and horticultural products, for a period not to exceed 42 days in any calendar year. Non-agricultural and non-horticultural products may comprise no more than ten percent of sales. This use includes Christmas tree and pumpkin sales.

**Farm Stores:** A location for the sale of agricultural and horticultural products for more than 42 days in a calendar year. The products for sale may include, but are not limited to, the sale of seasonal produce, which does not have to be grown on site.

**Farm-to-Table:** A social movement that promotes serving fresh, seasonal, and locally-grown food at restaurants, breweries, and school cafeterias through direct acquisition from the producer.

**Fecal Coliform:** A bacteria present in the lower intestines of warm-blooded animals. The presence or absence of fecal coliform is used as an indicator of water quality.

**Flood Irrigation:** A low-energy method of irrigating crops by delivering water to the field by ditch, pipe, or some other means and allowing the water to flow over the ground through the crop.

**Floodplain:** The low-lying area adjacent to a river or stream that is naturally subject to flooding.

**Genetically Modified Organisms (GMOs):** Organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has been altered through means other

than mating and/or natural recombination so that it contains one or more genes not normally found there. These genes can be transferred from one organism into another and also between unrelated species.

**Grass Banks:** Large grazeable areas that are not currently leased for agricultural operations but could be made available for livestock grazing during times of need, for instance drought, fire, or other natural resource considerations.

**Greenhouse:** A permanent structure used to extend the growing season that has heat, mechanical ventilation, artificial light and irrigation systems for a controlled environment in which plants are not typically grown in the ground.

**Habitat:** The environment where a plant or animal naturally or normally lives and grows.

**Hoophouse:** A temporary structure constructed of metal or plastic hoops covered with a single layer of polyethylene film used to extend the growing season and reduce production risks associated with inclement weather. Hoophouses lack the precision environmental control of greenhouses and typically rely on passive heating and cooling. Hoophouses are also known as polyhouses, hoop greenhouses, or high tunnels.

**Integrated Pest Management (IPM):** Focuses on the long-term prevention or suppression of pest problems while minimizing the impact on human-health, the environment and non-target organisms.

**Invasive Species:** A species that is non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

**Irrigation:** The supply of water to land or crops to help growth, typically by means of channels.

**Laterals:** A branch off of a main ditch used to deliver irrigation water to a shareholder.

**Lessees:** Farmers and ranchers who lease land from OSMP in support of their agricultural operations and act as stewards of the land.

**Micro Dairy:** A small-scale dairy operation, typically milking 10 or fewer cows, or the equivalent number of sheep, goats or other dairy animals. Milk is marketed directly from the farm, allowing the farmer to capture the full value of their milk.

**Mitigate:** To cause to become less harsh or hostile.

**Monoculture:** The agricultural practice of growing single crops intensively on a large scale.

**Monotypic**: Aggressive growth of an invasive species to the displacement and/or exclusion of other species, resulting in lowered habitat values and fewer ecosystem services.

**Mycorrhizal soil fungus:** A fungus that forms a symbiotic relationship with the roots of a vascular host plant. The mycorrhizal fungi increase plant uptake of water and soil nutrient in exchange for carbohydrates from the plant.

**Neonicotinoids:** A class of neuro-active insecticide that is extremely toxic to insects at very low doses. Neonicotinoids are commonly used in seed coatings in agriculture and in the production and maintenance of ornamental plants and turf.

**Noxious Weeds**: A weed that has been designated as injurious to agricultural productivity and environmental values of the State of Colorado.

**Nutrient Loading:** The quantity of nutrients entering an ecosystem in a given period of time.

**Passive Recreation**: Passive recreation is described as one of the purposes of Open Space with six activities listed as examples: hiking, photography or nature studies, and, if specifically designated, bicycling, horseback riding or fishing.

**Pedology**: A branch of soil science that focuses on the study of soils in their natural environment.

**Pollinators:** Species such as bees (honey bees, solitary species, bumblebees), wasps, beetles, butterflies, flies, moths, birds and bats which are essential for the pollination of native plants, cultivated crops and the overall function of ecosystems.

**Prescribed Fire:** A planned fire, also sometimes called a controlled or prescribed burn, used to meet management objectives such as reducing the damage of wildfire by safely reducing excessive amounts of brush, shrubs and trees, encouraging new growth of native vegetation and maintaining the many plant and animal species whose habitats depend on periodic fire.

**Prescriptive Grazing:** The application of domestic livestock grazing during a specified time period and at a specified intensity to accomplish specific vegetation management goals such as controlling invasive plant populations and enhancing desirable vegetation conditions.

**Propagate:** Breed specimens of a plant by natural processes from the parent stock.

**Resilience:** The ability of a community to prepare for and respond effectively to stress.

**Riffles:** These are shallow places where water runs fast and is agitated by rocks.

**Riparian Areas:** Areas along streams and rivers, including related vegetation community.

**Runoff:** The portion of precipitation on land that ultimately reaches streams often with dissolved or suspended material.

**Sidecasting:** The practice of dumping excavated material or debris alongside the line or ditch being excavated.

**Soil Health:** The continued capacity of soil to function as a vital living ecosystem that sustains plants, animals and humans.

**Soil Horizon:** Various layers in the soil that differ in color, texture, structure, thickness, and chemical and mineral content. The arrangement of these horizons in the soil is called a soil profile. Soil scientists observe and describe soil horizons and profiles to classify and interpret the soil for various uses. Categories include O (organic), A (surface horizon), B (subsoil), C (substratum), and E (eluviated subsurface horizon).

**Stewardship Plan:** A plan that will be developed for every agricultural property being leased by OSMP. These plans will include details about permitted agricultural uses, intensity of agricultural use and stewardship requirements; any OSMP required special conditions including requirements related to recreation and/or ecological management; as well as outline the condition of facilities on the property and detail who is responsible for facilities maintenance and repair.

**Strategy:** A systematic long-term plan to deploy a sequence of actions toward achieving one or more goals and associated set of management objectives.

**Stream Morphology:** Alluvial streams (rivers) are dynamic landforms subject to rapid change in channel shape and flow pattern. Water and sediment discharges determine the dimensions of a stream channel (width, depth, and meander wavelength and gradient).

**Sustainable:** Of, relating to, or being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged.

**U-Pick Event:** An event that allows paying participants to harvest their own produce at a garden, farm or orchard.

**Water Banking**: Water banking is a voluntary, market-based tool that facilitates water transactions between willing sellers and buyers. Water rights owners, who are willing to free up some of their water in a particularly dry year or years, would temporarily lease it to those who can't afford to be without water.

**Water Gaps:** Places where livestock are provided access to water along creeks.

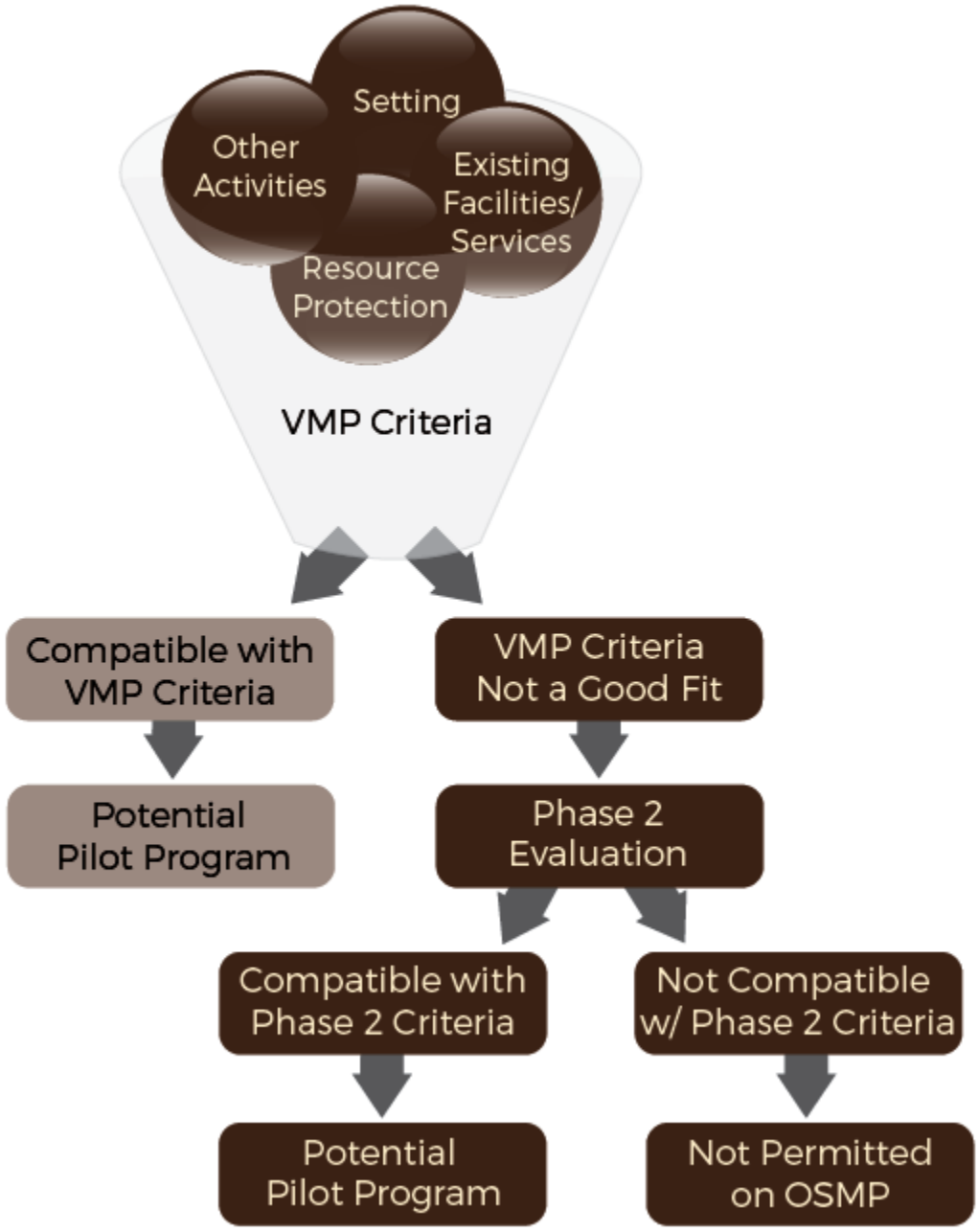
**Water Rights**: All surface and groundwater in Colorado is a public resource for beneficial use by public agencies, private persons, and entities;

1) A water right is a right to use a portion of the public's water resources;
2) Water rights owners may build facilities on the lands of others to divert, extract, or move water from a stream or aquifer to its place of use; and,
3) Water rights owners may use streams and aquifers for the transportation and storage of water.

**Wetlands:** Where water is present above or near the surface of soil. Wetlands vary depending on soils, topography, climate, water chemistry and vegetation.

## Appendix B: Process and Criteria for Evaluating New Agriculturally Related Activities

**Process for Evaluating New Agriculturally Related Activities**



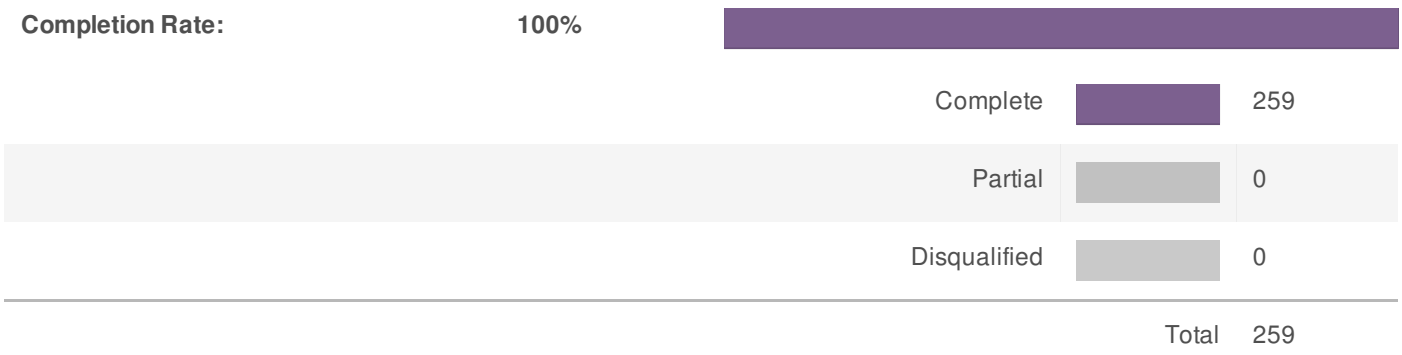
**VMP Passive Recreation Activity Assessment Criteria**

| | |
|---|---|
| Compatibility with other activities | Compatibility with preserving the quality of other visitors' experiences |
| | Effect on adjacent public and private land uses |
| Compatibility with resource protection | Compatibility with the long term preservation of natural resources |
| | Compatibility with the long term preservation of cultural resources |
| | Compatibility with the long term preservation of scientific resources |
| | Compatibility with the long term preservation of agricultural resources |
| Compatibility with existing facilities and services | Compatibility with a low level of visitor facilities |
| | Compatibility with low levels of visitor services |
| | Compatibility with providing a safe recreational experience |
| Relationship to setting | Activity's dependence on an agricultural setting and/or OSMP lands |
| | Activity's ability to increase people's appreciation of agriculture or understanding of open space purposes. |

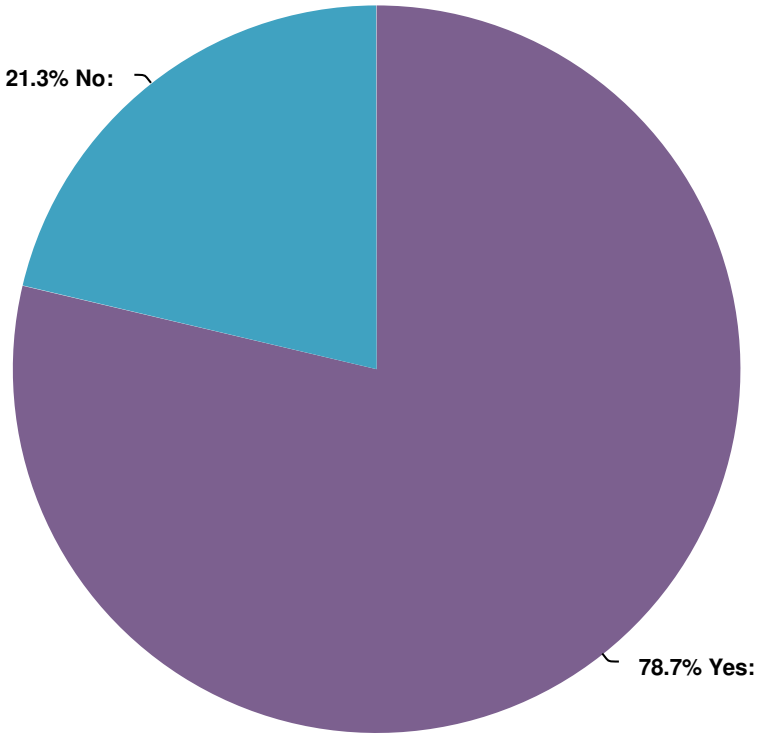
# Appendix C: Community Questionnaire Results

## Report for OSMP Agricultural Resources Management Plan

### 1. Response Counts

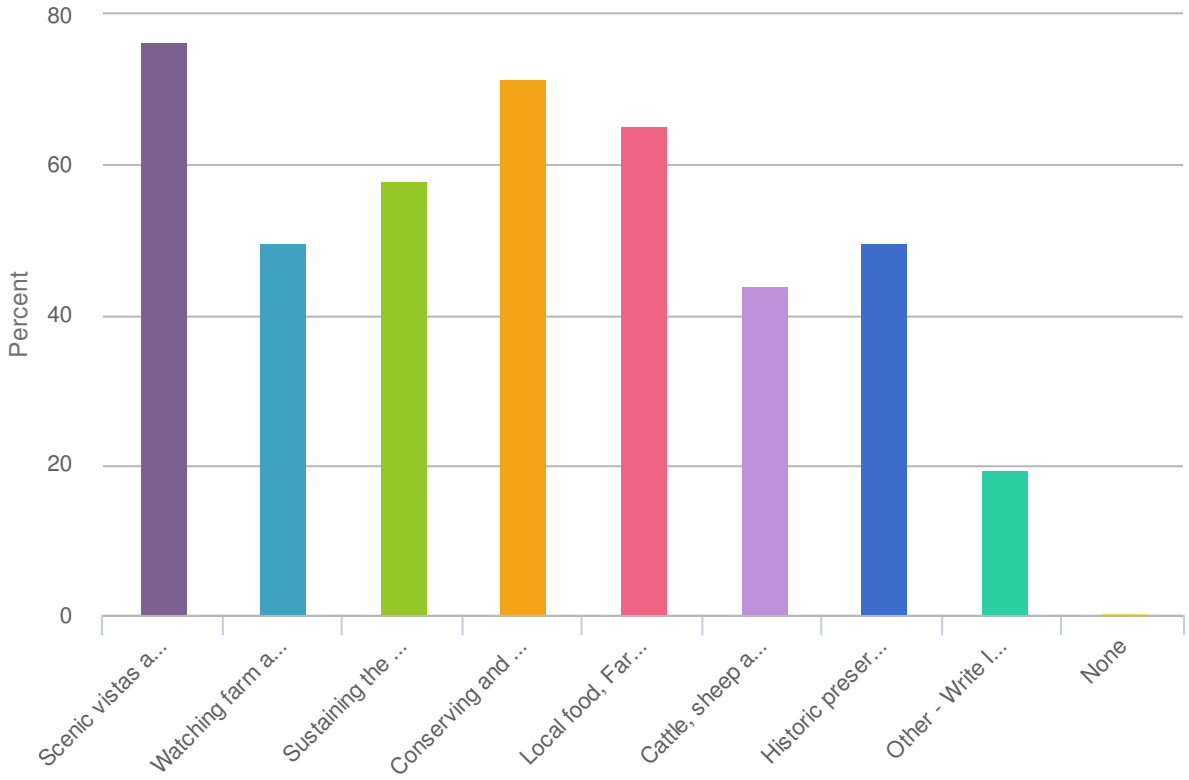


2. Did you know that the City of Boulder Open Space and Mountain Parks (OSMP) Department, in order to fulfill its city charter purposes, leases city open space to preserve the area's agricultural uses and land suitable for agricultural production?




| Value | Percent | | Count |
|---|---|---|---|
| Yes | 78.7% | | 203 |
| No | 21.3% | | 55 |
| | | **Total** | **258** |

## 3. Which items do you value most about City of Boulder Open Space and Mountain Parks' agricultural land? Please check all that apply.



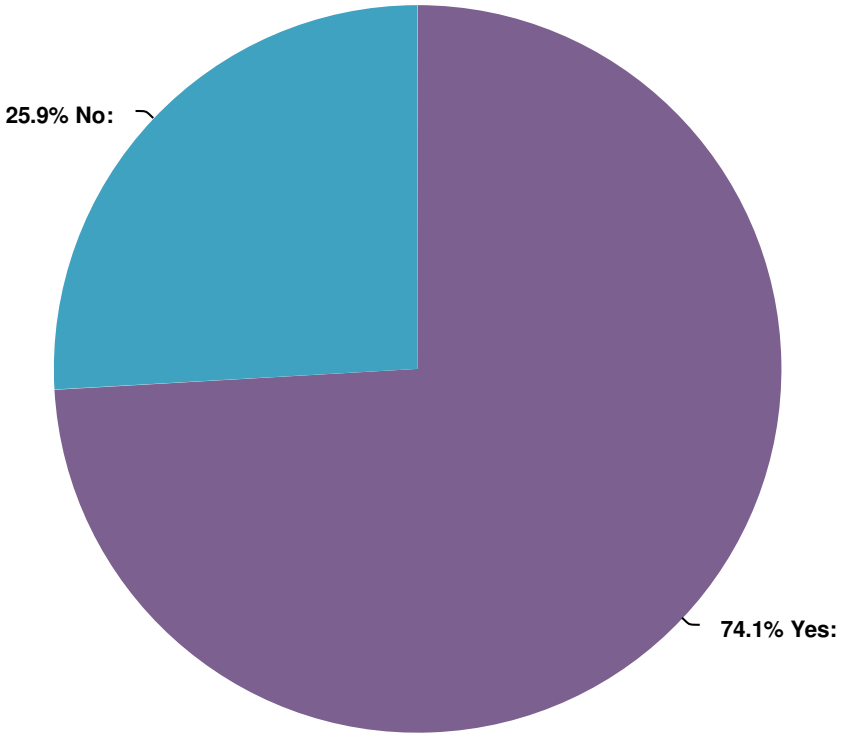

| Value | Percent | Count |
|---|---|---|
| Scenic vistas and seeing working agricultural lands, pastoral landscapes | 76.4% | 198 |
| Watching farm animals, farming machinery, ranchers and farmers in action | 49.8% | 129 |
| Sustaining the area's agricultural traditions | 57.9% | 150 |
| Conserving and managing plant and wildlife habitats | 71.4% | 185 |
| Local food, Farm-to-Market opportunities | 65.3% | 169 |
| Cattle, sheep and other livestock grazing | 44.0% | 114 |
| Historic preservation | 49.8% | 129 |
| Other - Write In | 19.3% | 50 |
| None | 0.4% | 1 |

| Other - Write In | Count |
|---|---|
| Total | 48 |

**Summary of Write-In Responses**

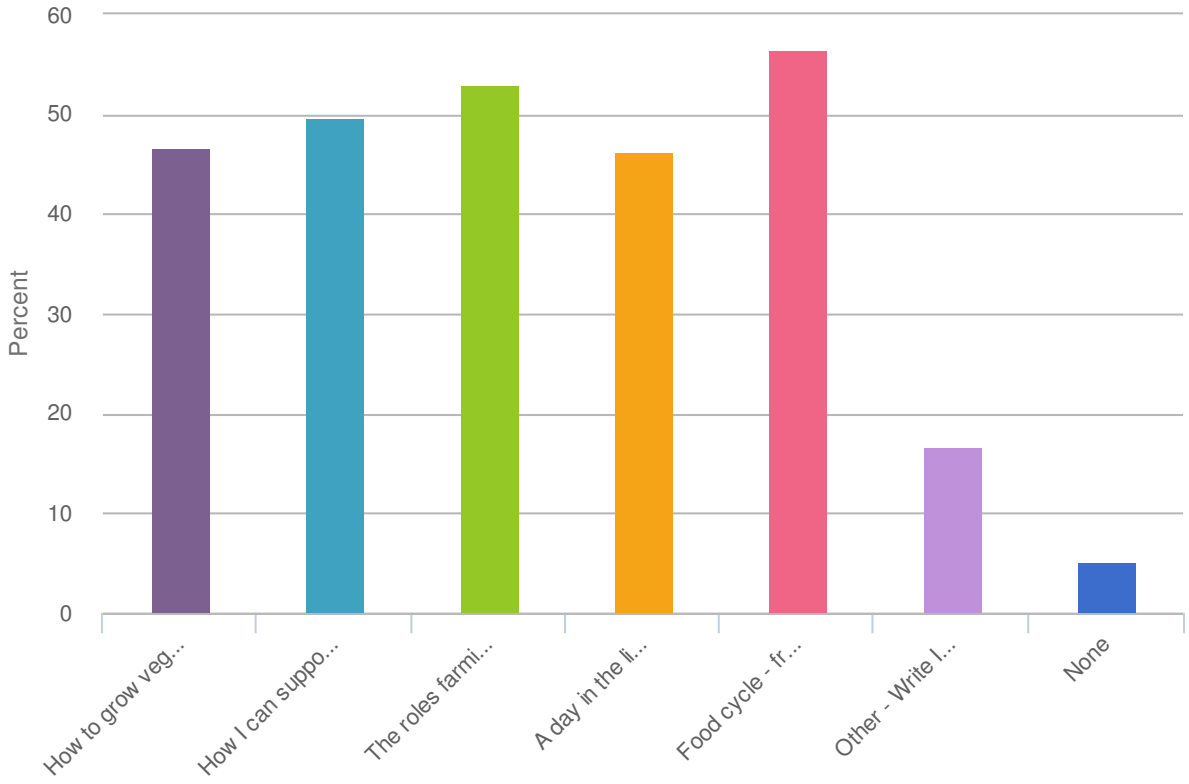
| |
|---|
| Access for Passive Recreation (hiking, running, biking, off-leash dog access, horseback riding, etc.) |
| Organic, GMO-, pesticide-, herbicide-, neonicotinoid-, chemical- free, sustainable agricultural practices |
| Accessibility of farmland to local farmers through affordable leasing programs |
| Protection of agricultural land from development |
| Opportunities to participate in and learn about local agriculture |

4. Did you know agricultural operations play a role in helping City of Boulder Open Space and Mountain Parks to conserve and manage wildlife and plant habitats?




| Value | Percent | | Count |
|---|---|---|---|
| Yes | 74.1% | | 192 |
| No | 25.9% | | 67 |
| | | **Total** | **259** |

## 5. What type of learning opportunities would you like to have available on City of Boulder Open Space and Mountain Parks' agricultural land?




| Value | Percent | Count |
|---|---|---|
| How to grow vegetables | 46.6% | 118 |
| How I can support local farmers and ranchers | 49.8% | 126 |
| The roles farming and ranching play in our community | 53.0% | 134 |
| A day in the life of a local farmer or rancher | 46.2% | 117 |
| Food cycle - from tilling to table | 56.5% | 143 |
| Other - Write In | 16.6% | 42 |
| None | 5.1% | 13 |

| Other - Write In | Count |
|---|---|
| Total | 40 |

**Summary of Write-In Responses**

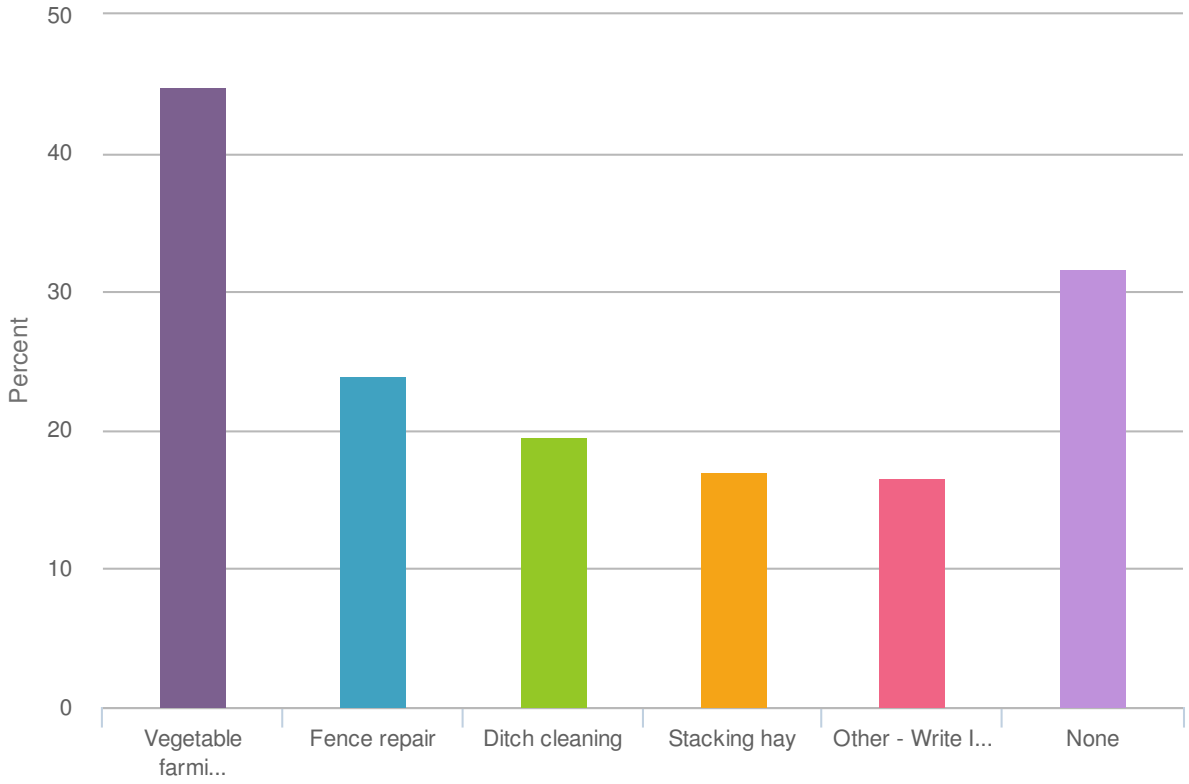
| |
|---|
| Apprenticeships and hands-on opportunities to participate in community farming |
| Farm tours/classes/workshops/programs that educate and connect adults and kids with ranching, farming, and our local food sources. |
| Opportunities to learn (e.g. how ag land helps conserve wildlife/plant habitats; how ag land benefits the environment and our community health; about plants and animals on OSMP ag lands; how/if OSMP ag lands are used to sequester carbon; water management and xeriscaping techniques) |
| Classes/demonstrations/research and development on how to grow food organically without pesticides/herbicides/petrochemical fertilizers and support soil health |
| Therapeutic horseback riding opportunities |
| Trails available for horse riding and other passive recreation |
| Increased awareness of/connection of community to local farmers (beyond farmers' markets) E.g. a webpage listing local farmers and how to buy from them |

6. Please list activities that you may want to do on Open Space and Mountain Parks' agricultural land, such as farm dinners and you-pick events.

**Summary of Write-In Responses**

| |
|---|
| Farm Dinners/Picnics/Potluck style gatherings |
| You-pick events (apples, berries, corn, peaches, pumpkins) |
| Pumpkin/Apple/Harvest/holiday festivals (family-friendly and dog-friendly seasonal events) |
| Private events (parties, weddings, etc.) |
| Music and Dancing events (barn dance/square dancing socials) |
| Volunteer activities (weeding/harvesting fields, ditch clearing, barn raising, conservation activities) |
| Apprenticeships/internships/opportunity to be a farmer for a day |
| Classes and demonstrations (e.g. farming techniques; importance of bee keeping; canning and preserving; growing healthy soils/compost, gardening tips, smart watering, ecofriendly insect and weed control tips, benefits of GMO-free farming, difference between heirloom and modern crops, etc. |
| Kids camp/field trips/educational talks and hands-on demonstrations (coordinate with BVSD) |
| Opportunity to meet/pet/milk/care for farm animals |
| Observe/participate in cattle operations: roundup, branding, sorting, calving (animal husbandry workshops) |
| Equine assisted therapy |
| Guided tours (walking/biking/horseback riding) sharing information about farming history and activities |
| Public access for activities such as hiking, horseback riding, dog-walking, biking, picnicking, photography, fishing, hunting, etc. |
| Community gardens/farms |
| Farm stands/CSAs |
| Hay/Wagon rides |
| Corn mazes |
| Stargazing |

## 7. What type of volunteer activities would you like to do on City of Boulder Open Space and Mountain Parks' agricultural land?



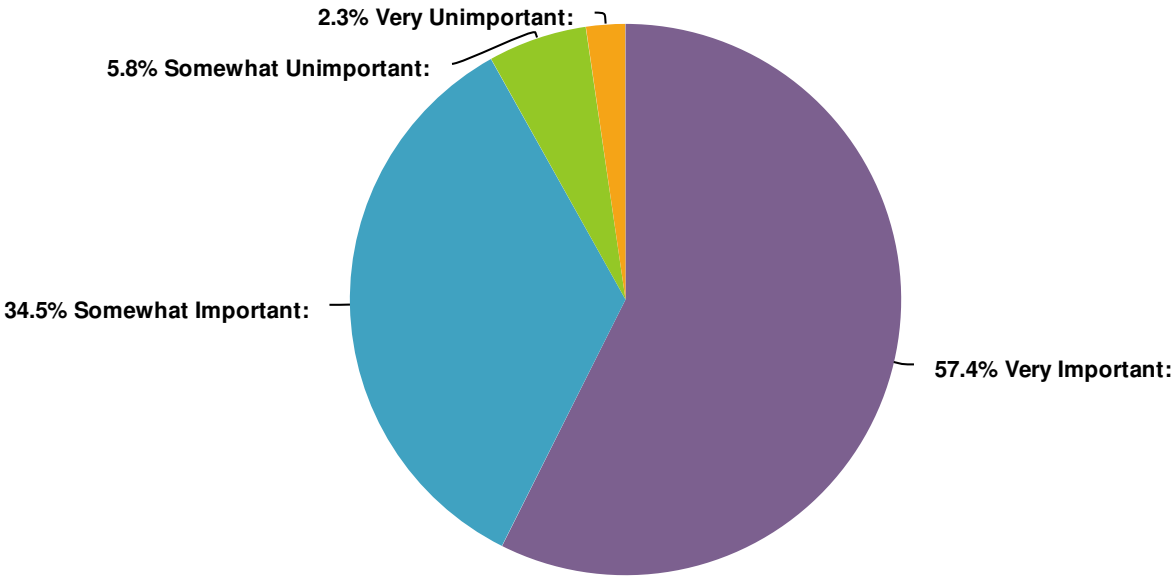

| Value | Percent | Count |
|---|---|---|
| Vegetable farming | 44.8% | 103 |
| Fence repair | 23.9% | 55 |
| Ditch cleaning | 19.6% | 45 |
| Stacking hay | 17.0% | 39 |
| Other - Write In | 16.5% | 38 |
| None | 31.7% | 73 |

| Other - Write In | Count |
|---|---|
| Total | 35 |

**Summary of Write-In Responses**

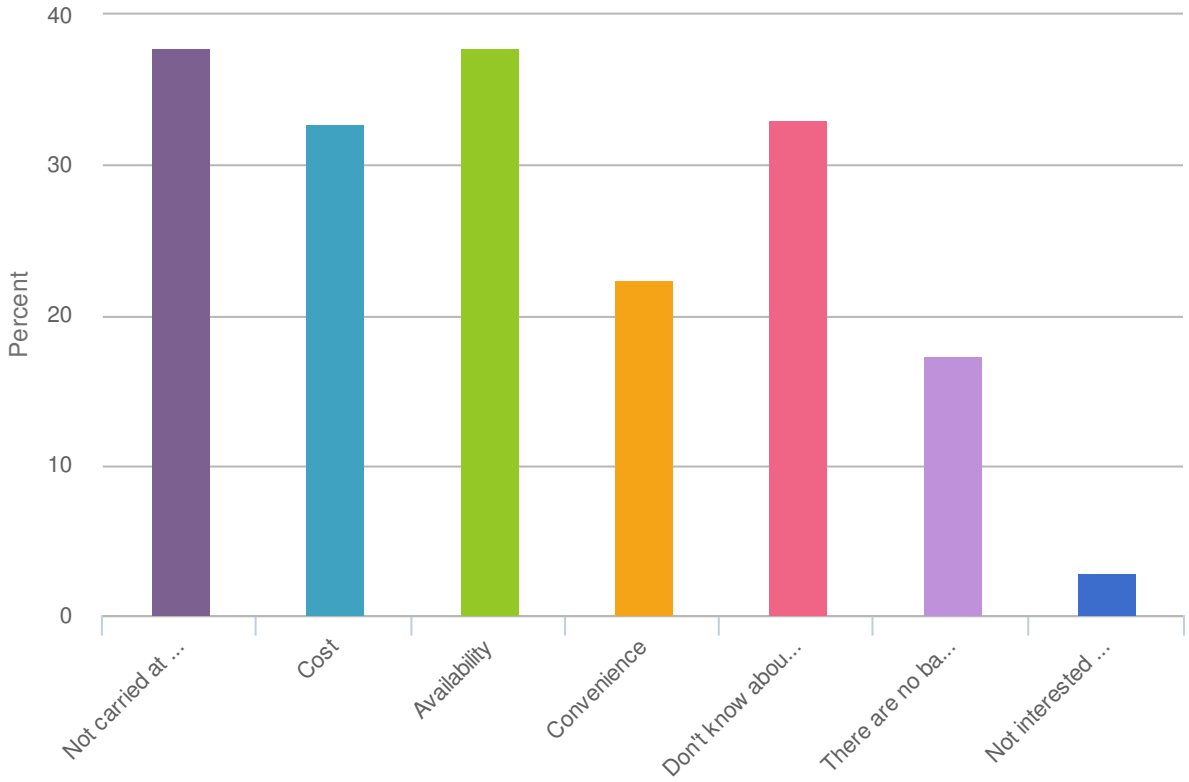
| |
|---|
| Cattle drives/branding |
| Animal care |
| Bee keeping |
| Barn raising |
| Weeding |
| General clean up |
| Fence removal |
| Harvesting/canning/preserving foods |
| Trail construction and maintenance |
| Farm stand sales |
| Installation of perennial food systems |
| Also see previous: desired activities (weeding/harvesting fields, ditch clearing, barn raising, conservation activities) |

## 8. How important is buying local food to you?



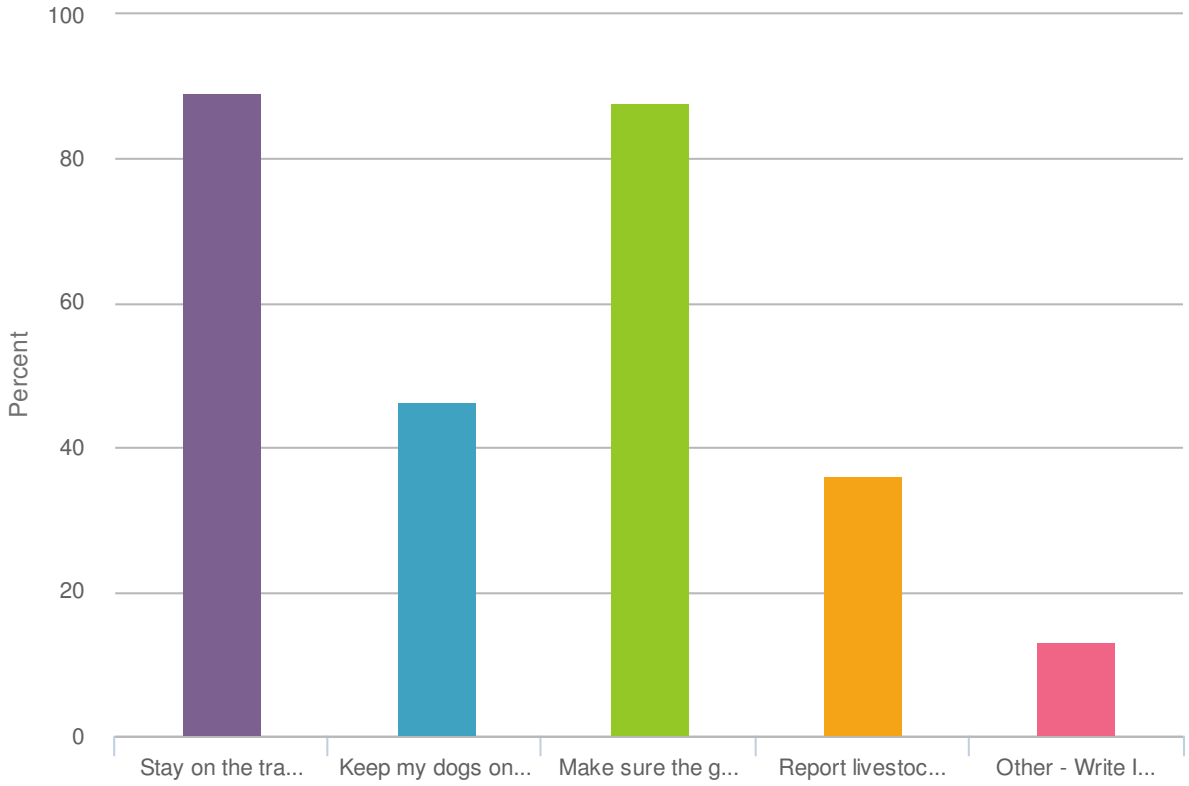

| Value | Percent | | Count |
|---|---|---|---|
| Very Important | 57.4% | | 148 |
| Somewhat Important | 34.5% | | 89 |
| Somewhat Unimportant | 5.8% | | 15 |
| Very Unimportant | 2.3% | | 6 |
| | | **Total** | **258** |

## 9. What are the barriers limiting you from purchasing food grown or raised on City of Boulder Open Space and Mountain Parks' agricultural land?




| Value | Percent | Count |
|---|---|---|
| Not carried at the grocery store | 37.8% | 96 |
| Cost | 32.7% | 83 |
| Availability | 37.8% | 96 |
| Convenience | 22.4% | 57 |
| Don't know about it | 33.1% | 84 |
| There are no barriers | 17.3% | 44 |
| Not interested in local food from OSMP | 2.8% | 7 |

## 10. While visiting City of Boulder Open Space and Mountain Parks' agricultural land, do you?




| Value | Percent | Count |
|---|---|---|
| Stay on the trail when near the pastures, hayfields and crops | 89.3% | 218 |
| Keep my dogs on a leash whenever livestock is visible | 46.3% | 113 |
| Make sure the gates are closed behind me | 87.7% | 214 |
| Report livestock outside of fenced fields | 36.1% | 88 |
| Other - Write In | 13.1% | 32 |

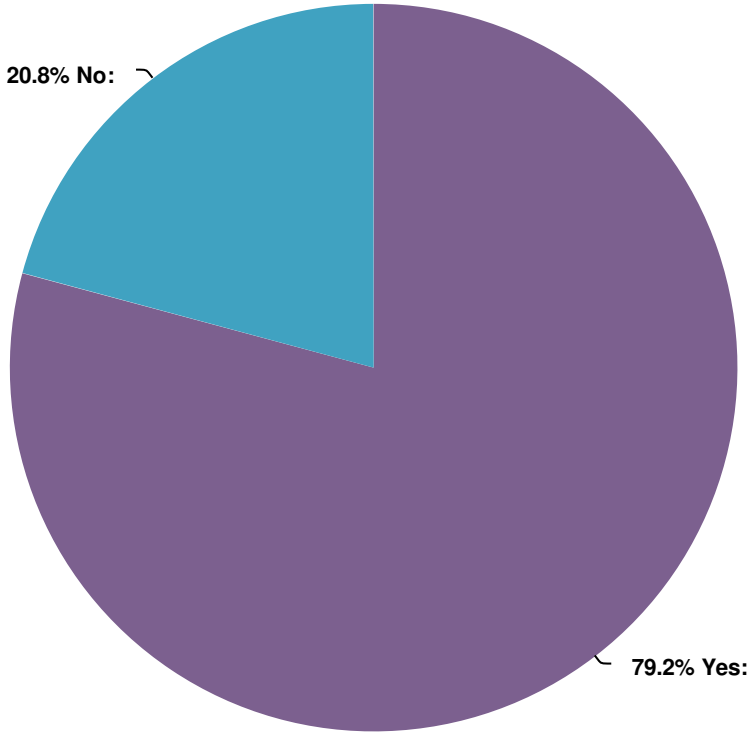
| Other - Write In | Count |
|---|---|

| | |
|---|---|
| Total | 31 |

**Summary of Write-In Responses**

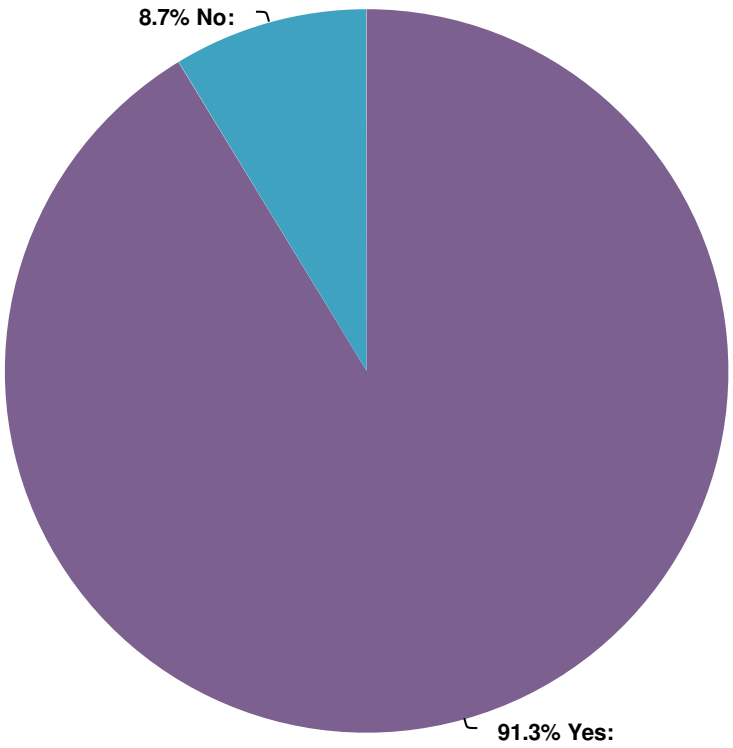
| |
|---|
| Respect habitat, wildlife and agricultural operations while on trail on agricultural land |
| Share trails safely and respectfully |
| Report safety issues and violations |
| Read signs along pathways and public access points |
| Volunteer |

**11**. Do you intentionally support local farmers and ranchers by seeking to purchase their products?




| Value | Percent | | Count |
|---|---|---|---|
| Yes | 79.2% | | 202 |
| No | 20.8% | | 53 |
| | | **Total** | **255** |

12. Would you support temporary closures of discrete agricultural fields in response to crop damage caused by humans or pets trampling crops during the production season?




| Value | Percent | | Count |
|---|---|---|---|
| Yes | 91.3% | | 230 |
| No | 8.7% | | 22 |
| | | **Total** | **252** |

**13**. Please describe how you support or connect with local farmers and ranchers. If nothing comes to mind, please leave this question blank.


| Count | Response |
|---|---|

**Summary of Write-In Responses**

| |
|---|
| Buy local foods, including meat, dairy and produce (from farmers' markets, local farm stands/ranchers, through CSAs, at local grocery stores) |
| Promote local food to friends and family |
| Eat at locally sourced restaurants |
| Attend farm dinners |
| Buy locally grown hay |
| Grow specialty crops for local brewers and herb companies |
| Volunteer |
| Bee keep |
| Take classes at farms |
| Talk with/wave to farmers while hiking/passing by or through ag properties |
| Attend agricultural open house days in Longmont |
| Attend Boulder County 4H and Fair |
| Attend ag tours/other OSMP events |
| Advocate for farmers on various committees, organizations and in front of City Council |
| Support a food hub to facilitate wholesale sales of local food |

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# Appendix D: Links to Source Documents of Existing Policy Guidance

***Federal***

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Migratory Bird Treaty Act (1918)

Endangered Species Act

U.S. Fish and Wildlife Service's Ute ladies'-tresses (*Spiranthes diluvialis*) Recovery Plan

Bald and Golden Eagle Protection Act (1940)

U.S. Fish and Wildlife Service's National Bald Eagle Management Guidelines (2007)

Clean Water Act (CWA)

***State***

Colorado Right to Farm Enabling Statutes

Section 7 of Article XVI of the Colorado Constitution

Title 37, Article 84 of the Colorado Revised Statutes

Colorado Pesticide Act

Colorado Pesticide Applicators' Act

Colorado Climate Plan (2015)

Colorado Climate Change Vulnerability Study (2015)

Colorado Water Plan (2015)

Colorado Natural Heritage Program

Colorado Division of Parks and Wildlife "Recommended Buffer Zones and Seasonal Restrictions for Colorado's Raptors"

Colorado Water Law

Colorado Department of Public Health and Environment, Water Quality Control Commission sets the state water quality standards.

***County***

Boulder County Comprehensive Plan (BCCP)

Boulder County floodplain protection program

***Local***

City Charter ARTICLE XII. Open Space

Boulder Valley Comprehensive Plan (BVCP)

Boulder Revised Code (Section 2-2-8)

Boulder Resilience Strategy

Open Space Long Range Management Practices (Open Space LRMP)

Grassland Ecosystem Management Plan (Grassland Plan)

City of Boulder Integrated Pest Management (IPM) Policy

Boulder County Climate Change Preparedness Plan (2012)

City of Boulder's Climate Commitment

City of Boulder's Drought Plan, Volume I (2010)

City of Boulder's Drought Plan, Volume 2 (2003, revised 2004)

South Boulder Creek Area Management Plan

Forest Ecosystem Management Plan

Resolution No. 1159 (Neonicotinoid Ordinance)

City of Boulder Urban Wildlife Management Plan

City of Boulder Wildlife Protection Ordinance

City of Boulder floodplain protection program

City of Boulder Stream, Wetland and Water Body Ordinance

Visitor Master Plan (VMP)

Open Space Cultural Resource Guidelines

2013-2019 OSMP Acquisition Update

City of Boulder Sustainability Framework

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# Appendix E: Table of Objectives, Management Strategies and Measures of Success

| Working Lands | | |
|---|---|---|
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Maintain and support working agricultural lands, including the preservation of water resources by maintaining land for agricultural uses. | • Lease lands to agricultural producers.<br>• Restore irrigation and agricultural uses to selected sites. | • Acres in agricultural production (number of acres leased).<br>• Percent of irrigable land leased for agricultural purposes. (desired condition = all selected sites) |
| **Leasing Agricultural Lands** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Maintain an agricultural lease program compatible with agricultural and resource stewardship and a working lands program.<br>• Clearly define management responsibilities, agricultural stewardship expectations and permissible uses with lessees. | • Develop a fee structure compatible with agricultural and resource stewardship and a working lands program and evaluate the feasibility of a compensation program for stewardship activities by 2020.<br>• Develop Stewardship Plans.<br>• Establish new first time lease process that incorporates the new fee structure and stewardship plans.<br>• Establish a new renewal process that incorporates the new fee structure and stewardship plans.<br>• Transition existing lessees into new lease and renewal process. | • Tenure of lessees. (desired condition = long term relationships)<br>• Proportion of leases signed and renewed at updated OSMP-established lease rates. (desired condition = all leases)<br>• Proportion of leases that have a Stewardship Plan. (desired condition = all leases)<br>• Proportion of leases in compliance with Stewardship Plan. (desired condition = all leases) |
| **Diversity of Agriculture and Local Foods** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Maintain and support a diversity of agricultural operations and uses on OSMP lands, with the exception of genetically modified organisms (GMOs).<br>• Establish/restore diversified vegetable/pastured livestock farms or micro dairies in accordance with city values, community demand and land availability. | • Evaluate the suitability of other agriculturally related enterprises/activities on OSMP.<br>• Explore offering new opportunities and activities related to agriculture.<br>• Provide the infrastructure necessary to support a diversity of agricultural operations. | • Types of agricultural operations and agriculturally related uses/activities on OSMP lands. (desired condition = a variety of types of operations)<br>• Number of acres dedicated to the various types of agricultural operations. (desired condition = a variety of types of |

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| • Provide or improve resources to connect lessees to local markets.<br>• Support and create opportunities for direct sales on-site and off-site. | • Identify Best Opportunity Areas (BOAs) for diversified vegetable/pastured livestock farms and micro dairies.<br>• Establish diversified vegetable/pastured livestock farms in accordance with demand and land availability.<br>• Mitigate impacts to existing operations and neighbors, if any, resulting from establishing/restoring diversified vegetable/pastured livestock farms or micro dairies.<br>• Explore the feasibility of a variety of ways to connect lessees to local markets.<br>• Explore synergies between agricultural producers to meet local demand or develop new products.<br>• Explore providing support to lessees for grant writing. | agriculture with a focus on increasing local vegetable production)<br>• Number of operators engaged in on-site direct sales. (desired condition = increase in direct sales)<br>• Percent of operators selling to local markets. (desired condition = increase in local foods) |
| **Connecting Farmers to Resources** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Provide or improve information and resources to support local and aspiring agricultural operators. | • Examine the feasibility of providing additional resources. | • Resources available to support local and aspiring agricultural operators. (desired condition = increase in resources)<br>• Number of qualified applicants for properties available to lease. (desired condition = at least one)<br>• Number of lease renewals. (desired condition = most renew) |
| **Infrastructure - Structures** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Provide the infrastructure necessary to support a | • Prioritize current and future infrastructure needs. | • Proportion of operations for which the necessary infrastructure has been |

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| diversity of agricultural operations.<br>• Maintain agriculturally related structures in an acceptable condition. | • Work with lessees to identify current and future infrastructure needs, repairs and/or enhancements. (includes fences).<br>• Evaluate new or replacement structures with the process/criteria. | identified. (desired condition = all operations)<br>• Proportion of operations for which the necessary infrastructure is currently available. (desired conditions = all operations)<br>• Proportion of necessary structures in an acceptable condition. (desired condition = all necessary structures in acceptable condition) |
| **Infrastructure - Water Delivery** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Maintain existing irrigation infrastructure in good condition as required by state law.<br>• Provide the infrastructure necessary to meet the needs of the diverse agricultural operations on OSMP lands.<br>• Ensure the water delivery system infrastructure and associated maintenance is compatible with natural resource objectives. | • Maintain a regularly updated inventory of irrigation infrastructure that includes location and conditions information.<br>• Develop criteria to prioritize current and future infrastructure needs.<br>• Partner with lessees to provide and maintain infrastructure necessary to meet the needs of their agricultural operations.<br>• Develop and implement irrigation infrastructure BMPs for water delivery infrastructure maintenance and construction on OSMP lands.<br>• Evaluate the water delivery infrastructure and associated operational and maintenance activities to enhance related natural resources.<br>• Conduct ditch and/or lateral burns to improve irrigation and reduce labor intensiveness of ditch maintenance. | • Percent of irrigation infrastructure in good condition as required by state law. (desired condition = all infrastructure in good condition)<br>• Proportion of operations for which the necessary irrigation infrastructure is currently available. (desired conditions = all operations)<br>• Proportion of irrigation infrastructure maintenance sites in compliance with departmental BMPs. (desired conditions = all sites) |

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| **Soil Conditions** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Manage agricultural activities to minimize soil erosion and protect soil fertility.<br>• Maintain soil organic matter and soil biological diversity within ranges of natural variation on native range lands and other untilled lands in agricultural production.<br>• Increase or maintain soil organic matter and soil biological diversity on tilled/converted lands in agricultural production with non-native vegetation. | • Apply Natural Resources Conservation Service (NRCS) BMPs as appropriate.<br>• Develop soil health monitoring plan to track soil organic matter and soil health over time. | • Soil organic matter and soil biological diversity. (desired condition = maintain or increase)<br>• Proportion of operations implementing BMPs. (desired condition = all operations) |
| **Integrated Pest Management** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Reduce state-listed noxious weeds on OSMP lands with agricultural leases, prioritizing State List A Species for eradication and State List B Species for containment and suppression.<br>• Reduce or eliminate the use of pesticides, wherever possible. When reduction or elimination of pesticides is not possible, use the least toxic and least persistent pesticide. | • Encourage lessees to explore BMPs focusing on preventative, cultural and mechanical methods that are best suited to their particular property.<br>• Promote adoption of BMPs by exploring cost-sharing, lease reductions and collaboration with NRCS.<br>• Review and make determinations about chemical treatments. | • Decrease in amount of pesticide applied and acreage of pesticide applications (it is unlikely that pesticide use will be eliminated as long as certain crops are grown on OSMP lands).<br>• Decrease in the volume of EPA Risk Category II pesticide applications.<br>• Proportion of operations in compliance with IPM requirement of established Stewardship Plans. (desired conditions = all operations)<br>• Decrease in state-listed noxious and invasive weeds on agricultural properties. |
| **Climate Change Preparedness** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Identify agricultural management practices that help prepare for a more arid future.<br>• Research the potential for agricultural practices to mitigate climate change, | • Develop a water strategy to 1) increase efficiency of and prioritize water distribution, 2) explore water banking and storm water retention strategies; and 3) increase the use of | • Completion and implementation of a water strategy, a de-stocking protocol and a rangeland condition assessment protocol and monitoring. |

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| including a "carbon credit" incentive program for land managers to sequester carbon such as the State of California. | low-water use crops and varieties.<br>• Develop a grazing de-stocking protocol.<br>• Collaborate with farmers to increase the flexibility of agricultural management techniques.<br>• Establish objectives for soil health on OSMP agricultural lands that include consideration of water holding capacities and water infiltration into soils during rainfall events, to mitigate the effects of predicted drought and severe rainfall events from climate change. | • The number of research reports that address climate change preparedness. |
| **Bobolink Habitat** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Integrate agricultural management practices that support nesting habitat for bobolinks. | • Adjust management by delaying mowing on a select number of hayfields until after bobolink fledging, July 15, unless otherwise determined by monitoring.<br>• Establish/maintain four fields (267 acres) as Class A Bobolink Management Areas where mowing does not occur before July 15.<br>• Establish/maintain 10.5 fields (or 223-316 acres) as Class B Bobolink Management Areas where mowing does not occur before July 15 in one out of three years.<br>• Consider most current bobolink density data to identify areas with higher bobolink abundances or densities with good landscape context to provide larger contiguous habitat blocks. | • Acres of Class A Bobolink Management Areas designated (267 acres to reach desired "Good" rating).<br>• Acres of Class B Bobolink Management Areas designated (223-316 acres to reach desired "Good" rating).<br>• Percent of Class A fields cut after July 15 every year (100 percent to reach desired "Good" rating).<br>• Percent of Class B fields cut after July 15 one year out of three [100 percent of 223-316 acres or 10 fields (written in the Grassland Plan as 75 percent of the 14 designated and candidate fields) to reach desired "Good" rating). |

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| | • Hayfields are monitored annually for bobolinks. If/when applicable (i.e. many more acres exist with very high or high densities and/or abundances with good landscape character than is necessary to meet the standards set in the Grassland Plan) staff will take lessee field preferences into consideration when choosing between fields.<br>• When applicable, evaluate compensation strategies to mitigate the economic impact to lessees for decreased yields resulting from delayed mowing.<br>• Evaluate new acquisitions for potential additional Bobolink Management Areas. | |
| **Ute ladies'-tresses Orchid Habitat** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Integrate agricultural management practices that support ULTO habitat.<br>• Maintain a "Good" viability ranking for ULTO indicators in the Grassland Plan. | • Manage ULTO habitat according to BMPs.<br>• When applicable, evaluate compensation strategies to mitigate financial impacts associated with implementation of ULTO BMPs to affected lessees.<br>• Develop criteria for identifying potential ULTO habitat on existing properties or properties purchased in the future. | • Percent of ULTO sub-occurrences managed in a manner that is consistent with BMPs.<br>• Percent of ULTO sub-occurrences:<br>- Prescriptively grazed only outside of most sensitive time (i.e. no grazing May 15 - Oct. 15)<br>- Prescriptively grazed following prescribed burning in ULTO habitat.<br>- Irrigated in the spring (April to June) before haying and again after haying (August, September)<br>- Omitted from haying every 3-5 years in selected areas within |

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| | | high density, hayfield sub-occurrences.<br>• Grassland Plan viability rating of "Good". |
| **Raptor Habitat** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Integrate agricultural management practices that support effective habitat for nesting raptors. | • Continue to manage raptor nesting sites with agricultural activities on a case-by-case basis.<br>• Consider agricultural and water resources information and activities when establishing habitat management guidelines and requirements. | • Number of prairie dog colonies with successful nesting attempts by burrowing owls.<br>- Three to four prairie dog colonies surveyed to have successful burrowing owl nesting attempts signify a "Good" rating identified in the Grassland Plan.<br>• Number of successful bald eagle nesting attempts in the Grassland Planning Area<br>- Two or more successful bald eagle nesting attempts on OSMP signify a "Good" rating identified in the Grassland Plan. |
| **Preble's Meadow Jumping Mouse Habitat** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Integrate agricultural management practices that support and minimize adverse impacts to high quality Preble's habitat.<br>• Adhere to Federal regulations in agricultural operations to avoid "take" as defined under the Endangered Species Act, including working within stipulations of 4(d) rule for non-native species management and ditch management activities. | • Increase outreach to and awareness of lessees and ditch operators surrounding the importance of ditch and stream habitat for Preble's, and applicable regulations and management practices.<br>• When applicable, evaluate strategies and partnerships with ditch companies to mitigate financial impacts associated with implementation of BMPs.<br>• Adhere to BMPs and limitations included in the special rule 4(d) exemptions when maintaining water delivery | • Extent of high-quality Preble's habitat along ditches and creeks in occupied areas of the system.<br>• Adherence to Federal regulations in agricultural operations to avoid "take" as defined under the Endangered Species Act.<br>• Adherence to BMPs as outlined in 4(d) rule.<br>• Percent of riparian corridors fenced in Preble's habitat. |

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| | infrastructure and ditches on OSMP.<br>• Maintain existing fencing and examine opportunities for additional fencing or water gaps. | |
| **Native Plant Propagation** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Establish a native plant propagation program to grow native plant materials for ecosystem restoration and other reclamation needs.<br>• Increase the availability of materials currently not commercially available or cost prohibitive for use by OSMP and potentially other landowners in the Boulder Valley.<br>• Make high-quality plant materials available that are neonicotinoid-free and locally adapted to conditions in the Boulder Valley. | • Identify Best Opportunity Areas for native plant propagation.<br>• Explore and pursue partnerships. | • Increase of number of new plant species/local genotypes grown by OSMP-led propagation program (Species/local genotypes that aren't otherwise available).<br>• Total acres in native plant propagation.<br>• Increase in plant diversity of ecological restoration projects.<br>• Amount of native plant materials supplied to local governmental agencies and others.<br>• Amount of native plant materials provided by partners (e.g. Southern Rockies Seed Network). |
| **Pollinator Habitat** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Integrate/establish agricultural management practices that support native pollinators. | • Establish pollinator-friendly habitat.<br>• Explore adoption of no- and/or reduced-till practices since most pollinators are ground-nesting bees and tillage can destroy their nests.<br>• Develop plant mixes based on hydrology, pedology, bloom season, ease of establishment and maintenance, and compatibility with existing farming practices.<br>• Increase lessee and public understanding of pollinator habitat. | • Native pollinator number and diversity. (desired condition = increased number and diversity)<br>• Proportion of agricultural fields with established pollinator habitat. (desired condition = increase in habitat) |

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| **Prairie Dog Habitat** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Decrease impacts to agricultural production from prairie dog occupation. | • Evaluate options to better manage prairie dogs and agricultural conflicts.<br>• Re-apply the prairie dog colony management area designation criteria to agricultural lands to help evaluate and prioritize properties for removal.<br>• Identify process for rapid response restoration and re-colonization prevention of agricultural properties when prairie dogs are removed, die off or are reduced in spatial extent.<br>• Explore changes to grazing regimes, vegetation restoration and non-native vegetation management techniques to encourage faster recovery of vegetation in potential relocation sites. | • Reduction in acres of prairie dog occupation in transition or removal areas. (desired condition = zero agricultural acres degraded by prairie dogs)<br>• Acres of transition or removal areas from which prairie dogs have been relocated.<br>• Acres of agriculturally managed land (or previously agriculturally managed land) restored following occupation by prairie dogs.<br>• Other measures of success related to prairie dog conservation are established in the Grassland Plan and include:<br>- Percent of occupied land in Grassland Preserves, Multiple Objective Areas or Prairie Dog Conservation Areas. (Desired condition = 70-85 percent)<br>- Grassland Preserves with occupancy between 10-26 percent<br>- Number of prairie dog colonies with successful nesting attempts by burrowing owls. (Desired condition = 3-4 colonies)<br>- Percent of colonies with territorial horned larks. (Desired condition = 50-75 percent)<br>- Predator community composition/abundance. (Desired condition = at least one generalist |

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| | | predator species present at 50 percent of colonies and at least one sensitive predator species present on 25 percent of colonies and breeding by either badger, ferruginous hawks or northern harrier)<br>- Acres of active prairie dog colonies. (Desired condition = 800 - 3,137 acres) |
| **Grazing in Native Grasslands** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Support livestock grazing on native grasslands that supports achieving Grassland Plan management objectives (on leased and unleased lands). | • Continue the practice of incorporating native grasslands in agricultural leases as appropriate to support livestock grazing operations.<br>• Prescriptively graze some unleased native grasslands.<br>• Develop a grazing condition assessment and procedure to evaluate the condition of grazed fields and inform grazing plans and infrastructure development.<br>• Create and maintain an agricultural database and information management system to accurately monitor and manage livestock grazing timing and locations.<br>• Maintain and/or improve agricultural infrastructure to enhance the prescribed grazing program and assist meeting native grassland management objectives.<br>• Evaluate compost applications to grazed grasslands and holistic range management for their potential to improve native grasslands and to | • Proportion of native grassland parcels that have adequate infrastructure maintained in "good" condition to support prescriptive grazing.<br>• Percent of rangeland in "good' condition as identified by the grazing condition assessments. ("Good" condition to be defined during assessment protocol development.)<br>• Percent of grazed native grasslands that meet the Grassland Plan vegetation composition and structure and animal species composition desired "good" rating.<br>Mixedgrass Prairie Mosaic Vegetation Composition<br>- Native species relative cover- at least 75 percent of the samples have a native relative cover ≥ 86 percent for the Western Wheatgrass Herbaceous Alliance and 88 percent for the Needle-and-Thread/Blue Grama Herbaceous Alliance. |

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| | help grasslands adapt to climate changes.<br>• Evaluate and develop drought management strategies (e.g. identification of grass banks), and destocking guidelines for native grasslands included in agricultural leases. | - Native species richness- at least 75 percent of the samples have a native species richness ≥ 33 for the Needle-and-Thread/Blue Grama Herbaceous Alliance and 31 for the Western Wheatgrass Herbaceous Alliance.<br>- Non-native species – 1-3 percent domination by non-native species, 3-9 percent prevalence of non-native species.<br>- Richness of selected conservative plant species- at least 75 percent of samples > 17.<br>- Size of Bell's twinpod populations- 100 percent of sub-occurrences are stable or increasing in area and/or number of individuals.<br>Mixedgrass Prairie Mosaic Vegetation Structure<br>- Absolute cover bare ground- Needle-and-Thread/Blue Grama Herbaceous Alliance at least 75 percent of samples ≤ 25 percent and > 10 percent; Western Wheatgrass Herbaceous Alliance at least 75 percent of samples ≤ 10 percent.<br>Mixedgrass Prairie Mosaic Animal Species Composition<br>- Percent occurrence of Colorado Natural Heritage Program (CNHP)-tracked grassland dependent butterflies and skipper species- 10-25 percent. |

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| | | - Percent occurrence of grassland dependent butterflies and skipper species- 51-75 percent.<br>- Percent of target with acceptable bird conservation score- at least 75 percent of transects with a derived score of 3.9.<br>Xeric Tallgrass Prairie Vegetation Composition<br>- Native species relative cover- at least 75 percent of samples have a Native Relative Cover > 90 percent.<br>- Native species richness- at least 75 percent of samples have a native species richness ≥ 22.<br>- Non-native species- 1-3 percent domination by non-native species, 3-9 percent prevalence of non-native species.<br>- Richness of selected conservative plant species- at least 75 percent of samples > 12.<br>- Size of dwarf leadplant populations- 90-99 percent of sub-occurrences are stable or increasing in areal extent and/or number of individuals.<br>- Size of grassyslope sedge populations- 100 percent of occurrences are stable or increasing in areal extent and/or stem density.<br>- Size of Prairie violet/bird's foot violet populations- 90-99 percent of sub-occurrences are stable or increasing in areal |

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| | | extent and/or number of individuals.<br>Xeric Tallgrass Vegetation Structure<br>- Absolute cover bare ground- at least 75 percent of samples < 26 percent.<br>Xeric Tallgrass Animal Species Composition<br>- Percent occurrence of CNHP-tracked grassland dependent butterflies and skipper species- 10-25 percent.<br>- Percent occurrence of grassland dependent butterflies and skipper species- 51-75 percent.<br>- Percent of target with acceptable bird conservation score- at least 75 percent of transects with a derived score of 3.9.<br>- Relative cover of host plants for skipper/butterfly species of concern (big bluestem and little bluestem)- at least 75 percent of samples ≥ 8.<br>Mesic Bluestem Prairie Vegetation Composition<br>- Native species relative cover- at least 75 percent of samples have a Native Relative Cover > 85 percent.<br>- Native species richness- at least 75 percent of samples > 23.<br>- Non-native species- 1-3 percent domination by non-native species, 3-9 percent prevalence of non-native species.<br>- Presence of populations of Ute ladies'-tresses orchid. |

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| | | - Richness of selected conservative plant species- at least 75 percent of samples > 11.<br>Mesic Bluestem Prairie Vegetation Structure<br>- Absolute cover bare ground- at least 75 percent of samples < 13 percent.<br>Mesic Bluestem Prairie Animal Species Composition<br>- Percent occurrence of CNHP-tracked grassland dependent butterflies and skipper species- 10-25 percent.<br>- Percent occurrence of grassland dependent butterflies and skipper species- 51-75 percent.<br>- Relative cover of host plants for skipper/butterfly species of concern (big bluestem and little bluestem)- at least 75 percent of samples ≥ 8 percent.<br>- Species richness of sensitive breeding birds- successful breeding by all indicator species. |
| **Riparian Areas - Creeks** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Integrate agricultural management practices to support and improve riparian hydrology. Restore riparian hydrology to a more natural flow regime to the extent practicable. A more natural flow regime would consider the frequency, timing and magnitude of creek discharge.<br>• Integrate agricultural management practices to | • Evaluate modifications to the timing and quantity of agricultural water use.<br>• Evaluate modifications to grazing management to support and restore riparian corridors.<br>• Address impediments to fish passage at irrigation ditch diversion points.<br>• Identify and obtain or transfer existing | • Native plant species cover (at least 75 percent of riparian areas exhibit a relative cover of native species > 67 percent)<br>• Percent of wetland acreage dominated by non-native species (< 3 percent of riparian acreage dominated by non-native species)<br>• Percent of wetland acreage with prevalence of non- |

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| support and improve riparian habitat. | agricultural water rights for instream flow. | native species (< 9 percent of wetland acreage with prevalence of non-native species)<br>• Cottonwood regeneration (at least 50 percent of recruitment sites have cottonwood seedlings)<br>• Impediments to fish passage (No impediments to fish passage)<br>• Instream flows (standard varies by creek – see Grassland Plan)<br>• Fish index of biotic integrity (IBI) (75 percent of sites have a IBI score > 44)<br>• Macroinvertebrate IBI (75 percent of sites have a IBI score > 50)<br>• Percent of target with acceptable bird conservation score (at least 75 percent of target with a derived score >19)<br>• Physical instream and riparian habitat (75 percent of sites have an average score > 10)<br>• Creek dimensions, plan, and profile (at least 75 percent of the length of creeks match reference conditions as determined by regional curves) |
| **Wetlands - Ponds** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Integrate agricultural management practices to support wetland hydrology.<br>• Integrate agricultural management practices to support wetland habitat, including northern leopard frog habitat. | • Evaluate modifications to the timing and quantity of agricultural water use.<br>• Evaluate modifications to grazing management to support and restore wetland habitat.<br>• Manage wetland habitat through compatible haying and irrigation practices.<br>• Manage Ute ladies'-tresses orchid habitat through | • Native plant species cover (at least 75 percent of wetlands exhibit a relative cover of native species > 66 percent)<br>• Percent of wetland acreage dominated by non-native species (< 3 percent of wetland acreage dominated by non-native species)<br>• Percent of wetland acreage with prevalence of non- |

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| | compatible haying, grazing and irrigation practices.<br>• Evaluate ponds initially established or currently used for agricultural purposes for northern leopard frog habitat and/or native fish refugia. | native species (< 9 percent of wetland acreage with prevalence of non-native species)<br>• Distance to nearest wetland or riparian area (at least 75 percent of wetland/riparian complexes are < 200 m from the nearest wetland/riparian complex)<br>• Native frog presence in suitable habitat (at least 50 percent of suitable sites contain only native frogs) |
| **Water Quality** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Minimize the impact of agricultural activities on water quality. | • Identify agricultural activities that have the potential to impact ground and surface water quality.<br>• Assess water quality on OSMP lands.<br>• Evaluate modifications to grazing management to maintain or improve water quality.<br>• Explore other irrigation approaches to improve water use efficiency and minimize runoff and discharges from agricultural land to surface waters.<br>• Manage IPM activities to mitigate their effects on water quality.<br>• Develop BMPs to manage agricultural activities to maintain or improve water quality. | • Percent of operators implementing BMPs to minimize the impact of agricultural uses on water quality.<br>• Partner with city utilities staff to monitor water quality before and after implementation to measure effectiveness of the BMPs and potential improvements in water quality.<br>• Compliance with state water quality standards.<br>• The following measures of success related to water quality were established in the Grassland Plan:<br>- At least 75 percent of the sites exceed the state water quality standards for dissolved oxygen. For coldwater streams the standard is 7.0 mg/L during spawning season; 6.0 mg/L outside of spawning season. For warmwater streams the standard is 5.0 mg/L. (the state standards are set by the Colorado Department of Public |

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| | | Health and Environment.)<br>- For total phosphorus – lotic, at least 75 percent of the sites exhibit a TP concentration < 0.007 mg/L in coldwater streams and < 0.06 mg/L in warmwater streams<br>- For total phosphorous – lentic, at least 75 percent of the ponds exhibit a TP concentration <0.02 mg/L<br>- For water clarity, at least 75 percent of the sites have a Secchi disk depth > 1.5 m |
| **Scenic Resources** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Maintain integrity of agriculturally related viewsheds and ameliorate views which impact landscape character.<br>• In the context of a larger scenic resources management program, identify scenic resources and support improvements that advance the Ag Plan objectives. | • Conduct baseline inventory and condition assessment of agriculturally related viewsheds.<br>• Identify major landscape types that define the character of the working landscape in order to develop a scenic management tool that protects the qualities of the setting the community values.<br>• Categorize and prioritize (for protection and maintenance) agriculturally related viewsheds. | • Percent of agricultural landscape inventoried for viewsheds.<br>• Percent of agriculturally related viewsheds in acceptable condition. |
| **Cultural Resources** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Develop cultural resource management practices relating to agriculture that consider how to preserve the working landscape and associated cultural traditions. | • When, possible use structural cultural resources for their intended agriculturally related use.<br>• Conduct cultural resource surveys on all agricultural | • Percent of agriculturally related cultural resources integrated into the working landscape.<br>• Percent of cultural assessments complete. |

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| • Ensure agricultural activities are compatible with protecting archaeological and prehistoric sites according to Federal and State regulations.<br>• In the context of a larger cultural resource management plan, identify structures, sites and landscapes with cultural or historical significance and integrity that could confer eligibility for recognition at the federal, state or local level that will support improvements that advance the Ag Plan objectives. | lands not adequately surveyed.<br>• Develop criteria to prioritize the infrastructure and maintenance needs for the protection and use of historic structures.<br>• Prioritize archaeological and prehistoric assessments on the Vegetable/Pastured Livestock Farm/Micro Dairy Best Opportunity Areas. | • Percent of structural cultural resources in good condition. |
| **Public Access/Passive Recreation** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Continue to integrate compatible recreation activities on agricultural working lands to provide opportunities for high quality visitor experiences and learning about Boulder's agricultural heritage.<br>• Maintain existing and develop new visitor facilities that support both a high-quality visitor experience and efficient agricultural operations.<br>• Recognizing the historic connection between equestrianism and agriculture, pursue and preserve reasonable equestrian access across agricultural lands. | • Work to better understand the community's desires surrounding access to, learning about, and recreating on working agricultural lands.<br>• Consider providing new, inclusive recreation and access opportunities that connect the community to agricultural working lands.<br>• Develop Visitor BMPs to provide visitors with information on how to safely and respectfully enjoy recreation opportunities on agricultural lands.<br>• Support agricultural lessees with technical advice, planning and design to minimize and mitigate impacts or perceived impacts from recreational use.<br>• Minimize possibility for human and livestock conflict.<br>• Continue the practice of temporarily closing or limiting access to | • Types and amount of recreational activities and access opportunities integrated into working agricultural lands (desired condition = variety of activities and access opportunities)<br>• Development of visitor BMPs.<br>• Number of reports of damage to crops/livestock from recreation per year. (desired condition = none)<br>• Percent of lessees implementing BMPs to minimize the possibility of visitor and livestock conflict. (desired condition = all applicable lessees)<br>• Number of recreation-related, agricultural gates. (desired condition = decrease in trail and agricultural fence intersections)<br>• Percentage of gates with bike, runner and equestrian friendly designs. (desired condition = all applicable gates) |

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| | agricultural properties when crop damage has occurred or for visitor safety concerns if other deterrence methods or access designs have proven ineffective.<br>• Incorporate visitor experience considerations when developing fence alignments and designing fence and gate related infrastructure.<br>• Maintain and enhance agricultural landscapes to provide high quality experiences and connections to agriculture for the community passing by or through working lands.<br>• Evaluate the effectiveness of signing agricultural properties to:<br>- Inform visitors and passers-by about crops, agricultural practices, and considerate behaviors;<br>- Clearly indicate preferred access points and areas; and<br>- Suggest ways that visitors can support local agriculture. | |
| **Community Connections and Partnerships** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Offer a range of experiences and opportunities for the community to connect, learn about, discover and enjoy agricultural lands and their associated operations. | • Consider offering experiences or types of agriculturally related activities related to connecting the community to agriculture.<br>• Explore offering new opportunities and experiences related to agriculture.<br>• Explore and create partnerships to develop opportunities and offer | • Variety/types of experiences or agriculturally related activities occurring on OSMP lands.<br>• Increased number of experiences or agriculturally related events occurring on OSMP lands.<br>• Increased number of lessees offering new agriculturally related experiences/activities. |

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| | activities related to agriculture. | • Effectiveness of experiences and activities to connect the community with agricultural lands, farmers and ranchers.<br>• Ability of OSMP to accommodate emerging trends and meet community desires. |
| **Education and Outreach** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Offer a variety of educational opportunities to the community to learn about, connect with and enjoy agricultural lands. | • Develop an education and outreach program specific to agriculture on OSMP lands and that promotes the City of Boulder food policy.<br>• Explore offering experiential programs connecting the Boulder community to local food production and working landscapes.<br>• Explore and create partnerships to develop opportunities and programmatic components. | • Types/diversity of agriculture specific educational opportunities.<br>• Increased number of agriculture specific educational opportunities offered.<br>• Effectiveness of education and outreach programs:<br>- A strong community connection to local food in terms of understanding food production and working landscapes.<br>- Community participation in the production of food and associated activities through hands-on practices, events.<br>- Increase in Boulder youth understanding of agriculture, food production and employment opportunities in agriculture. |
| **Service Learning and Volunteers** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Retain existing service learning and volunteer opportunities to encourage the community to learn about, connect with and enjoy agricultural lands.<br>• Develop new and innovative opportunities for service learning and volunteer | • Continue offering service learning and volunteer activities related to agriculture.<br>• Explore offering new and innovative opportunities for service learning and volunteer activities related to agriculture. | • Types of service learning and volunteer opportunities offered.<br>• Increased number of service learning and volunteer opportunities offered. |

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| activities related to agriculture. | • Continue offering volunteer activities related to enhancing recreational infrastructure on shared agricultural lands.<br>• Explore service learning and volunteer activities related to maintaining and/or enhancing visitor infrastructure and providing new recreational opportunities. | • Increased number of lessees participating in the offering of volunteer or service learning opportunities.<br>• Effectiveness of service learning and volunteer opportunities offered. |
| **Land and Water Acquisitions** | | |
| **Objectives** | **Management Strategies** | **Measures of Success** |
| • Strategically acquire properties and water resources with agricultural value. | • Identify and pursue strategic acquisition of land and water resources that will help OSMP meet the objectives and management strategies identified in this plan, that meet multiple objectives, or are at risk of loss. | • Properties/acres acquired that support agricultural operations.<br>• Water rights acquired that support agricultural operations. |

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# Appendix F: Implementation Table: Strategies Identified for Integration with Ongoing Operations (no additional costs identified)

| Chapter | Management Strategy |
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| Agricultural Management | Apply Natural Resources Conservation Service (NRCS) Best Management Practices (Best Management Practices) as appropriate. |
| Agricultural Management | Collaborate with farmers to increase the flexibility of agricultural management techniques. |
| Agricultural Management | Develop a fee structure compatible with agricultural and resource stewardship and a working lands program and evaluate the feasibility of a compensation program for stewardship activities by 2020. |
| Agricultural Management | Develop a grazing de-stocking protocol. |
| Agricultural Management | Develop a water strategy to 1) increase efficiency of and prioritize water distribution, 2) explore water banking and storm water retention strategies; and 3) increase the use of low-water use crops and varieties. |
| Agricultural Management | Encourage lessees to explore Best Management Practices focusing on preventative, cultural and mechanical methods that are best suited to their property. |
| Agricultural Management | Establish a new first time lease process that incorporates the new fee structure and stewardship plans. |
| Agricultural Management | Establish a new renewal process that incorporates the new fee structure and stewardship plans. |
| Agricultural Management | Establish objectives for soil health on OSMP agricultural lands that include consideration of water holding capacities and water infiltration into soils during rainfall events, to mitigate the effects of predicted drought and severe rainfall events from climate change. |
| Agricultural Management | Evaluate new or replacement structures with the defined process/criteria. |
| Agricultural Management | Evaluate the possibility of working with appropriate agencies to allow participation in programs that support conservation practices on local agricultural lands. |
| Agricultural Management | Evaluate the suitability of other agriculturally related enterprises/activities on OSMP. |
| Agricultural Management | Explore offering new opportunities and activities related to agriculture. |
| Agricultural Management | Explore providing support to lessees for grant writing. |
| Agricultural Management | Explore synergies between agricultural producers to meet local demand or develop new products. |
| Agricultural Management | Explore the feasibility of a variety of ways to connect lessees to local markets. |
| Agricultural Management | Explore the feasibility of providing additional resources such as farm worker/lessee housing. |

| Chapter | Management Strategy |
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| Agricultural Management | Identify Best Opportunity Areas (BOAs) for diversified vegetable/pastured livestock farms and micro dairies. |
| Agricultural Management | Interagency partnerships. |
| Agricultural Management | Lease lands to agricultural producers. |
| Agricultural Management | Maintain a regularly updated inventory of irrigation infrastructure that includes location and conditions information (tracking database). |
| Agricultural Management | Mitigate impacts to existing operations, if any, resulting from establishing/restoring diversified vegetable/pastured livestock farms or micro dairies. |
| Agricultural Management | Partner with lessees to provide and maintain infrastructure necessary to meet the needs of their agricultural operations. |
| Agricultural Management | Review and make determinations about chemical treatments according to the process outlined in the New Chemical Treatment Review Process figure. |
| Agricultural Management | Transition existing lessees into new lease and renewal process. |
| Agricultural Management | Work with lessees to identify current and future infrastructure needs, repairs, and or enhancements (includes fences). |
| Ecological Integration | Adhere to Best Management Practices and limitations included in the special rule 4(d) exemptions when maintaining water delivery infrastructure and ditches on OSMP. |
| Ecological Integration | Adjust management by delaying mowing on a select number of hayfields until after bobolink fledging, July 15, unless otherwise determined by monitoring. |
| Ecological Integration | Assess water quality on OSMP lands. |
| Ecological Integration | Consider agricultural and water resources information and activities when establishing habitat management guidelines and requirements. |
| Ecological Integration | Consider most current bobolink density data to identify areas with higher bobolink abundances or densities with good landscape context to provide larger contiguous habitat blocks. |
| Ecological Integration | Continue the practice of incorporating native grasslands in agricultural leases as appropriate to support livestock grazing operations. |
| Ecological Integration | Continue to manage raptor nesting sites with agricultural activities on a case-by-case basis. |
| Ecological Integration | Create and maintain an agricultural database and information management system to accurately monitor and manage livestock grazing timing and locations. |

| Chapter | Management Strategy |
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| Ecological Integration | Develop a grazing condition assessment and procedure to evaluate the condition of grazed fields and inform grazing plans and infrastructure development. |
| Ecological Integration | Develop Best Management Practices to manage agricultural activities to maintain or improve water quality. |
| Ecological Integration | Develop criteria for identifying potential Ute ladies'-tresses orchid habitat on existing properties or properties purchased in the future. |
| Ecological Integration | Develop plant mixes based on hydrology, pedology, bloom season, ease of establishment and maintenance, and compatibility with existing farming practices. |
| Ecological Integration | Establish/maintain 10.5 fields (or 223-316 acres) as Class B Bobolink Management Areas where mowing does not occur before July 15 in one out of three years. |
| Ecological Integration | Establish/maintain four fields (267 acres) as Class A Bobolink Management Areas where mowing does not occur before July 15. |
| Ecological Integration | Evaluate and develop drought management strategies (e.g. identification of grass banks), and destocking guidelines for native grasslands included in agricultural leases. |
| Ecological Integration | Evaluate compost applications to grazed grasslands and holistic range management for their potential to improve native grasslands and to help grasslands adapt to climate changes. |
| Ecological Integration | Evaluate modifications to grazing management to maintain or improve water quality. |
| Ecological Integration | Evaluate modifications to the timing and quantity of agricultural water use to support and improve wetland hydrology. |
| Ecological Integration | Evaluate modifications to the timing and quantity of agricultural water use to support and improve riparian hydrology. |
| Ecological Integration | Evaluate ponds initially established or currently used for agricultural purposes for northern leopard frog habitat and/or native fish refugia. |
| Ecological Integration | Explore adoption of no- and/or reduced-till practices since most pollinators are ground-nesting bees and tillage can destroy their nests. |
| Ecological Integration | Explore and pursue partnerships. |
| Ecological Integration | Explore other irrigation approaches to improve water use efficiency and minimize runoff and discharges from agricultural land to surface waters. |

| Chapter | Management Strategy |
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| Ecological Integration | Hayfields are monitored annually for bobolinks. If/when applicable (i.e. many more acres exist with very high or high densities and/or abundances with good landscape character than is necessary to meet the standards set in the Grassland Plan) staff will take lessee field preferences into consideration when choosing between fields. |
| Ecological Integration | Identify agricultural activities that have the potential to impact ground and surface water quality. |
| Ecological Integration | Increase lessee and public understanding of pollinator habitat. |
| Ecological Integration | Increase outreach to and awareness of lessees and ditch operators surrounding the importance of ditch and stream habitat for Preble's, and applicable regulations and management practices. |
| Ecological Integration | Manage IPM activities to mitigate their effects on water quality. |
| Ecological Integration | Manage Ute ladies'-tresses orchid habitat according to Best Management Practices (BMPs) |
| Ecological Integration | Manage Ute ladies'-tresses orchid habitat through compatible haying, grazing and irrigation practices. |
| Ecological Integration | Manage wetland habitat through compatible haying and irrigation practices. |
| Ecological Integration | Prescriptively graze some unleased native grasslands. |
| Ecological Integration | When applicable, evaluate compensation strategies to mitigate financial impacts associated with implementation of Ute ladies'-tresses orchid BMPs to affected lessees. |
| Ecological Integration | When applicable, evaluate compensation strategies to mitigate the economic impact to lessees for decreased yields resulting from delayed mowing. |
| Community and Visitor Integration | Categorize and prioritize (for protection and maintenance) agriculturally related viewsheds. |
| Community and Visitor Integration | Consider providing new, inclusive recreational, informational, and access opportunities that connect the community to agricultural working lands. |
| Community and Visitor Integration | Continue offering service learning and volunteer activities related to agriculture. |
| Community and Visitor Integration | Continue offering volunteer activities related to enhancing recreation infrastructure on shared agricultural lands. |
| Community and Visitor Integration | Continue the practice of temporarily closing or limiting access to agricultural properties when crop damage has occurred or for visitor safety concerns if other deterrence methods or access designs have proven ineffective. |

| Chapter | Management Strategy |
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| Community and Visitor Integration | Develop criteria to prioritize the infrastructure and maintenance needs for the protection and use of historic structures. |
| Community and Visitor Integration | Develop Visitor Best Management Practices to provide visitors with information on how to safely and respectfully enjoy recreation opportunities on agricultural lands. |
| Community and Visitor Integration | Evaluate the effectiveness of signing agricultural properties to: inform visitors and passers-by about crops, agricultural practices, and considerate behaviors; clearly indicate preferred access points and areas; and suggest ways that visitors can support local agriculture. |
| Community and Visitor Integration | Explore offering new and innovative opportunities for service learning and volunteer activities related to agriculture. |
| Community and Visitor Integration | Identify major landscape types that define the character of the working landscape to develop a scenic management tool that protects the qualities of the setting the community values. |
| Community and Visitor Integration | Maintain and enhance agricultural landscapes to provide high quality experiences and connections to agriculture for the community passing by or through working lands. |
| Community and Visitor Integration | Support agricultural lessees with technical advice, planning, design, and implementation to minimize and mitigate impacts or perceived impacts from recreational use. |
| Community and Visitor Integration | Work to better understand the community's desires surrounding access to, learning about, and recreating on working agricultural lands. |
| All | Identify, prioritize and pursue agricultural research opportunities. |

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# Appendix G: Implementation Table: Strategies Identified for Additional Operating Funding

| Chapter | Management Strategy | Implementation Item | Estimated Cost |
|---|---|---|---|
| Agricultural Management | Technical advice/agronomy services | Technical advice/agronomy services | $50,000-$500,000 |
| Agricultural Management | Establish diversified vegetable/pastured livestock farms or micro dairies in accordance with demands and other factors. | On site opportunities for marketing | $10,000-$500,000 |
| Agricultural Management | Develop Stewardship Plans | Develop Stewardship Plans | $125,000-$250,000 |
| Agricultural Management | Succession planning | Succession planning | $15,000-$100,000 |
| Agricultural Management | Farm apprentice program | Farm apprentice program | $8,000-$25,000 |
| Agricultural Management | Producer outreach | Producer outreach | $15,000-$50,000 |
| Agricultural Management | Promote adoption of Integrated Pest Management Best Management Practices by exploring cost-sharing, lease reductions and collaboration with Natural Resource Conservation Service. | Cost-sharing reduced risk chemicals and invasive species scouting. | $10,000-$50,000 |
| Agricultural Management | Develop and implement irrigation infrastructure Best Management Practices for water delivery infrastructure maintenance and construction on OSMP lands. | Irrigation infrastructure Best Management Practices | $10,000-$30,000 |
| Agricultural Management | Develop soil health monitoring plan to track soil organic matter and soil health over time. | Annual cost of soil sampling and tests, cover crop seed, compost. | $10,000-$60,000 |
| Ecological Integration | Establish pollinator-friendly habitat. | Cost-sharing reduced risk chemicals | $10,000-$50,000 |
| Ecological Integration | Maintain existing fencing and examine opportunities for additional fencing or water gaps, to provide continuous high quality habitat and allow shrub regeneration in areas of low shrub cover along occupied stream corridors. | Additional labor costs to encourage ditch companies to comply with Best Management Practices. | $20,000-$50,000 |

| Chapter | Management Strategy | Implementation Item | Estimated Cost |
|---|---|---|---|
| Community and Visitor Integration | Explore offering experiential programs connecting the Boulder community to local food production and working landscapes. | New agricultural community engagement program.<br>Staff: Increase staffing depending on level of additional outreach.<br>Outreach materials: Signs, posters, print or electronic materials. | $100,000-$500,000 |
| Community and Visitor Integration | Consider offering experiences or types of agriculturally related activities related to connecting the community to agriculture. | Pilot or promote agriculturally related experiences for visitors. | $10,000-$500,000 |

# Appendix H: Implementation Table: Capital Projects

| Chapter | Management Strategy | Implementation Item | Estimated Cost |
|---|---|---|---|
| Agricultural Management | Demonstration Farm | Demonstration Farm | $300,000 |
| Agricultural Management | Develop criteria to prioritize current and future infrastructure needs. | Irrigation infrastructure improvements. | $300,000-$650,000 |
| Agricultural Management | Evaluate the water delivery infrastructure and associated operational and maintenance activities to enhance related natural resources. | Water management to enhance natural resources. | $50,000 |
| Agricultural Management | Infrastructure improvements to establish diversified vegetable/pastured livestock farming and/or micro dairies on the Best Opportunity Areas. | Infrastructure improvements | $1,100,000-$3,400,000 |
| Agricultural Management | Prioritize current and future infrastructure needs. | Maintain infrastructure (non-irrigation) "Structure improvements, construction, deconstruction" | $1,200,000-$2,400,000 |
| Agricultural Management | Producer survey | Producer survey | $15,000-$30,000 |
| Agricultural Management | Restore irrigation and agricultural uses to selected sites. | Deferred fence maintenance and construction | $80,000-$200,000 |
| Agricultural Management | Restore irrigation and agricultural uses to selected sites. | Water infrastructure improvements, including livestock watering facilities | $80,000-$500,000 |
| Ecological Integration | Establish pollinator-friendly habitat. | Pollinator Strip establishment | $5,000-$25,000 |

| Chapter | Management Strategy | Implementation Item | Estimated Cost |
|---|---|---|---|
| Ecological Integration | Evaluate modifications to grazing management to support and restore riparian corridors. | Water gap/fence improvements for better riparian habitat/water quality. | $10,000-$100,000 |
| Ecological Integration | Evaluate modifications to grazing management to support and restore riparian corridors. | Fence riparian areas and creeks; establish alternative water sources | $60,000-$200,000 |
| Ecological Integration | Evaluate modifications to grazing management to support and restore wetland habitat. | Water gap/fence improvements for better wetland habitat/water quality. | $10,000-$100,000 |
| Ecological Integration | Evaluate modifications to grazing management to support and restore wetland habitat. | Fence wetlands and ponds; establish alternative water sources | $60,000-$200,000 |
| Ecological Integration | Evaluate options to better manage prairie dogs and agricultural conflicts. | Prairie dog removal and site restoration | $50,000-$500,000 |
| Ecological Integration | Identify Best Opportunity Areas for native plant propagation. | Field improvements/establishment | $10,000-$50,000 |
| Ecological Integration | Identify Best Opportunity Areas for native plant propagation. | Maintenance and operations (lessee or other operator, if not undertaken by staff) | $10,000-$50,000 |
| Ecological Integration | Maintain and/or improve agricultural infrastructure to enhance the prescribed grazing program and assist meeting native grassland management objectives. | To construct and/or repair fencing and livestock watering infrastructure. | $100,000-$500,000 |

| Chapter | Management Strategy | Implementation Item | Estimated Cost |
|---|---|---|---|
| Ecological Integration | Maintain existing fencing and examine opportunities for additional fencing or water gaps, to provide continuous high quality habitat and allow shrub regeneration in areas of low shrub cover along occupied stream corridors. | Debris removal (vs. side casting for ditch maintenance) | $10,000-$50,000 |
| Ecological Integration | Maintain existing fencing and examine opportunities for additional fencing or water gaps, to provide continuous high quality habitat and allow shrub regeneration in areas of low shrub cover along occupied stream corridors. | Fencing/Water gaps | $10,000-$25,000 |
| Community and Visitor Integration | Conduct baseline inventory and condition assessment of agriculturally related viewsheds. | Contracted services to complete scenic resource baseline survey | $10,000-$50,000 |
| Community and Visitor Integration | Conduct cultural resource surveys on all agricultural lands not adequately surveyed. | Cultural assessments | $10,000-$50,000 |
| Community and Visitor Integration | Incorporate visitor experience considerations when developing fence alignments and designing fence and gate related infrastructure. | Reconfigure fencing alignments (to improve the visitor experience while still maintaining efficiency of agricultural operations) | $10,000-$50,000 |
| Community and Visitor Integration | Minimize possibility for human and livestock conflict. | Visitor friendly infrastructure/cattle guards. Estimated 24 new cattle guards are need at $1,400 per guard. (includes associated infrastructure) | $35,000 |

| Chapter | Management Strategy | Implementation Item | Estimated Cost |
|---|---|---|---|
| Community and Visitor Integration | Prioritize archaeological and prehistoric assessments on the Diversified Vegetable/Pastured Livestock Farm/Micro Dairy Best Opportunity Areas. | Archaeology and prehistoric assessment of proposed tilled lands (vegetable farms). | $10,000-$50,000 |
| Acquisitions | Identify and pursue strategic acquisition of land and water resources that will help OSMP meet the objectives and management strategies identified in this plan, that meet multiple objectives, or are at risk of loss. | | TBD |

# Appendix I: Literature Cited

**Below refers to citations from the Diversity of Agriculture and Local Foods and the Connecting Farmers to Resources sections.**

Meetz, J., 2016. Final Report: Boulder County Meat Brand Feasibility Study.

**Below refers to citations from the Soil Conditions section.**

Chen, Y., De Nobili, M., Aviad, T., 2004. Stimulatory effects of humic substances on plant growth. In: Magdoff, F., Weil, R.R. (Eds.), Soil Organic Matter in Sustainable Agriculture. CRC Press, Boca Raton, FL.

Drinkwater, L.E., Wagoner, P., Sarrantonio, M., 1998. Legume-based cropping systems have reduced carbon and nitrogen losses. Nature 396, 262-265.

Greenland, D.J., Szabolcs, I., 1994. Soil resilience and sustainable land use. CAB, Wallingford, U.K.

Weil, R.R., and F. Magdoff. 2004. Significance of soil organic matter to soil quality and health. p.1-43. In: Magdoff, F., Weil, R.R. (Eds.), Soil organic matter in sustainable agriculture. CRC Press, Boca Raton, FL.

USDA NRCS. 2011. National Agronomy Manual. Available: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1043208.pdf

**Below refers to citations from the Climate Change Preparedness section.**

Adams, R., Hurd, B., Reilly, J. 2001. Impacts on the U.S. Agricultural Sector. p. 25-42. In: Clausen, E. (ed.), Climate Change: Science, Strategies, and Solutions, Brill Publishers, Leiden, Boston, and Köln.

CCSP. 2008. The Effects of Climate Change on Land Resources, Water Resources, and Biodiversity in the United States. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research.

Howden, S, Soussana, J, Tubiello, F, Chhetri, N., Dunlop, M., Meinke, H. 2007. Adapting agriculture to climate change. Proceedings of the National Academy of Sciences 104: 19691-19696.

IPCC, 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324.

Lal, R. 2004. Soil carbon sequestration impacts on global climate change and food security. Science 304: 1623-1627.

Trenberth, K, Fasullo, J, & Shepherd, T. 2015. Attribution of climate extreme events. Nature Climate Change.

USGCRP. 2009. Global Climate Change Impacts in the US. U.S. Global Change Research Program. Available: http://www.globalchange.gov/what-we-do/assessment/previousassessments/global-climate-change-impacts-in-the-us-2009.

Vogel, J., Gordon, E., Brislawn, J., Barsugli, J., LeDolce, E., Mills, D, Smith, J., Aggett, G., Harding, B. 2012. Boulder County Climate Change Preparedness Plan.

**Below refers to citations from the Bobolink Habitat section.**

Bollinger, E.K., P.B. Bollinger, and T.A. Gavin. 1990. Effects of hay-cropping on eastern populations of the Bobolink. *Wildlife Society Bulletin 18:142-150.*

**Below refers to citations from the Pollinator Habitat section.**

Kearns C.A. and D.M. Oliveras. 2009a. Boulder County bees revisited: A resampling of Boulder Colorado bees a century later. *Journal of Insect Conservation 13: 603-613.*

Kearns C.A. and D.M. Oliveras. 2009b. Environmental factors affecting bee diversity in urban and remote grassland plots in Boulder, Colorado. *Journal of Insect Conservation 13: 655–665.*

Richards, A.J. 1986. Plant breeding systems. George Allen and Unwin, London. 529 p.