Land Use Management Plan

Buffalo Flats Floodplain Restoration Project

October 14, 2024

Executive Summary and Purpose

The Buffalo Peak Land and Livestock property is the site of a proposed habitat restoration project designed to support the recovery and conservation of ESA-listed salmon and steelhead and will also benefit state sensitive native fish on working lands. The objectives are to re-naturalize a native wet meadow and restore important ecological processes to an impaired channel and floodplain in collaboration with private agricultural operations.

This is a nature-based solution that will provide value to both natural ecosystems and people. The implementation and long-term monitoring and management approaches area significant consideration to protect the aquatic habitat restoration investment while allowing the private landowners to continue to maintain their livelihoods as ranchers. Creating a win-win approach to the conservation and recovery of ESA-listed fish on working lands is an important step, as a large amount of critical habitat is on private lands.

The livestock management approach described in this document supports an aquatic habitat restoration design that allows for dynamic floodplain and channel development with a multithreaded meadow system. Defining a permanent riparian protection boundary with hard fencing will not work in this dynamic context. Rather livestock control including electric fencing, herding, and virtual fence will be used so that managers can respond to the dynamic channel and floodplain condition, protect the investment, and achieve the goals and objectives of this project. This working land management approach allows restoration that occurs on private land to be more innovative and impactful in supporting aquatic habitat, adjusting geomorphology, and increasing climate change resiliency.

Protection of the aquatic habitat investment in the form of a permanent conservation easement attached to the property, along with a robust monitoring scheme that leads to clear management responses to measure results and apply management changes if and when required (adaptive management) is an essential component of the working lands restoration approach to restore aquatic habitat and floodplains.

A. Purpose of this document

The following document aims to meet two key needs:

1. Outline the long-term livestock management approach for this property that supports the investment of the aquatic restoration.

2. Provide a basis for the plan that will be recorded with Union County as an easement on the property to ensure long-term conservation and protection.

B. Additional supporting information

The Land Management Plan supports a package of work at this site. The documents listed below provide additional information about the ecology and history of the site, the proposed aquatic restoration actions, and the regenerative ranching approach informed by Ecological Outcome Verification.

- Catherine Creek Tributary Assessment
- Catherine Creek Reach Assessment
- Buffalo Flats Project Design reports/drawings
- Ecological Outcome Verification

C. Sections of this document include:

I. **Site and Project Overview**: The approach for using a conservation agreement to codify the land management approaches described in this document

II. **Land Management Conservation Agreement:** The conservation agreement will apply to that portion of the property owned by Buffalo Peak Land & Livestock, LLC defined as the Buffalo Flats Floodplain Restoration Project and become an encumbrance on the property deed.

III. **Resource Inventory:** A description of the natural resources and key infrastructure related to ranching and farming.

IV. **Management Approach**: An overview of the land management approach for terrestrial, riparian and aquatic areas of the property, the goals and objectives of the land management operation on the Buffalo Flats property, and a description of the decision-making approach that managers use to measure such things as forage availability, stocking rate, and the time and duration of livestock use to enhance ecological health.

V. **Planned Grazing for Desired Outcomes**: The proposed "holistic management" grazing plan and approach to employed at this site to protect the aquatic habitat and support the ecological health including:
   a. Zones delineated based on their relation to the aquatic and floodplain habitats.
   b. The land management approach with respect to livestock and other management activities

VI. **Wildlife Considerations**: The potential responses to ungulate grazing and beaver colonization of the site.

VII. **Appendix - Monitoring Plan and Purpose:** Methodology that will be used by the operators and owners to monitor and support ecosystem health.

I. Site and Project Overview

A. Site Description

The property owned by Buffalo Peak Land and Livestock, LLC (BPLL), and the subject of the Buffalo Flats Restoration Project, is located east and adjacent to the City of Union, Oregon and within the Catherine Creek Watershed (Figure 1). The project area is approximately 268 acres in size and includes approximately 1 mile of historic floodplains of Catherine Creek and approximately 1.25 miles of Little Creek, as they enter the Grande Ronde River valley. This is a portion of the larger 628-acre ranch owned by BPLL. The property has been managed under private ownership for over a century for farming and ranching, with most of the historic floodplain in hay and pasture production. The project property was purchased in 2018 by owners who have been implementing Holistic Management and Ecological Outcome Verification to raise livestock while improving ecological conditions for fish and wildlife populations.

B. Restoration Project Description & Objectives

Restoration planning and implementation on the BPLL property is proposed to restore habitat to support the recovery and conservation of ESA-listed salmon and steelhead and to benefit state sensitive native fish on working lands. Technical assistance was requested in 2018 from the Union Soil & Water Conservation District (USWCD) and other conservation partners to plan and design restoration actions aimed at restoring functional floodplain and stream conditions while supporting a successful ranching operation. Proposed conceptual actions for the floodplains of Catherine Creek and Little Creek are intended to increase and improve salmonid spawning areas and summer and over-wintering juvenile salmonid habitat conditions (Figure 2). Restoring a more natural plan form in a connected floodplain with a complex of meandering channels and side channels will not only provide an improved physical foundation for aquatic habitat, but will also increase the storage of water, ice, and large wood that contribute to flood damage during high flow events. The addition of large wood will improve aquatic habitat, increase instream cover, and protect deep soils where riparian vegetation can be established.

The combination of restoration actions is designed to meet the following goals:

1. Enhance and restore aquatic habitat conditions and increase habitat diversity and complexity for salmonids.
2. Improve water quality conditions (temperature and sediment) for salmonids,
3. Promote conditions for restoring ecological function and improving soil health.
4. Improve riparian corridor and floodplain vegetative diversity and function.
5. Reconnect both Catherine Creek and Little Creek with their associated floodplains and expand quality floodplain habitat availability for salmonids.
6. Increase streambank and floodplain storage of water and ice; thereby, increasing the potential for attenuating flows, and reducing ice formation.

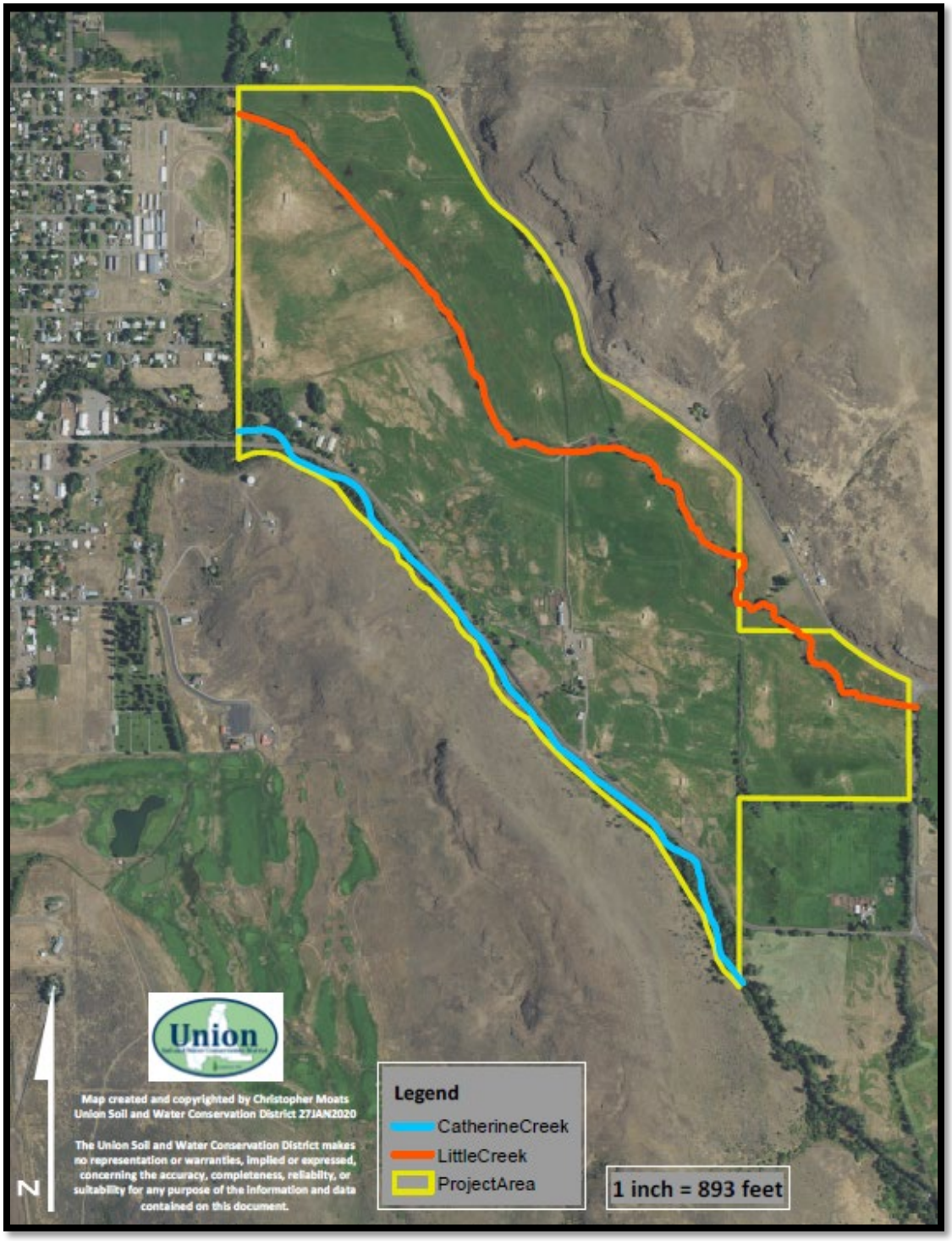

Figure 1. Buffalo Flats Floodplain Restoration Project Area.

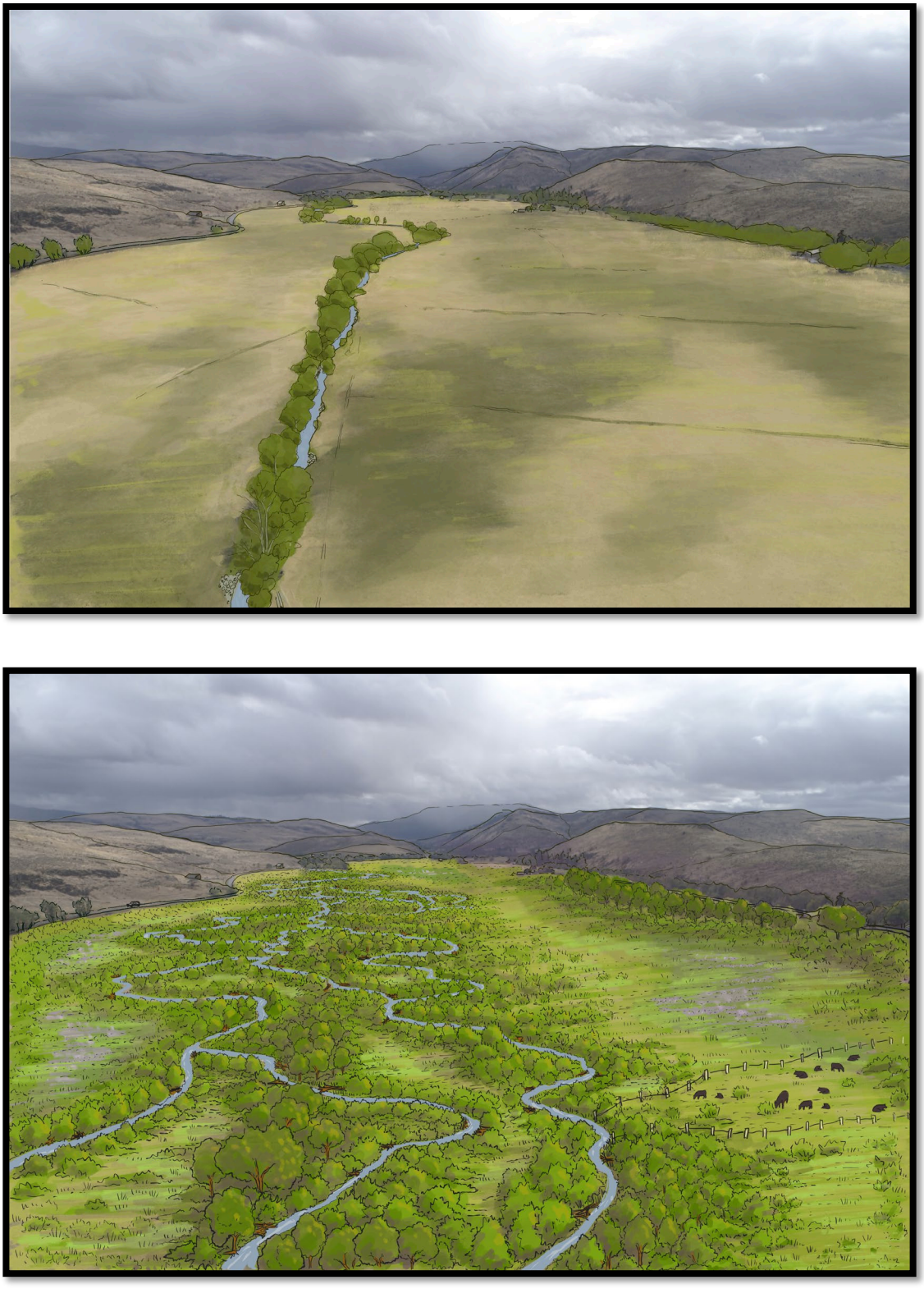

Figure 2. Conceptual drawings of Existing (above) and Proposed (below) conditions for Little Creek (reaches 3 and 4) in the Buffalo Flats Restoration Project area.

II. Land Management Conservation Agreement

The owners of Buffalo Peak Land & Livestock, LLC will enter a permanent conservation agreement with the Union Soil & Water Conservation District (Union SWCD) to assure application of this Land Management Plan in perpetuity. This conservation agreement will be implemented in two parts. Part one includes the flood zone and surrounding uplands associated with Little Creek. Part two of this agreement will include the floodplain and uplands associated with Catherine Creek but will be delayed until the restoration designs are completed and implemented for that portion of the property.

The conservation agreement will provide basic details including identification of the parties, legal description of the conservation property where this plan will be applied, and term length of the agreement. The responsibilities of each party that are in addition to this land management plan will be described and will include the expected actions and tasks to be performed by the Union SWCD and the expected actions and tasks to be performed by the landowner.

The conservation agreement will apply to that portion of the property owned by Buffalo Peak Land & Livestock, LLC defined as the Buffalo Flats Floodplain Restoration Project and become an encumbrance on the property deed. The conservation agreement will be recorded with the Union County Planning Office. Recording this agreement will assure the implementation of this Land Management Plan in perpetuity, no matter the ownership.

III. Resource Inventory:

A depth of information exists for the BPLL property contained in other existing documents, and is summarizes here:

A. Natural Resources

rivers,
wetlands,
vegetation community,
soils…
Proposed condition description. Multiple channels, wider riparian area and developed plant community

B. Key Agricultural Infrastructure

irrigation systems -
fence – Much of the existing internal fencing will be removed, leaving only property boundary fences. Temporary electric fencing will be in place to control livestock according to the holistic grazing plans and rolled up when the livestock are moved to the next grazing area.
livestock watering infrastructure – Off-site water system designed by NRCS is being implemented.
roads and access trails, etc.

IV. Management Approach:

A. Overview of Management Approach

A focus on the desired outcomes of restoring floodplain processes, a resilient vegetation community, and aquatic habitat will be the management approach for the project area rather than relying on traditional practices. This approach is 1) responsive to impacts and changes in management decisions, 2) made throughout the years, and 3) will be informed by monitoring and evaluation of ecological function. This outcome-based approach will withstand land ownership changes, is agnostic to practices, and protects the investments made to restore ecological function and aquatic habitat by reconnecting Little Creek and Catherine Creek to their historic floodplains.

The decrease in populations of Endangered Species Act (ESA)-listed salmon, steelhead, bull trout, and state sensitive lamprey and trout species in the project area may be caused in part by the fact that over the decades Little Creek and Catherine Creek have been anthropogenically degraded, simplified, and channelized. A significant step toward regenerating habitat for the threatened and endangered species will be addressing key limiting factors by restoring the connection of these two rivers to their floodplain and promoting and supporting a healthy and sustainable vegetation community. These activities will also increase ecosystem and species resiliency to adverse climate change impacts.

Ecological Outcome Verification (EOV) monitoring protocol is an outcome-based methodology designed for grassland environments, grazed orchards, silvopasture systems, mixed livestock-cropping systems, and mixed livestock-forest areas to evaluate both leading and lagging indicators to provide a holistic assessment of ecosystem function. The EOV protocol was developed to be a practical and scalable soil and landscape assessment methodology that tracks outcomes in biodiversity, water, soil health, and ecosystem function. It will be the monitoring protocol used in this working-lands management approach to measure outcomes and inform decisions for livestock and vegetation management and ensure that this aquatic habitat restoration investment is successful.

Under the EOV protocol, the land management approach for this property will include a process of planning, monitoring, controlling, or adjusting, and re-planning if necessary. As part of the short-term monitoring, every year there will be an Ecological Health Index (EHI) assessment that is calibrated to the appropriate ecoregion and is based on the four ecosystem processes of water cycle, mineral cycle, energy flow, and community dynamics. The EHI score gives the distance to the potential of that ecological state in relation to the reference area and serves as a combined measure of ecosystem health. As part of that process, every five-years there will be an EOV long-term monitoring effort. The baseline long-term monitoring was conducted in 2019 with the five-year monitoring event concluded in 2024.

The EOV long-term monitoring sites are permanent benchmark sites that are located at representative areas of the ranch. It begins with establishing the baseline and is repeated every 5-years to detect structural changes of the land base and track the functionality of the ecosystem processes which cannot be assessed through short-term monitoring for all of the attributes. Both the short-term and long-term monitoring procedures are used for the Ecological Health Index, which is calculated using the Evaluation Matrix for the

associated ecoregion. These two tools will ensure the achievement of the following goals, objectives, and outcomes.

The EOV protocol includes ecoregion calibration, creating a monitoring plan, state and transition catalog, and reference areas, and conducting baseline (long-term monitoring every five years) to assess lagging indicators and annual short-term monitoring to look at leading indicators, quality assurance review of the data, and reporting data to land managers and regulators. Land-based mapping is a necessary first step in creating plans for short- and long-term ecological monitoring, assessing resources under management, and identifying different soil strata. Strata boundaries are then defined, and their area is calculated. This is done by an accredited EOV Master Verifier. The plan determines the number and location of both short-term and long-term monitoring sites. This process was completed at the project area in 2019. More information is provided in Appendix A. While the mapping and monitoring was done to take into account the restoration efforts of this project, additional sites may be needed to provide baseline since morphological structure will change with floodplain restoration.

The managers will keep actual use records, execute growing and dormant season grazing plans, and adjust livestock numbers to meet restoration goals and objectives. In addition, third-party monitors hired by the landowners will conduct annual EOV short-term monitoring and long-term monitoring every five years.

The landowners and managers will base stocking rates on the volume of forage available and how long it must last, thereby aligning the management approach with carrying capacity (the number of animals the land can carry based on the forage available over the non-growing season plus a month or more of drought reserve). This will also consider wildlife and fishery needs on the same land. The stocking rate for the growing season will be based on estimated animal days per acre (ADA) that will be grown, seasonal weather predictions, historical production, progress measured through EOV, and most importantly recovery periods of plants.

B. Land Management Plan Goals

1. Reconnect, restore, and protect the hydro-geomorphic channel and floodplain form and function for Little Creek and Catherine Creek. This will enhance and expand the quantity and quality of floodplain habitat availability for ESA-listed and state sensitive fish species in the project area.

2. Improve the riparian corridor and floodplain vegetative diversity and function in the project area.

3. Promote conditions for restoring terrestrial ecological function and improving soil health in the project area.

C. Land Management Plan Objectives by Goal

Ecological function depends on natural elements and processes properly interacting to support one another. For the purposes of clarity and understanding, we are separating them into three Zones, each with specific objectives, and categorizing them by (1) Channel and floodplain function, (2) Riparian and floodplain vegetation function, and (3) Terrestrial function.

Zone 1 Description: Zone 1 includes the stream bed, banks, riparian zone, and floodplain extending from the center of the channels. We acknowledge that this zone will expand and contract yearly to spread its presence over time. Management based on monitoring EOV indicators such as live canopy abundance, erosion, bare ground, and functional groups of desired species will ensure that the investment made in channel, floodplain, and vegetation and ecological function will be enhanced.

Ecological purpose/value: Zone 1 includes areas that directly support fish habitat and foodwebs. Flooding in Zone 1 typically occurs annually. Enhancing and restoring functional, hydrogeomorphic processes to Little Creek by reconnecting the floodplain and improving aquatic habitat conditions are a high priority for addressing key limiting factors to ESA-listed and state sensitive fish. Favoring the establishment and maintenance of woody and herbaceous species will be imperative. EOV data will guide management to insure the outcomes of creating an adaptive and dynamic state to quickly recover from annual disturbance so there is little bare ground to avoid weeds and promote the desired live canopy vegetation beneficial to the foodweb.

Zone 1 Goals and Objectives:

1. Reconnect, restore, and protect the hydro-geomorphic channel and floodplain form and function for Little Creek. This will enhance and expand the quantity and quality of floodplain habitat availability for ESA-listed and state sensitive fish species in the project area.
    a. Protect the restoration investment by closely monitoring channel conditions (using temporary fencing, off channel water, proper grazing and animal impacts, monitoring)
    b. Decrease bare ground, channel erosion, compaction, and thatch cover within the project area, thereby improving water infiltration rates and supporting an increased water table elevation.
2. Improve riparian corridor and floodplain vegetative diversity and function in the project area within 5-years of project implementation.
    a. Expand riparian area and increase vegetative cover to trap sediment, reduce water quality impairments, and enhance the amount of vegetation to perform filtering and buffering functions.
    b. Increase stream shade by enhancing native woody vegetation within the limitations of soil structure and hydrology throughout the project reach to maximize shade on water surfaces and increase edge effect.

Zone II Description: Zone II is defined as the area from the dynamic outer boundary of Zone I and includes the width of the floodplain, approximately the modeled 25-year recurrence flow level.

Ecological purpose/value: Zone II will provide the greatest plant production. For this reason, this Zone is anticipated to support high levels of improvement in floodplain function by creating an edge effect imperative for the necessary diversity and complexity needed to meet the goals of the floodplain restoration project.

Zone II Goals and Objectives:

1. Promote conditions for restoring terrestrial ecological function, advancing the foodweb,and improving soil health in the project area.
    a. Advance plant succession by encouraging desired plant and reducing undesirable and invasive plants to less than 5% of the total project area within 5 years of project completion.
    b. Increase soil organic matter and Ecological Health Index scores to a regenerative state within 5 years of project completion.
2. Promote and improve contextually desired functional groups (shrubs and trees, forbs and legumes, and perennial bunchgrasses) of vegetation communities so that the live canopy of perennial species exceeds 80% of site potential.
    a. Increase species richness and distribution, vigor, and age class distribution of native riparian and floodplain functional groups by over 400% within 10 years of project completion.

Zone III Description: Zone III, Terrestrial Zone, begins at the dynamic outer boundary of Zone II and includes the remaining portion of the project area not in Zones I and II and the higher elevation bench and terrace areas within the valley bottom.

Ecological purpose/value: Zone III plays an important role in enhancing overall ecological function, provides important edge effect for connection to the uplands, and consists of valuable agricultural lands.

Zone III Goals and Objectives:

1. Promote conditions for restoring terrestrial ecological function and improving soil health in the project area.
    a. Through active weed management and advancing plant succession to encourage currently rare plants (reference plant species list), undesirable and invasive plants will be reduced to less than 5% of the total project area within 5 years of project completion.
    b. Increase soil organic matter and Ecological Health Index scores to a regenerative state within 5 years of project completion.
    c. Promote and improve contextually desired functional groups (shrubs and trees, forbs and legumes, and perennial bunchgrasses) of vegetation communities so that the live canopy of perennial species exceeds 80% of site potential.

d. Increase species richness and distribution, vigor, and age class distribution of native riparian and floodplain functional groups by over 400% within 10 years of project completion.

V. Planned Grazing for Desired Outcomes

A. Land Management Layout

This land use management plan is developed for the measured and controlled management of livestock to be in the right place, at the right time, for the right reason, with the right behavior. Livestock management will be based on ecological and grazing goals and objectives and informed by monitoring results that will also ensure the fish habitat restoration objectives are being met.

This plan recognizes the diversity of landforms, soils, hydrology, wildlife, and vegetation across the managed property. The diversity of land features, including Little Creek and Catherine Creek channels, floodplains, and wetlands, as well as surrounding uplands, creates conditions that vary in sensitivity to agricultural activities and require different levels of protection from impacts. For example, streambanks and vegetation located in riparian areas and active floodplains surrounding a stream channel will be much more susceptible to livestock-driven compaction and erosion than dryer upland pasture areas if a management approach is not applied correctly. For this reason, livestock location, density, frequency, and duration will be managed based on leading indicators for ecosystem process function as well as physical bank, vegetation, and soil conditions.

Modeled hydraulic inundation levels during high flow events, vegetation species composition, hydric soil characteristics, and soil types were used to identify Zones 1, II and III in the project area. Using this information in combination, the boundaries between Zones are defined by measuring a distance from the center of primary stream channels. In each Zone, a specific set of management criteria is applied to provide a specific level of protection while allowing certain management actions. The objective is to provide an appropriate level of protection from management impacts while meeting ecological goals.

Zone 1, the riparian management zone, extends from the center of the channel into the floodplain, requiring strict protection of this ecologically important and dynamic area. Zone 2, the floodplain management zone, extends from the Zone 1 boundary out to approximately a 25-year flood recurrence boundary and will have management criteria applied to meet vegetation and soil conservation goals. Zone 3, the Terrestrial Zone, is the area furthest from stream channels with a frequency of flooding greater than 25 years and contains the remaining portions of the project area outside Zones I and II.

This management plan will utilize temporary electric fencing, virtual fencing, and herding as the preferred methods for controlling livestock locations and protecting sensitive areas. Restoration project designs applied in the Columbia Basin often cannot support dynamic channel function and evolution when hard fencing is required around

Zone 1. Many of these designs emphasize a more simplified and oversized channel form, allowing hard fencing to remain static. Properly functioning ecological conditions with multi-threaded, complex channels and meadow areas that support floodplain connectivity and dynamic channel movement are incompatible with this static fencing approach. The project area setting is an ideal location and opportunity to support dynamic channel and floodplain habitat to address a key limiting factor for ESA-listed salmon and steelhead on these working lands. Therefore, temporary electric fencing will be used to manage livestock. A temporary electric fence is a tried-and-true management tool for controlling grazing, reducing animal impact, and implementing rest for specific areas allowing land managers to be more responsive to monitoring results and achieving desired outcomes. Electric fences are 95% effective when livestock are appropriately trained.[1] While hard fencing has an illusion of control to fence out livestock from riparian areas, it actually fences out management. It has been practically proven ineffective, expensive to install, and difficult to maintain. With tools such as electric fencing and herding guided by an annual Holistic Grazing Plan, managers will be able to allow streams to evolve and animal use that responds directly to the conditions present on the landscape. The following Zone descriptions identify specific ecological function, value, purpose, and corresponding management targets and strategies. Regulatory certainty will be achieved through Ecological Outcome Verification to ensure livestock are managed by implementing an annual growing and dormant season grazing plan. Primary water will be off the river corridor through an established watering system.

1. Zone I- Riparian Management Zone

Description: Zone I includes the stream bed, banks, riparian zone, and floodplain extending to 60-100 feet out from the center of a channel.

Ecological purpose/value: Zone I includes areas that support fish habitat and foodwebs most directly. Flooding in Zone I typically occurs annually. Enhancing and restoring functional, hydrogeomorphic processes to Little Creek and Catherine Creek, including reconnection of the floodplain and improvement in aquatic habitat conditions are a high priority. Favoring the establishment and maintenance of woody species along the stream channel and in the adjacent floodplain will be imperative.

Management targets/goals: (describe of form - ideal bed, banks, vegetation)

Management strategies:

[1] The 5% error is largely due to clip malfunction from charger leads, which can be corrected within hours without a high level of grazing or animal impact events. Failure of hard fencing is similar at around 5%, although the impact can be much more significant because the typical situation in these scenarios that involves livestock that are not managed daily. Even one trespass animal in the exclosure can do substantial damage.

a. Immediately following construction of a restoration design, Zone I will be the most impacted, with bare soil, fragile streambanks, and newly planted riparian vegetation. This zone will be restricted to protect these more sensitive and impacted areas. In particular, woody vegetation growth adjacent to stream banks will be prioritized.

b. If symptoms of overrest in Zone 1 are observed and/or measured, management tools such as livestock grazing can be applied. These symptoms may include but are not limited to:
   - Standing dead forage older than two years
   - Perennial grass plants oxidizing, pedestalling, and with dead plant centers
   - Missing or decline of functional groups of plants such as cool season grasses, forbs, and legumes
   - Accumulated plant litter decomposing chemically rather than biologically.
   - Increase in noxious weeds
   - Soil capping
   - Wind and water erosion due to bare ground

The landowners and Union SWCD anticipate it will take at least two years after the restoration planting plan is completed for riparian vegetation to become established and may take several more years before symptoms of overrest are observed. Once symptoms of overrest are observed, (e.g., oxidizing grasses choking plant growth points) livestock will be used to halt the effects of overrest if monitoring shows the tools of grazing and animal impact are necessary to advance succession, thus biodiversity, when these treatments are deemed beneficial. If the plant community demonstrates soil health has digressed to a bacterial state with cheatgrass, Reed's canary grass, medusahead, thistle, or other noxious weeds that thrive on overrested land, the tool of living organisms (including grazing and animal impact) will be implemented to move the soil health towards a more balanced bacterial/fungal community.

When holistic planned grazing is employed in Zone I, the outcomes of the action will be monitored through the grazing plan so there are no prolonged effects of animal impact or over utilization of riparian vegetation. Herbaceous species will be grazed early in the season to open the canopy to woody plant seedlings. The grazing and browse of established woody species will be monitored to avoid grazing of second-year wood, where woody species presence is to be maintained and encouraged. Finally, livestock use will be prohibited in areas with desired woody species after the first frost of fall and before most leaves have fallen.

2. Zone II- Floodplain Management Zone

Description: Zone II is defined as the area from the outer boundary of Zone I and includes the width of floodplain to approximately a modeled 25-year recurrence flow level.

Ecological purpose/value: Zone II will provide the greatest plant production. For this reason, this zone is anticipated to support high levels of improvement in floodplain function.

Management targets/goals: The benefits and outcomes include:

- Improved soil health allowing for better water infiltration thereby decreasing the need for irrigation and increasing instream flow
- Cooling of the soil surface by decreasing bare ground and increasing photosynthesis and transpiration
- Creation of an edge effect allowing for increased biodiversity and wildlife corridors

Management strategies: Management will work to keep as many plants as possible in Zone II in their vegetative state to capture the maximum amount of sunlight. Plant growth rates will be monitored to plan for adequate recovery periods.

3. Zone III- Terrestrial Zone

Description: Zone III, the terrestrial zone, begins at the outer boundary of zone II and includes the remaining portion of the project area not in zones I and II and the higher elevation bench and terrace areas within the valley bottom.

Ecological purpose/value: Zone III plays an important role in enhancing overall ecological function, provides important edge effect for connection to the uplands, and consists of valuable agricultural lands.

Management targets/goals: The areas included in zone III are usually the most appropriate siting areas for infrastructure such as human dwellings, shops, livestock working facilities, roads, and highways.

Management strategies: Zone III provides forage production for livestock in the least sensitive portions of the project area. Zone III is also essential to allow for improved placement of infrastructure thereby allowing for the more appropriate use and restoration of Zone I and II.

B. Land Management Approach

1. Livestock Management

Livestock have a dual purpose by both generating income for the producer and therefore the tax base, and as a tool to enhance ecological function. As such, each enterprise (e.g., cow-calf, yearling, grass-finished beef, sheep) has a specific role. These roles are relative to feed quality and disturbance needs as well as season and duration of use to enhance ecological function. The needs of the plant community drive the grazing planning and execution, which supports a functional floodplain and therefore aquatic community.

The key principles for livestock management that will lead to the desired ecological outcomes include:

i. **Planning for livestock watering.** Access to water for livestock is an important consideration for a successful grazing management plan. Off-channel, frost-free pipeline has been installed, which provides not only the ability to water livestock but to disperse their impact by limiting the time they are in one place so that adequate plant recovery is achieved.

ii. **Planning plant recovery times before planning grazing times.** This allows the planning of recovery periods, rather than grazing periods. Livestock moves allow for the reserve of certain areas for the animals at crucial times, such as calving and plans for wildlife needs, like nesting birds and fish spawning.

iii. **Monitor the plan.** Given that what we expect to happen rarely does, the livestock management approach for this project will be a process of planning, monitoring, controlling, or adjusting, and re-planning if necessary. The protocol will consist of monitoring daily growth rates of plants to ensure adequate plant recovery and to reduce the potential for overgrazing. In addition to adjusting management and livestock moves by assessing daily growth rates, we will do landscape level monitoring so that we are using livestock to produce the desired landscape as described in the goals and objectives. Progress toward that future landscape will be monitored annually to inform the grazing plan and track leading indicators. A more comprehensive trend and condition monitoring protocol will be conducted every five years to assess lagging indicators such as plant species richness, water infiltration rates, and soil health.

iv. **Maximum density for minimum time.** Animals that remain bunched in a single herd are more effective at chipping the soil surface with their hooves and trampling down plant material to cover the soil so that air and water enter, and new plants can grow. Scattered animals have less positive impact on the soil surface with their hooves and will create less litter to cover the soil surface. If animals – bunched or scattered – are left in any one place too long, or if returned

to it too soon, they will overgraze plants and compact and pulverize soils. The livestock management approach employed in the Buffalo Flats project will ensure that animal density is appropriate to aerate the soil and provide adequate time for plant and soil recovery.

v. **Overgrazing by livestock is more often linked to the time animals are present, rather than animal numbers.** Overgrazing commonly occurs at three different times:
    a. When plants are exposed to the animals for too many days and the animals are around to re-graze the plants as they regrow;
    b. When animals move away but return too soon and graze the plants again while the plants are still using stored energy to reform leave; and/or
    c. Immediately following dormancy when plants are growing new leaf from stored energy.

    The Buffalo Flats project livestock management approach will ensure that overgrazing does not occur by providing adequate time for plant recovery and by ensuring the proper time of grazing. Two grazing plans, informed by the monitoring data, will be created and executed each year. The growing season plan is created before main growth starts. This plan aims to grow the maximum amount of forage possible during the growing season (which typically starts in mid-April when grasses have reached the 3 1/2 leaf stage) so that animals have enough to eat throughout the year and plants are not overgrazed. The dormant season plan is used when grasses stop growing (typically November through mid-April). This plan aims to prepare the soil and plants for the coming growing season and ration out the remaining forage over the months ahead – right through to a month or more after main growth is expected to start. This additional "month or more" becomes the drought reserve used if the next growing season starts late.

    While the focus is on enhancing the live canopy abundance, age class diversity, density, and duration of vegetative state of perennial grasses in the grazing plan, other factors will be considered such as enhancing woody species.

As growth rates slow, some pastures are removed from active grazing, and growth in those pastures is stockpiled for winter grazing needs or to support other identified goals and objectives. Early warning indicators for approaching unwanted outcomes are identified triggers at every stage. These indicators of growth rate, recovery period, residuals, trails, or streambank conditions help managers adjust grazing periods and stocking rates to achieve the desired ecological outcomes.

2. Other Management Activities (fire, weed control)

Fire is an option for the removal of plant residue and changing species compositions. Although, due to the tendency to send nutrients into the atmosphere and creating bare ground, rather than transferring those nutrients into the soil, fire will rarely be used across this landbase. If the situation occurs where trees and shrubs become aged and less productive, or if grazing animals are unable to impact and breakdown the plant material, fire would be carefully considered for revitalizing the vegetative community.

Vegetation management will be focused on increasing the species diversity and density of desirable functional groups of plants (perennial grasses, forbs, legumes, trees, and shrubs). Weeds will be viewed as an early warning indicator that plant community dynamics are not moving toward the desired state and soil dysfunction persists. Understanding the state and advancing the transition to more plant diversity and complexity and soil stability will inform management to move the plant community and the soil structure that it depends upon toward the desired regenerative state. Actions such as prescribed grazing, carbon loading, digging, and pesticide application that does not harm the aquatic community will be tested and applied as deemed necessary to enhance succession and reach the desired state of ecological function.

Currently, the irrigated ground has severe compaction from overirrigation, haying, and low stock density for prolonged periods of time. The plan to address this condition will continue to be less irrigation and changes in grazing management to encourage better plant vigor and diversity, increase mineral and water cycling, and improve soil structure. As soil microorganism populations increase, the compaction barrier should transition to a soil sponge, increasing water holding capacity. If this does not happen in an expected time frame, managers will consider such tactics as applying soil amendments, mechanically aerating, or no-till planting cover crops in targeted areas.

VI. Wildlife Considerations:

Elk and Deer- If elk and deer browsing becomes an issue, it will be evaluated and addressed.

Beaver – increasing population with improving and expanding riparian plant communities. Potential impacts to developing plant communities.

VII. Appendix-Monitoring Plan and Purpose:

Monitoring Approach and Methods

Ecological Outcome Verification (EOV) will measure outcomes and inform decisions for livestock and vegetation management to achieve stated goals and objectives. In 2019 and 2020, the owners and managers of Buffalo Peak Land & Livestock, LLC, engaged third-party professionals to set up EOV on the property using satellite cartography. EOV tracks outcomes in biodiversity, soil health, and ecosystem function – water cycle, mineral cycle, energy flow, and community dynamics.

The monitoring plan combines the establishment of 11 Short-Term Monitoring (STM) sites distributed throughout the project area, with 3 Long-Term Monitoring (LTM) trend and condition transects and photopoints located at representative areas (Figure 1). Monitoring at STM locations occurs annually, while monitoring at LTM locations occurs every five years beginning as a baseline assessment in 2019 and 2024 for year five. The Ecological Health Index links both monitoring procedures, calculated using the targeted, contextually relevant scorecard (Borrelli, et al.; Pellant, et al. Tongway, et al.; Xu, et al.).

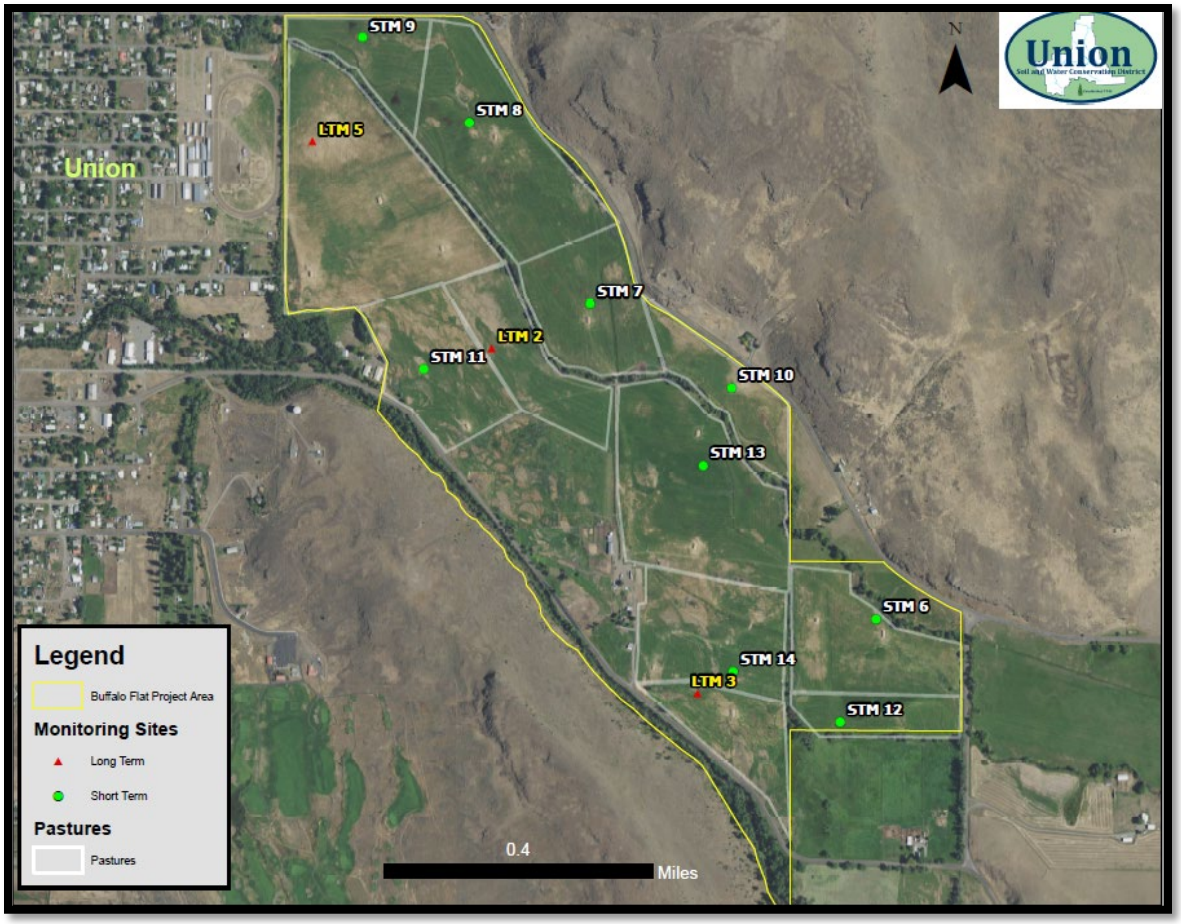

Figure 3. Ecological Outcome Verification (EOV) monitoring sites on Buffalo Peak Land & Livestock property.

EOV is a landscape monitoring protocol based on outcomes rather than practices. It is contextually relevant and can lead to better management decisions. EOV annual monitoring criteria is comprised of "leading indicators" of ecological health, or those indicators that have predictive value about the direction of changes. Leading indicators, as shown in *Table 1*, are informative for documenting and influencing management.

Long-term criteria are comprised of all the short-term criteria listed in *Table 1*, plus a suite of "lagging indicators" for land regeneration such as canopy cover by species and functional groups, biodiversity indicators, water infiltration, soil carbon, and soil health. An estimated score is applied to these indicators within a range shown in *Table 2* using acknowledged scientific methodologies. Unlike leading indicators, lagging indicator values usually take a longer period for corrective measures to take effect. However, lagging indicators do provide scientifically solid validation on the function of the ecosystem processes.

Table 1. Leading indicators of ecological health

Num	INDICATOR	UNIT	SOURCE	TYPE	Water Cycle	Mineral Cycle	Energy Flow	Comm Dynamics
1	LIVE CANOPY ABUNDANCE	Total green biomass production/Site Potential	2, 3, 5	Relative			■	
2	LIVING ORGANISMS (MICROFAUNA)	Evidence of Microfauna	2.3	Absolute		■		
3	FG 1 WARM SEASSON GRASSES	Vigor, reproduction, crown integrity	1,2,3,5	Relative				■
4	FG 2 COOL SEASSON GRASSES	Vigor, reproduction, crown integrity	1,2,3,5	Relative				■
5	FG 3 FORBS & LEGUMES	Vigor, reproduction, crown integrity	1,2,3,5	Relative				■
6	FG 4 TREES & SHRUBS	Vigor, reproduction, crown integrity	1,2,3,5	Relative				■
7	CONTEXT DESIRABLE RARE SP	Frequency	1,2	Relative				■
8	CONTEXT UNDESIRABLE SP	Frequency	1,2,5	Relative				■
9	LITTER ABUNDANCE	% Cover	1,2,3,4,5,7,	Relative	■	■		
10	LITTER DECOMPOSITION	Litter type/soil contact	2,3,4,5,7,	Absolute		■		
11	DUNG DECOMPOSITION	Dung dissapearance rate	2.3	Absolute		■		
12	BARE SOIL	% Bare soil	1,2,3,4,5,7	Relative	■	■	■	■
13	CAPPING	Soil surface resistance	2,4,7	Absolute	■			
14	WIND EROSION	Blowout/deposition active pedestals	1,2,3,4,5,7	Absolute	■			
15	WATER EROSION	Rills/water flows, gullies	1,2,3,4,5,7	Absolute	■			

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2. Pellant, M; Shaver, P; Pyke, D; and J. Herrick. 2005. Interpreting indicators of rangeland Health, version 4. Technical Reference 1734-6 US Department of Interior, Bureau of Land Management, National Science and Technology Center, Denver CO, BLM/WO/ST-00/001+1734/REV05 122pp

3. Tongway D.J. y Hindley N.L. 2004. Landscape Function Analysis: procedures for monitoring and assessing landscapes with special reference to Minesite and Rangelands. CSIRO Australia, 80 pp.

4. Gabriel Oliva, Juan Gaitán, Donaldo Bran, Viviana Nakamatsu, 2009 Manual para instalación y lectura de monitores MARAS.INTA Proyecto PNUD GEF 07/35. 69 pp https://www.undp.org/content/dam/argentina/Publications/Energia%20y%20Desarrollo%20Sostenible/AF_maras_web.pdf[2]

5. Borrelli,P y Oliva, G. 2001.: Ganadería Ovina Sustentable en la Patagonia Austral. Borrelli P. y Oliva, G. Ed. INTA Reg. Pat. Sur. 269pp.

6. Committee on Rangeland Classification Board on Agriculture. National Research Council. 1994. Rangeland Health: New Methods to Classify, Inventory, and Monitor Rangelands https://www.nap.edu/catalog/2212.html

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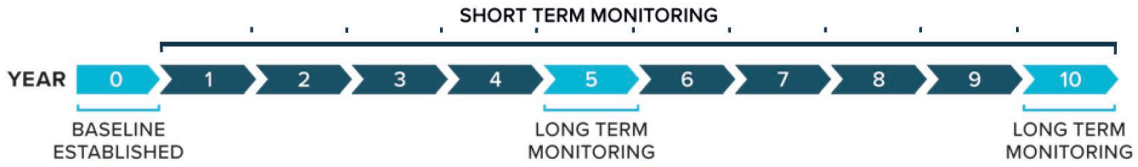
Table 2. Scoring ranges for ecosystem processes (EHI) and lagging indicators.

INDICATOR	UNIT	LOW	MEDIUM	HIGH	VERY HIGH
EHI	Average Score	<0	1-30	30-60	>60
	INTERPRETATION	High to extreme departure from Ecoregion potential. Land degradation active. Ecosystem processes affected.	Moderate departure from Ecoregion potential. Ecosys-tem processes affected.	Light to moderate departure from Ecoregion potential. Most Ecosystem processes perform about 60% of potential	Light departure from Ecoregion potential. Effective Ecosystem processes. Healthy land.
SPECIES RICHNESS	N° of Species	<15	15-25	25-35	>35
	INTERPRETATION	Low Biodiversity	Moderate Biodiversity	High Biodiversity	Biodiversity at full expresion
SHANNON-WEAVER INDEX	Index	<1.5	1.5-2.0	2.0-2.5	>2.5
	INTERPRETATION	Cover is dominated by few species	Moderate dominance of some species	Cover is distributed relatively even between species	Cover is well distributed between species
INFILTRATION RATE	Minutes/25mm	>30	10 to 30	3 to 10	<3
	mm/hour	<50	50-150	150-500	>500
	INTERPRETATION	Moderate to very slow infiltration rate	Moderately rapid infiltration rate	Rapid infiltration rate	Very rapid infiltration rate

EOV documents the dynamic aspects of soil health that are dependent on soils' inherent properties and the influence that land use and management can have over time. To achieve desired outcomes, two distinct grazing plans are created and executed each year on a planning chart so that the managers can plan months ahead to meet livestock and wildlife needs, cover drought reserves, increase diversity and vigor of desirable plant species, mitigate the prevalence of undesirable plant species, and ensure fishery habitat protection. The grazing chart provides a clear picture of where livestock need to be and when, and this determines how managers plan their moves to ensure adequate plant recovery. The chart is also essential for monitoring and adjusting or controlling the plan. For example, if grazing periods need to be modified in the growing season, the effect on the recovery periods for plants in all grazing divisions are easily viewed in the chart.

The monitoring plan combines the establishment of 11 short-term monitoring sites, distributed extensively throughout the entire landbase, with four long-term permanent

transects and photopoints located in representative areas. Both monitoring procedures are linked by the Ecological Health Index, calculated using the targeted, contextually relevant scorecard.



Short-term monitoring occurs annually. Long-term monitoring visits occur in year 0, 2019 (the baseline assessment) and every five years thereafter with monitoring being completed in 2024. Additional monitoring sites can be installed if it is determined that more are needed to inform and to assess management for desired outcomes.

The areas covered by EOV are separated into broad ecological regions, defined as areas that contain characteristic geographically distinct assemblages of natural communities and species. The biodiversity of flora, fauna, and environments that characterize an ecological region tends to be distinct from other ecological regions. Ecological regions are the result of climate, geology, and landforms. They have a defined degree of brittleness (or how much humidity remains at the soil surface throughout the year) and therefore have differential responses to management tools. The tools available to managers are fire, living organisms (including grazing and animal impact), and rest. None of these tools can be used without money and human creativity.

The monitoring plan for the Buffalo Peak Land and Livestock property focused on the plant communities relevant in the Middle Rocky Blue Mountain Region. According to the EOV protocol, a specific scorecard was created to measure ecological health within this context and will be relevant to assess the ecological function within the three zones.

A State and Transition Catalogue for the Middle Rocky Blue Mountain Ecoregion was created to inform management and make monitoring contextually relevant.

The catalog summarizes the possible states of vegetation, functional groups of plants in each state, possible transitions between states, and the tools and events that promote change of states for the ecoregion. The State and Transition Catalogue shows the extent of comprehensive changes in soil and vegetation and the effect of human management and different tools to promote or avoid transitions.

When monitoring the established transects, we determined what state the area is in compared to what the desired state is and score accordingly. For example, currently, the state of the project area is developed hay pastures, and the desired state is floodplain-connected perennial meadows. We assessed ecosystem function through the Ecological Health Index (EHI). For this purpose, biological indicators are used according to an evaluation matrix that we adapted to the Middle Rocky Blue Mountain Ecoregion.

Each indicator receives a score according to the degree of departure from the ecological area potential. The values are added together to obtain a total score at each sampling site. The possible values for this ecoregion range from 120 to – 140 as described in Table 3.

Table 3. Scoring ranges for ecosystem processes – Ecological Health Index (EHI)

Ecological Health Index (EHI) Indicators	High/Low Scores	Water Cycle	Mineral Cycle	Energy Flow	Community Dynamics
Live Canopy Abundance	10/-10			✓	
Living Organisms (microfauna)	10/-10		✓		
Functional Group – Warm Season Grasses	10/-10				✓
Functional Group – Cool Season Grasses	10/-10				✓
Functional Group - Forbes/Legumes	10/-10				✓
Functional Group - Trees/Shrubs	10/-10				✓
Contextually Desired Rare Species	10/0				✓
Contextually Undesired Species	0/-10				✓
Litter Abundance	10/0	✓	✓		
Litter Incorporation	10/0		✓		
Dung Decomposition	10/0		✓		
Bare Soil	20/-20	✓	✓	✓	✓
Capping	0/-10	✓			
Wind Erosion	0/-20	✓			
Water Erosion	0/-20	✓			
Total EHI Score Possible	**120/-140**	**-70/30**	**-30/60**	**-30/30**	**-70/70**

These quantified variables are surveyed in the field and then processed and weighted to obtain a value per pasture as well as a weighted average for the ranch. Values above 60 in the Middle Rocky Blue Mountain Ecoregion reflect that ecosystem processes (water cycling, nutrient cycling, energy flow, and community dynamics) are functioning reasonably. Scores closer to 120 show that ecosystem processes are approaching their

potential. Negative values indicate that ecosystem processes are ineffective and far from the site's potential.

The landscape function analysis allows us to see how each ecosystem process functions independently. Of course, these processes work in tandem, but viewing them as four windows looking in the same room can give the manager insight into applying the tools available to influence their function.

It must be reiterated that EHI scores evaluate leading indicators. With management, these indicators can change very quickly, especially when one looks at the ecosystem processes that are functioning well and deciphering how one can use this to advance measurement.

Three long-term monitoring sites were installed in the project area place and one on Buffalo Peak upland. Since we are looking at lagging indicators such as soil health and species composition, we can more fully understand how the ecosystem processes are functioning in different habitats over time.

At each long-term site, the following indicators were evaluated:

- Percentage of bare ground, litter, and live canopy
- Botanical composition by species and functional groups
- Distance between perennial plants
- Species richness and biodiversity
- Water infiltration rate
- Soil health

Diagram of the Long-Term Monitoring Site