5 Prescribed Fire Plan

5.1 Introduction

Prescribed fire is a land management tool that can be used to:

- Restore fire to the landscape, simulating prior natural processes;
- Reduce unnaturally high accumulations of vegetation;
- Decrease the risk and severity of unwanted wildland fires in the future;
- Lessen the potential loss of life and property;
- Control many undesirable plant species, plant diseases, and pest insects;
- Create and enhance wildlife habitat and increase availability of forage;
- Promote the growth of native trees, wildflowers and other plants; and
- Expose mineral-rich soil and recycle plant nutrients back to the soil.

While Midpen staff would take the lead on defining the location, objectives, goals, and monitoring of the prescribed fire, CAL FIRE or another local fire agency will take the lead role in approving, conducting, and supervising all activities. Typically, designated Midpen staff are trained to provide a discrete supporting role during prescribed burns, such as suppression staff or Resource Advisors.

SELECT PRESCRIBED FIRE STAFF

Agency Administrator - Authorizes the prescribed fire and assigns Burn Boss to execute prescribed fire under predefined conditions.

Burn Boss - Ensures that all prescribed fire plan specifications are met before, during, and after a prescribed fire. Supervises all prescribed fire resources and is responsible for the safe and effective implementation of the prescribed fire.

Firing Boss - Leads ground ignition operations and is responsible for the safety and coordination of assigned resources on prescribed fire and wildfire incidents. Reports to the Burn Boss and coordinates with the Holding Specialist.

Prescribed fire activities are implemented in accordance to a pre-written plan (Burn Plan) that identifies land management goals and specific fire use strategies to safely achieve those goals, with prior approval by the applicable regulatory agencies. Burn Plans address characteristics of the land being treated (like topography and vegetation type) and include carefully defined and required parameters to initiate a prescribed fire for temperature, humidity, wind, moisture of the vegetation, and conditions for the dispersal of smoke. The Burn Plans also specify how the fire will be applied, by whom, and what fire control people and equipment must be on-scene before the burn can commence. After the Burn Plan is complete and conditions are right, a prescribed burn can proceed under the supervision of a qualified Burn Boss. Low intensity fire is skillfully applied to selectively burn fuels like dead wood, brush, forest understories, and grassland.

SELECT PRESCRIBED FIRE STAFF CON'T

Holding Specialist - Supervises all resources that are responsible for ensuring the prescribed fire stays within the burn unit boundaries. Reports to the Burn Boss and coordinates with Firing Boss.

Resource Advisor - Provides professional knowledge and expertise for the protection of natural, cultural, and other resources within an incident environment.

Fire Effects Monitor - Responsible for collecting incident status information and providing this information to the Burn Boss. The information may include fire perimeter location, onsite weather, fire behavior, fuel conditions, smoke, and fire effects information needed to assess firefighter safety and whether the fire is achieving established incident objectives and requirements.

The smoke from a prescribed fire can be a nuisance, but when prescribed fire is planned and executed by fire professionals, smoke impacts can be greatly reduced. Prescribed fire is usually the ideal wildland fuel treatment method. It is very compatible with environmental goals and a cost-effective alternative to more labor intensive and time-consuming methods like mechanical or hand-clearing of vegetation (City of Austin and Travis County, 2014).

Prescribed fire is a powerful tool for Midpen. The Program includes using prescribed fire for habitat enhancement and reduction of fuel loads, particularly in interior areas of OSPs, away from developed roads and infrastructure. This PFP outlines the key elements of how Midpen will utilize prescribed fire as part of the Program. The description presented in the PFP is programmatic in nature and will be updated with additional details into the burn units, methods, locations, and planning prescriptions as they are developed.

5.2 Fire History

5.2.1 Historic and Current Vegetation Management and Fire History

Historic and current vegetation management and fire history are described in Section 4.2.1. Today, in the absence of fire for decades, both live and dead fuels have accumulated creating higher surface fuel loads, vegetation density, and varied species composition from what was seen prior to European contact.

5.2.2 Recent Use of Prescribed Fire

Midpen has utilized prescribed fire as a vegetation management tool in the past, primarily in grasslands. Prescribed burns were conducted for training and ecological purposes at Sierra Azul and Russian Ridge OSPs. These prescribed fires were focused in primarily annual grasslands with relatively well-developed road access and road boundaries. Midpen has not conducted a prescribed burn within the last 10 years.

5.3 Purpose and Need

Periodic fires historically were a part of natural ecological processes on Midpen lands; as a result, many species evolved with fire adaptations and need periodic fire for renewal. Fire opens forests to new generations of younger trees, preserves open grasslands by reducing the spread of encroaching shrubs and/or trees, and stimulates seed germination and shoot growth in chaparral. Without fire, fire-adapted communities are eventually replaced by forest, resulting in a reduction of biodiversity. Fuel in unburned areas can build up to such a high level that when a wildland fire occurs, it can have devastating effects.

Native Americans used fire to shape the natural environment and to clear underbrush and create meadow areas attractive to deer and other animals. Open meadows improved visibility for hunting and encouraged the growth of acorn oaks and other edible plants. Subsequent implementation of fire suppression policies eliminated these benefits, reversing their positive environmental effects.

Impacts of fire suppression continue to reduce biodiversity in Midpen lands. Grasslands and oak woodlands are decreasing in extent due to invading brush and forest species. Stands of coastal scrub and chaparral have aged and are not being renewed. Dense tangles of brush and young trees have largely replaced the park-like understory beneath redwood and Douglas fir forests and mature oak woodlands described by early European explorers.

Changing climatic conditions, past land uses, and years of fire suppression have increased fuel loads and fire-prone conditions that could contribute to larger more intense wildland fires. The primary need for the PFP is to reduce live and dead fuels, particularly in areas where mechanical treatments are not feasible or effective due to access and vegetation type. Secondarily, reintroduction of fire as an ecological process can reduce potential fire risk, thus enhancing public safety, and restore ecological function and resiliency, particularly for fire adapted species.

Prescribed fire helps to restore ecosystems closer to pre-fire suppression conditions through the removal of dead and accumulated vegetation and treatment of forest disease and invasive species. Prior to the mid to late 20th century, landscapes in the San Francisco Bay Area were either managed through natural fire or through Native American practices of prescribed burning that kept fuel loads down. Prior to European contact, the spread of invasive species that alter ecosystems and increases fire risks was also much less of a concern.

The purpose of this PFP is to define the activities that Midpen will implement to reinstate prescribed fire practices on their lands that reduce wildland fire risks, while also preserving and restoring biodiversity and minimizing effects on the environment. This PFP identifies the following:

- Historic regional vegetation and fire regimes;
- History of vegetation management on OSPs and current practices;
- Locations and prioritization of prescribed fire projects;
- Planning process for undertaking prescribed fire projects;
- Methods for creating, implementing, and maintaining prescribed fire projects; and
- Best management and environmental protection measures to use during prescribed fire projects.

This PFP focuses on prescribed fire to reduce fuel loads and restore natural ecological processes in OSPs, away from the WUI and other infrastructure. Another component of the PFP will be the use of cultural burns in coordination with Native American Tribes.

5.4 Prescribed Burn Units

5.4.1 Units

Prescribed fire burn units will generally be of continuous vegetation types. Units are sized to allow a prescribed fire to be implemented in one operational period (typically an 8- to 12-hour shift). Unit boundaries will follow existing infrastructure (roads, trails, and disclines) where feasible and will generally be dominated by one vegetation type (e.g., grasslands, shrublands, oak woodlands). In some cases, multiple vegetation types may be burned within the same unit where fireline construction, topography, vegetation boundaries, and access constrain burning a single vegetation type. Once developed, the burn unit maps will be available in Appendix D.

5.4.2 Prioritization

Prescribed burns will generally be prioritized by vegetation type, fuels reduction value, and potential for implementation. Initial burns may focus first on re-establishing prescribed fire training areas that may be used for interagency training both on live fire and simulated fires, in an effort to improve resource coordination between Midpen and its neighboring local, state, and federal fire agencies who may participate in future burns. Considerations for prioritization will be defined in the future, but may include condition of area in terms of forest health, invasive species, and fuel loads; location and ability to manage the burn; and type of vegetation with consideration for improvement of ecosystem function through prescribed burning.

5.5 Planning Process

Individual prescribed fires will be conducted under an appropriate Burn Plan. The Burn Plan would be prepared under the guidance of the appropriate approving entity, which include CAL FIRE and/or the local county fire department, and will include the BAAQMD. Burn Plans typically specify the burn unit level approach and are prepared by a qualified person. These Burn Plans specify weather parameters for burning, personnel and equipment needed for implementation/mop up/patrol, contingency plans, smoke management, and post burn monitoring. Before burning is allowed, Midpen must complete the following planning steps:

- ~~Register their burn with BAAQMD;~~
- ~~Obtain a burn permit from BAAQMD and/or the local fire agency;~~
- ~~Submit a smoke management plan (SMP) to BAAQMD; and~~
- ~~Obtain BAAQMDs approval of the SMP.~~
- Notify BAAQMD of the proposed prescribed burn by submitting the Prescribed Burning Smoke Management Plan (Form Rx-1) form at least 30 days prior to burning.

- Develop burn plan in conjunction with CAL FIRE and local fire agency.
- Ensure both the smoke management plan and burn permit are issued and approved.
- Ensure burn is conducted on a permissive burn day as determined by BAAQMD.

Smoke management is an important component of the planning process. The California Air Resources Board (CARB) has adopted Smoke Management Guidelines, that will be used to create the SMP. The SMP specifies the "smoke prescription," which is an assessment of the air quality, meteorological, and fuel conditions of the proposed burn. Depending on the size and complexity of the burn, the SMP will contain some or all of the following information:

- Burner name and contact information
- Burn method and fuel type
- Nearby population centers
- Planned burn time
- Acceptable burn ignition conditions
- Contingency planning
- Burn monitoring procedures
- Location and size of the burn
- Expected pollutant emissions
- Smoke travel projections – including maps
- Duration of the burn
- Smoke minimization techniques
- Description of alternatives to burning
- Public notification procedures

Midpen may begin making final preparations for CAL FIRE or a local fire agency to carry out a prescribed burn once BAAQMD (and if also required the local fire department) approves the Burn Plan, including the permit and SMP. For a prescribed burn conducted to enhance habitat for California red-legged frog or San Francisco garter snake, Midpen will notify USFWS in accordance with Midpen's Recovery Permit.

Midpen will organize the resources needed to conduct the burn, notifying the public about the planned timing and specifics of the burn, and obtaining final BAAQMD authorization to actually conduct the burn in accordance with the prior approved Burn Plan. Midpen would contact BAAQMD up to 96 hours prior to the desired burn time to obtain a forecast of the meteorology and air quality needed to safely conduct the burn. Midpen would continue to work with BAAQMD and CARB until the day of the burn to update the forecast information.

BAAQMD authorization to conduct a prescribed burn is provided for no more than 24 hours prior to the burn. The individual who is granted the authority to burn (Burn Boss) is responsible for assuring that all conditions in the approved SMP and burn permit are met throughout the burn. Once the fire has been ignited, Midpen and participating firefighting agencies must make all reasonable efforts to assure the burn stays within the approved SMP prescription. If a burn goes out of its prescription, or adverse smoke impacts are observed, the Burn Boss will implement smoke mitigation measures as described in the SMP (CARB, 2019).

5.6 Prescribed Burning

5.6.1 Overview

This section describes how prescribed burns are carried out, including pretreatment; definition of burn units; mop up; and different treatment types, equipment, personnel, and schedules.

5.6.2 Implementation

Planning and Preparation

Creation and Maintenance of Control Lines

Where feasible and effective, existing control lines (also known as firelines) including paved roads, dirt roads, trails, and disclines will be utilized for control lines. These existing lines may be improved by clearing accumulated vegetation on or near the lines; removing dead trees that may fall on, near, or across lines; blacklining; and widening. Blacklining involves pre-burning of fuels adjacent to a control line before igniting a prescribed burn. Blacklining is usually done in heavy fuels adjacent to a control line during periods of low fire danger to reduce heat on holding crews and lessen chances for spotting across control line. In fire suppression, a blackline denotes a condition where there is no unburned material between the fireline and the fire edge. New firelines will be constructed to standards described in the Burn Plan, but typically will be 1-foot to 6-foot wide, depending on location, vegetation type, and type of equipment used to construct the line. Hose lays may be used along firelines at the discretion of the Burn Boss, or as described in the unit-level Burn Plan. Temporary lines may be rehabilitated as needed once the prescribed fire is declared out by the Burn Boss.

Safety Precautions

The unit-level Burn Plan will describe burn unit safety, including potential hazards and mitigations. These precautions can include, but are not limited to, managing individual firefighter safety through proper equipment (including respiration), training, and hydration. Mitigating risks of potential falling live and dead trees or managing vehicle and human traffic within the proximity of the burn will be considered.

Prescribed Burning by Unit

Units will be ignited using approved ignition devices, which can include equipment such as a drip torch or hand-held flare (“fusee”). The Burn Plan will describe the general ignition pattern such as a strip head fire, dot ignition, or other, with discretion given to the burn boss to use the pattern they deem most appropriate given local vegetation and weather conditions.

Mop Up

Mop up is when firefighters extinguish or remove burning material near the control lines. Select snags or trees may need to be taken down because of fire inside their trunk. Logs may need to be trenched to prevent their rolling after an area has burned. Putting out any flames or stirring up a hot spot that is smoking is also done. The work starts as soon as possible along the back or cooler sides of an active fire. Dependent upon multiple factors (i.e., fire behavior, weather forecast), some crew may remain on site for extended periods of time (overnight). Mop up work is generally done all the way around a fire's edge. Mop up will be conducted using hand crews, equipment, hose lays, or other method as described in the unit-level Burn Plan.

Rehabilitation

Rehabilitation consists of the decommissioning of control lines as well as follow-up weed control. Control line decommissioning is generally limited to the manual re-distribution of duff and brush back into the previous cleared lines. This spreads native seed back into the lines to facilitate natural revegetation. It also provides erosion control and discourages the formation of social trails. Because some weed seeds are stimulated by fire or become readily established in post-fire settings, prescribed burn sites will be patrolled by Midpen EDRR crews for 1 to 5 years as needed following a burn event to identify the need for weeding or additional restoration work.

5.6.3 Treatment Types and Methods

Physical Control

The prescribed fire will be controlled using methods and resources described in the unit-level Burn Plan under the direction of the Burn Boss. Control methods can include, but are not limited to, hand crews, fire engines, hose lays, portable pumps, backpack pumps, and hand tools. Aerial support, such as a helicopter with the ability to drop water, on more complex burns may be utilized as well.

Mechanical Pre-Treatment

Burn units may have limited mechanical pre-treatment to improve firelines or operational safety. Treatments may include, but are not limited to mowing, mastication, chipping, falling of snags, and brushing of roads. These treatments will generally follow those described in Chapter 4: Vegetation Management Plan.

Pre-treatment includes:

- Removal of live limbs of trees up to 10 feet above the ground to minimize the potential for fire to spread to the canopy;
- Scattering and/or mastication of accumulated dead and decadent woody brush;
- Top-cutting and on-site scattering of green brush (particularly broom) a minimum of 60 days before the burn event to cure, which facilitates horizontal fire spread during the event and reduces smoke production; and
- Installation of control lines (approximately 1- to 6-foot-wide bands where vegetation has been cleared to expose mineral soil) where natural control lines such as roads, trails, or water bodies are unavailable.

Limbing, scattering, and masticating dead material and top-cutting of green material may occur many months to days prior to the burn event, depending on the larger project goals and site conditions. The work is accomplished with a combination of heavy equipment, power tools, and hand tools. Control line installation occurs within a few weeks or days of the burn event and may be accomplished with heavy equipment or hand tools.

Pile burning may be used to remove cut or dead vegetative material where chipping, hauling, or decomposition are not feasible. Piles can be constructed of vegetative material, covered (to keep dry) and burned when conditions are wet. Pile burning can impact soils directly underneath the pile due to excessive heating. Depending on the surrounding vegetation and under the advice of a Midpen Resource Advisor, the charred remains may be raked out and the site will be allowed to passively revegetate and/or will be directly seeded with native Santa Cruz Mountain plants.

Pile burning is a method of biomass disposal that uses fire to eliminate piles of dried plant material. Piles vary in size from 5 to 10 feet in diameter and 4 to 6 feet in height. Piles are constructed in concert with brush or weed removal and are placed in openings away from power lines and tree canopies to allow for safe ignition at a later date. The composition of piles varies with vegetation type, and could consist of chaparral species, broom, as well as hardwoods and conifer limbs. The total volume of material allowed to be burned in a year will be determined in the future.

Pile burning occurs between November and May under the direction of Midpen staff on days when weather conditions meet the specifications of the BAAQMD permit. Multiple piles may be burned on a single day. Drip torches are used to start ignitions, with fuel use limited to 10 gallons or less per day. Midpen staff remain on-site with fire suppression equipment including a water tender to ensure safety and to extinguish embers by each workday’s end.

Prescribed Burn Types

Ecosystem Restoration Burns

Generally, all prescribed burns will provide ecosystem restoration benefits. In cases where small areas may not passively revegetate, these sites may be seeded with native species, under the advice of a Midpen Resource Advisor.

Cultural Resource Burns

Cultural resource burns may be conducted to protect, restore, or facilitate improved production of or collection of specific plants, trees, or seeds. The use of prescribed burning for cultural resources should be planned and implemented in collaboration with local Tribal Representatives.

Training Burns

Prescribed burns may be used for training by Midpen staff as well as cooperating agencies. Training burns can be conducted without ignitions (i.e., “mock burns”) allowing personnel to coordinate under a unified command, test communications, equipment interoperability, and contingency response prior to conducting live burn activities. Live burn activities can be used to train personnel on wildland fire suppression tactics. Training burns can be done as stand-alone burns or in conjunction with any prescribed burn under the direction of the Burn Boss.

Prescribed Natural Fire

The details of implementing prescribed natural fire are only conceptual at this time and will only be applicable under limited circumstances. In the case of multiple ignitions, such as multiple lighting fires, Midpen may need to work with an incident management team to prioritize fire suppression activities on Midpen lands. If there are designated natural areas where a resource could benefit from fire, suppression efforts may be aided by allowing the wildland fire to burn through these areas allowing firefighters to make tactical decisions such as lighting backfires or choosing a better location for a dozer line. Limited equipment, aircraft, and crews can be deployed to stop the wildland fire at the best locations to protect public safety rather than trying to protect natural areas that would benefit from a fire. This type of burn will never dictate suppression tactics but only identify areas that do not require protection from the effects of a wildland fire. ~~There may be cases where natural resources and fire suppression can benefit from allowing a larger area to burn and utilizing an existing control line (e.g., fuel break or roadway) to suppress and stop the fire. In these cases, there may be an opportunity to have lower priority fires burn for resource benefit so that higher priority fires may be staffed using limited equipment, aircraft, and crews.~~

5.6.4 Equipment and Personnel

The specific equipment and personnel needed to conduct a burn will be described in the unit-level Burn Plan. General types of equipment would be similar to those listed for the VMP and may include fire engines of different sizes (depending on cooperating agency or contractor equipment), fire hose, hand tools, chainsaws, and approved ignition devices. In some cases, contingency equipment may include a plow, small Bobcat, or bulldozer. Additional aerial equipment may include helicopters of different sizes if needed for implementation or contingency.

5.6.5 Schedule and Timing for Implementation

Midpen anticipates conducting one to two prescribed burns during the first three to five years of the Program. After year five, Midpen may implement as much as three burns a year. Burns will be prioritized based on factors such as location, vegetation type, and complexity, with implementation being dictated by local conditions on the ground. Prescribed burns typically occur from June through November, but other times of year may also be considered. Other considerations could include species protection requirements and permitting restrictions.

5.7 Best Management Practices Incorporated into the Plan

Burn Plans may incorporate additional unit-level BMPs, as needed to address local resource protection or other concerns at the unit level. These BMPs include specific precautionary actions to minimize the potential for erosion following a burn, reduce smoke during a burn, control the burn, and preserve important biological layers that exist at and below the ground surface.

The following prescribed fire BMPs could be included in a Burn Plan (USEPA, 2019):

- Develop and implement a smoke management plan in accordance with current relevant local, CAL FIRE, and BAAQMD guidelines;
- Develop and implement a firing plan that best meets unit-level resource objectives for vegetative cover;
- Utilize existing roads and trails for firebreaks where safe and feasible;
- Build waterbars and stabilize constructed firelines as needed to reduce direct erosion into streams;
- Limit use of mechanical equipment for fireline construction in riparian areas;
- Protect against excessive erosion or sedimentation to the extent practicable;
- Avoid:
  - Using fire-retardant chemicals[3] in riparian zones and over watercourses, and prevent their runoff into watercourses;
  - Applying chemicals in streamside management zones or wetlands;
  - Cleaning application equipment in watercourses or locations that drain into watercourses;
  - Constructing waterbars in firelines that divert surface runoff directly into streams;
- Comply with applicable local, state, and federal regulations regarding the transport, handling, storage, application, and disposal of pesticides, fire retardants, and fertilizers;
- Monitor weather conditions such as rain, wind speed, temperature, and humidity during application to prevent drift, volatilization, and surface water runoff;
- Carefully handle and dispose of oil and fuel for equipment and vehicles. Spills, leaks, empty containers, and filters are potential sources of soil and water contamination if improperly managed; and
- Develop and implement a spill contingency plan identifying all actions to be taken in the event of a chemical spill, including phone numbers for federal, state, and local agencies that must be notified.

[3] Note that fertilizers and fire retardants contain high amounts of both nitrogen and phosphorus. These compounds can accelerate eutrophication (a process whereby water bodies are choked by overabundant plant life and algae due to higher levels of nutrients such as nitrogen and phosphorus).

6 Wildland Fire Pre-Plan/Resource Advisor Maps

6.1 Overview and Background

Wildland Fire Pre-Plans and Resource Advisor Maps are map-based documents that can aid CAL FIRE and other firefighting agencies in their firefighting efforts in the event of a wildland fire. Midpen staff may serve as liaisons or Resource Advisors, working with fire managers during an incident. These plans and maps include the following elements:

- Existing locations for infrastructure, including roads, fuelbreaks, structures, and water sources (hydrants, water tanks, ponds, creeks, and springs);
- Known sensitive natural and cultural resources for fire personnel to avoid if possible, during fire suppression activities;
- Structures that are inhabited or are historically significant that should have resources committed to their defense during a wildland fire;
- Potential locations for fire suppression activities and equipment staging for Midpen lands in the event of a wildland fire;
- Suggested BMPs for wildland fire response and suppression activities.
- Areas where suppression activities should be limited (if feasible); and
- Circulation and emergency access roads, including designated evacuation routes.

The plan presented here also identifies potential BMPs to be implemented during and post fire activity and provides the general guidelines for appropriate rehabilitation measures to address erosion, revegetation, invasive species, trail and road stability, security, public safety, and natural and cultural resources following fires.

6.2 Pre-Plans and Maps

6.2.1 Purpose

The purpose of the Wildland Fire Pre-Plans and Resource Advisor Maps is to provide an appropriately scaled representation of the various access points and resources in all managed lands for use by firefighters and resource managers in the event of a wildland fire. The maps help firefighters better understand the operational environment, including where different types of apparatus can access (e.g., Wildland Type 3 fire engines); potential fire management locations; where firefighting resources are located, such as hydrants, water tanks, and ponds; specific buildings or structures needing protection; and where sensitive resources are located that should be avoided, if possible. Another purpose of the plans and mapping efforts is to identify where additional infrastructure may be needed to support firefighting efforts. The plans will identify critical site-specific information regarding escape routes, including the location of stable bridges, passable roads, gates, and water sources. The pre-plans and maps will identify areas where bulldozer lines could be created that may reduce environmental impacts in the event of an emergency, recognizing that firefighting agencies, in consultation with Midpen as landowner, will need to take the actions they deem necessary to protect human life and property.

6.2.2 Methods for Preparation of Pre-Plans and Maps, Including Outreach Efforts

The process for preparing each pre-plan and map entails both a field mapping effort and an outreach effort to understand the existing resources and resource needs for each OSP and other managed land. Data for each OSP is prepared and stored in GIS format and includes collected field data, as well as digitized data.

Each managed land's pre-plan includes a detailed map over an aerial image of the area, with a legend. The map is accompanied by a short document that describes the roads and trails, the other resources for firefighters, the natural resource protection, the sensitive resources in the managed land, and who maintains the plan. Midpen staff serve as liaisons or Resource Advisors, working with fire managers during an incident.

6.2.3 Schedule for Preparation and Map Management

Tentative Schedule by Managed Land to Prepare Maps

Midpen plans to prepare and complete all maps by 2022. The managed lands covered and the target schedule for preparation is presented below. As each pre-plan and map is prepared, it will be appended to this Program in Appendix E.

Table 6-1 Target Calendar Year of Preparation of Pre-Plans and Maps

Managed Land	Target Field Work Year of Completion	Target Year to Complete Pre-Plans and Maps
Bear Creek Redwoods OSP	2021-2022	2021-2022
Coal Creek OSP	2019	2020
El Corte de Madera Creek OSP	2021-2022	2021-2022
El Sereno OSP	2019	2020
Foothills OSP	2019	2020
Fremont Older OSP	2019	2020
La Honda Creek OSP	2018	2018
Long Ridge OSP	2021-2022	2021-2022
Los Trancos OSP	2019	2020
Miramontes Ridge OSP	2021-2022	2021-2022

Managed Land	Target Field Work Year of Completion	Target Year to Complete Pre-Plans and Maps
Monte Bello OSP	2019	2020
Picchetti Ranch OSP	2019	2020
Pulgas Ridge OSP	2019	2020
Purisima Creek Redwoods OSP	2021-2022	2021-2022
Rancho San Antonio OSP and County Park	2019	2019
Ravenswood OSP	2021-2022	2021-2022
Russian Ridge OSP	2019	2020
Saratoga Gap OSP	2021-2022	2021-2022
Sierra Azul OSP and Easements	2021-2022	2021-2022
Skyline Ridge OSP	2021-2022	2021-2022
St. Joseph's Hill OSP	2021-2022	2021-2022
Stevens Creek Shoreline Nature Study Area	2021-2022	2021-2022
Teague Hill OSP	2021-2022	2021-2022
Thornewood OSP	2020	2020
Tunitas Creek OSP	2021-2022	2021-2022
Windy Hill OSP	2019	2020

Map Management and Frequency of Updates

The pre-plans and maps are maintained by Midpen's GIS staff in digital format. Each plan is also provided to the Midpen staff for each managed area and provided to the local fire department. A copy of all plans is also kept on-site at each field office.

Updates would be performed as needed to ensure the accuracy of the mapping. As additional managed lands or acreages are added and as infrastructure to managed lands is added, maps and the pre-fire plans will be updated.

6.3 Pre-Plan and Resource Advisor Map Template

Each Wildland Fire Pre-Plan includes the following elements:

- **Wildland Fire Management Goal:** "Manage District [Midpen] land to reduce the severity of wildland fire and to reduce the impact of fire suppression activities within District [Midpen] Preserves and adjacent residential areas; manage habitats to support fire as a natural occurrence on the landscape; and promote District

[Midpen] and regional fire management objectives." – Midpen RM Policies, December 2014.

- **Fire Management Planning:** Identifies the purpose of the map and pre-plan, which is primarily focused on fire management and swift response to wildland fire.
  - **Roads and Trails:** Identifies the roads and trails that can be accessed by firefighters and the size of fire engine that can access the roads in the managed land.
  - **Other Resources for Firefighters**
    - **Water Sources:** Includes water tanks, ponds, and pipelines and their capacities.
    - **Potential Fire Management Locations**: Areas where staging can occur.
    - **Landing Zones**: Maintained helicopter landing zones in the managed land.
  - **Natural Resource Protection**
    - **Ponds:** Ponds that may have special-status species that should be avoided, if possible, and surrounding areas for avoidance.
    - **Streams:** Streams that support listed species, such as amphibians or fish that should be avoided, if possible.
    - **Protected Habitat:** Areas with sensitive habitat or habitat that supports a special-status species that should be avoided, if possible.
- **Suggested Best Management Practices During Firefighting Activities:** Describes best management practices that may be applied to protect resources during a fire, but only if practical and feasible. Examples of BMPs are provided in the next section.

6.4 Potential Best Management Practices for Firefighting During Wildland Fire

Firefighting activities have the potential to cause environmental impacts, particularly to soils and water quality. While in an emergency, firefighters must do what is necessary to protect life and property, there may be instances where precautions can be taken to protect the environment and reduce post-fire resource damage due to fire suppression activities. Ultimately the Incident Commander and firefighting staff on scene have the authority to decide how to manage the incident to best protect life and property, and safely contain the fire. Midpen staff may serve as liaisons or Resource Advisors, working with fire managers during an incident. The following are examples of BMPs that Midpen can recommend and encourage firefighters to implement during emergency firefighting activities to reduce environmental damage from firefighting:

- **Discharges Associated with Emergency Firefighting Activities**: To the extent allowed by the circumstances at the scene and without compromising the health and safety of personnel or the public, emergency firefighting activities should be performed in a manner that avoids or minimizes discharges to the stormwater facilities and waterways. BMPs that may be considered during emergency fire-fighting activities include the following: avoid directing firefighting foams and retardant directly on erodible surfaces where runoff will enter receiving waters or stormwater facilities

- **Discharges Associated with Hazardous Materials Spills:** Each fire department operates under a Hazardous Materials Area Plan that describes procedures for the allocation of resources and assigns tasks during hazardous materials emergencies. Fire department and safety personnel are trained to respond to hazardous material spills according to response protocols established for hazardous materials emergencies.
- **Minimizing Drafting of Water from Ponds or Streams with Sensitive Resources:** To protect sensitive amphibian and fish species, if possible, water should not be drafted from facilities that support listed populations. If water must be drawn, it should be done in a way to minimize sedimentation and without drying the facility.
- **Operation of Heavy Equipment:** Heavy equipment (tractors, large trucks, bulldozers, skidders) should be used for fireline construction and other suppression-related activities in a manner that limits disturbance to sensitive habitats, near riparian areas, or open water, where safe and feasible.
- **Staging of Equipment and Storage of Chemicals.** Staging of equipment and supplies, including chemicals, should be in areas that have appropriate buffers of protection from fire, good access, and appropriate drainage, as feasible.
- **Construction of Firelines.** When firelines are required, sensitive habitats as shown in the Resource Advisor Maps, should be avoided. Use natural firebreaks, where possible. Minimize plowing and blading, particularly in sloped areas. Use pre-existing features for fireline (roads, streams, lakes, wetland features, utility rights-of-way) to protect soil and water, and to avoid unnecessary ground disturbance.
- **Mitigating Spread of Weeds**: Provide weed washing stations for vehicles and equipment to limit the introduction and spread of noxious weeds, where possible.

6.5 Post-Fire Rehabilitation Plan Development

If a fire starts within an OSP or other managed land, several measures should be taken once the fire has been contained to reduce environmental impacts, including off-site impacts and to repair infrastructure. A Post-Fire Rehabilitation Plan should be prepared that assesses the potential short- and long-term impacts (and benefits) of a wildland fire and identifies the BMPs to effectively mitigate those impacts. BMPs can be implemented to reduce erosion and water quality impacts, to clean up any residual chemicals or materials from firefighting activities, to potentially remove trees damaged by fire with concurrence of a Midpen biologist, and to rehabilitate the area's habitat and vegetation, as appropriate.

Examples of potential BMPs that can be included in the Post-Fire Rehabilitation Plan include, but are not limited to (Diagneault, 2014):

- Reclaim and stabilize disturbed areas with vegetation with a focus on stabilization of areas with increased erosion potential or altered drainage patterns from activities, such as fireline construction, and minimize runoff, erosion and sediment delivery to water bodies.
- Install suitable drainage features (wing ditches, broad-based dip, rolling dip, rock berms), as well as sediment traps and sediment basins to promote dispersal of runoff, reduce erosion, and control, collect, or detain stormwater runoff from disturbed or burned areas.
- Mitigate soil compaction from firefighting activities by loosening soils to improve infiltration and promote revegetation.
- Repair and clear debris from water conveyance structures to reduce potential for failures and subsequent erosion.
- Apply groundcover treatments, such as chip or mulch, to promote soil biological activity and stabilize steep or excavated slopes.
- Remove heavily and moderately damaged trees near structures and roads. Remove these trees as soon as possible after a fire to avoid impacts to seedlings and other regenerating vegetation.
- Ensure that any landing areas created to remove dead and/or compromised trees are surrounded by temporary erosion and sediment control practices, such as silt fencing, when conditions may result in soil movement off the site. Maintain erosion control in good working condition.
- Ensure that debris piles and collection areas are at least 200 feet away from water bodies, riparian habitat, and sensitive habitats. Surround debris collection areas with silt fencing to prevent movement of small animals into or runoff of contaminants out of the site.
- Separate man-made debris from woody debris and place man-made debris on a base material that prevents any contaminants or other hazardous materials from penetrating into the soil.
- Dispose of debris in accordance with waste management guidelines and laws.
- Implement infrastructure and structural repairs during the appropriate construction season to avoid impacts to sensitive species such as spotted owl, marbled murrelet, California red-legged frog, San Francisco garter snake, and other species.
- Monitor disturbed areas for potential new noxious weed infestations or existing weed spread.

6.6 Identification, Improvement, and Installation of Infrastructure to Improve Firefighting Capabilities of Local and State Firefighting Agencies

6.6.1 Overview

During the preparation of each Pre-Fire Plan and Resource Advisor Map, and during the subsequent reviews of existing plans and maps, additional infrastructure to improve firefighter response may be identified.

6.6.2 Infrastructure Improvements

Types of New Infrastructure Improvements

Roads and Access

These types of facilities include improvements on existing road rights-of-way or potentially new access roads in areas where adequate access is lacking. Existing access roads may be widened to allow for larger firetrucks, turnarounds created, and road extensions built for improved access. Road surfaces may also be graded, and material placed on the surface, such a composite, to create a safer surface for travel by emergency vehicles.

Water Storage Tanks

Water storage tanks may be built in areas where needed and feasible. Water storage tanks should be sized to store adequate water for firefighting, be accessible, easily connected to the equipment that will use them, and be built using fire-resistant materials. Water tanks may be filled from existing water supply sources, wells, pumps, or water tender trucks, as appropriate for the local conditions. Stored water may be treated to limit growth of mold and algae with tank systems sealed to exclude entry of insects and animals. Water storage tanks may also be filled by trucking in water, where access to water infrastructure is not available.

Water Supply Pipelines, Hydrants, and Pumps

Water supply infrastructure includes underground pipelines that supply water storage tanks or hydrants. All permanent pipelines should be approved for use in fire service systems and designed for the expected water pressures. Where needed, new hydrants on new or existing pipelines may be added as well as permanent or temporary pumping stations to ensure flow from hydrants or pipelines during firefighting activities, where appropriate. Aboveground temporary pipelines or fire hoses may be used to fill water tanks that are not readily accessible by a water tender or water supply lines. Typically, the water would need to be chlorinated or bleached to avoid mold and clogging of pumps.

Staging and Landing Areas

Additional staging/fire management locations and landing areas may be needed in some OSPs or other managed lands. Where possible, these areas should be level, and away from water bodies, sensitive habitats, and riparian corridors. They should be constructed to the size needed for expected staging or landing needs, and the appropriate surface treatment (such as mulch or chip) should be applied. Erosion and drainage control should also be installed as needed.

Planning and Installation of New Infrastructure

The process for planning and installing new infrastructure involves the identification of infrastructure needs, development of detailed design plans, compliance with CEQA, contracting, and implementation. Design plans should include architectural or engineering design drawings and specifications that identify the location, sizing, materials, specifications, and construction methods of the infrastructure. Environmental review may include a Categorical Exemption, or an Initial Study and Mitigated Negative Declaration tiered off the Wildland Fire Resiliency Program EIR. Environmental review will most likely require some additional technical studies for biological and cultural resources. Permits may also be required, depending on the location of the infrastructure. Likewise, monitoring may be required during construction.

6.6.3 Equipment, Personnel, and Schedule

Equipment needed to install new or improved infrastructure could include the following:

- Pickups
- Backhoe/loader
- Bobcat
- Brush hog
- Dump/haul truck
- Water truck
- Tractor-harrow disc
- Concrete truck
- Crane
- Boom truck
- Forklift
- Air compressor
- Portable generators
- Semi-truck with trailer
- Hand tools (shovels, picks)

Workforces and personnel needed will vary by project and likely involve crews of 10 or less members. Additional crew may include biological or cultural resource monitors. The schedule for the work would depend on the jurisdiction within which the work is located and any timing constraints to protect natural resources, such as working outside the nesting season.

7 Monitoring Plan

7.1 Executive Summary of Monitoring Plan

The Monitoring Plan is an important component of the Program. This Monitoring Plan requires monitoring of site conditions before, during, and after treatments or fire events to determine if Program objectives are being met, and if and how vegetation treatment methods should be refined to reach those objectives. Monitoring requirements will vary depending on the activity undertaken and the conditions in the area where the activity is to occur. Monitoring and reporting may also be required as part of the mitigation adopted with the Final EIR for the Program or any permits obtained to perform specific work activities under the Program. Individual monitoring protocols will be determined on a case-by-case basis for each project at the discretion of professional Midpen staff and/or as required by mitigation.

The Monitoring Plan includes the following components and sequencing:

- **Monitoring Scales and Monitoring Parameters**: The Monitoring Plan first describes scales of monitoring and the monitoring parameters that apply to the PFP, the VMP, and post-fire events. Monitoring parameters include biodiversity, habitat, fuel loads, disease presence, invasive species, animal mortality, presence of special-status species, fire intensity and severity, ignitions, water quality, soils, and weather.
- **Methods of Monitoring/Monitoring Protocols**: The Monitoring Plan also describes the monitoring methods for obtaining data to assess the condition of each monitoring parameter. The protocols are based on best practices used by adjacent or regionally based land management agencies (e.g., Federal Geographic Data Committee, National Park Service [NPS], California State Parks) and supported by published research. The protocols address aspects of current condition, trend analysis, and pre-/post-treatment monitoring.
- **Monitoring Prescriptions:** The section describes the objectives for each plan within the Program to be monitored, including identification of the desired conditions as a result of vegetation management treatments, and the monitoring objectives. Monitoring prescriptions are described for each plan or event (e.g., PFP, VMP, post-fire events), the parameters to be monitored, the methods that apply to each monitoring parameter, the monitoring scale, and timing.
- **Reporting and Adaptive Management**: The Monitoring Plan, finally, provides the specifications for reporting and the adaptive management procedures that should be employed to refine future treatments to meet Program objectives, based on

monitoring results. Templates and forms to develop project-specific monitoring implementation plans and conduct annual reporting is provided in Appendix F.

7.2 Scales of Monitoring

7.2.1 Geographic Scales Considered for Monitoring

Monitoring the various indicators described in this Monitoring Plan is possible at multiple scales. The appropriate scale of monitoring should be determined by the information needs. Based on those needs, the geographic scale of monitoring (Section 7.2), the temporal scale of monitoring (Section 7.3), and the indicators to be monitored (Section 7.4) can be defined.

The general geographic scales of monitoring are defined in Table 7-1.

Table 7-1 Geographic Scales of Monitoring for Different Program Elements

Monitoring Unit	Description
By Natural Resource Classifications	
Individual Herbaceous Plants, Trees, Shrubs, Grasses	Individual plants, trees, and grasses that comprise a single organism of a specific taxon down to the species or infraspecific species level (subspecies or variety).
Wildlife Presence and Abundance	Identified down to the species or infraspecific species level (subspecies or variety).
Communities of Herbaceous Plants, Trees, Shrubs, Grasses	A community (or stand) of vegetation that is homogeneous in species composition and structure, and in a uniform habitat (Sawyer et al. 2009). The size of a community will vary by the vegetation type (shrubs, trees, grasses, herbaceous plants).
Animal Population	Usually a population estimate of one or more species to measure abundance pre- and post-treatment(s) and/or to measure if a treatment is having population level impacts (negative or positive).
Natural Vegetation Community	In the context of vegetation science, natural vegetation is defined as vegetation where ecological processes primarily determine species and site characteristics; that is, vegetation comprised of a largely spontaneously growing set of plant species that are shaped by both site and biotic processes (Küchler 1969, Westhoff and van der Maarel 1976). Natural vegetation forms recognizable physiognomic and floristic groupings that can be related to ecological site features (FDGC 2008). The natural vegetation hierarchy consists of eight levels, however, two levels (i.e. Alliance or Association) (FGCD 2008) are the most commonly used classification levels in California for mapping and regulatory purposes.

Monitoring Unit	Description
By Treatment Unit	
Treatment Unit (Planned)	The treatment unit is considered the continuous area contained within exterior boundaries of an intentionally planned and implemented project. This area can include both shaded and non-shaded fuelbreaks, ingress/egress routes, defensible space areas, fuel reduction areas, and other vegetation management actions. For linear features such as disclines, the treatment unit may be considered the disturbed area contained within that discline.
Disturbed Area (Unplanned)	A disturbance is an unplanned (natural) event, which can modify aboveground vegetation, belowground vegetation, soils, human built structures, and potentially topography. Disturbances can include events such as a wildland fire, landslide, flood, and high wind event (leading to windthrow). The disturbed area is considered the area contained within the exterior boundaries of the disturbance event. This area may be continuous for events such as a wildland fire, or discontinuous or patchy, for events such as windthrow. A disturbance may have measurable indirect effects outside of the immediately disturbed area. The geographic scale of monitoring for disturbances is expanded for those indicators that assess areas outside the disturbed area.
By Land Ownership or Jurisdictional Areas	
Individual OSP	An individual OSP includes the land and resources contained within the legal parcel boundaries of that OSP. For the purposes of monitoring, an OSP may be divided into subunits by vegetation type, management type, or other division, with monitoring occurring within that division.
Groups of OSPs	Groups of OSPs may be monitored for specific indicators such as vegetation or aquatic resources that cross adjacent or multiple OSP boundaries.
All OSPs	Monitoring for certain indicators such as vegetation type, vegetation cover, or water quality may occur over all OSPs.
Areas Outside of OSPs	Areas outside of OSPs that may be interest in monitoring include fuel treatments or disturbances on adjacent or nearby, non-Midpen lands or land managed, but not owned by Midpen.
County-Level Monitoring	Monitoring for certain indicators such as vegetation type, vegetation cover, or water quality may occur over entire individual counties or multiple counties as part of larger local and regional monitoring efforts.
By Hydrologic Areas	
Stream (Perennial or Intermittent)	Monitoring for certain indicators over the length of a stream.
Human-Made Watercourse (Irrigation or Drainage Ditch)	Monitoring for certain indicators over the length of an irrigation or drainage ditch.

Monitoring Unit	Description
Hydrologic Unit (HUC-various levels)	Monitoring for certain indicators over an area that identifies a hydrological feature like a river, river reach, lake, drainage basin, or catchment. Hydrologic units of varying types and scales are defined by the United States Geological Survey (https://water.usgs.gov/GIS/huc.html).
Water Body (Lakes or Ponds)	Monitoring for certain indicators in body of water, such as a lake or pond.
Watershed	Monitoring for certain indicators over the area of a watershed.
Other	
Statewide or Other Comparisons	Where available and of interest, conducting monitoring to compare with other local, county, statewide, or reference conditions may be useful to determine quantity or quality of various indicators and/or how they compare with similar indicators measured on other non-Midpen lands.

7.2.2 Temporal Scales Considered for Monitoring

Overview

Lands owned and managed by Midpen are not static. The land has been constantly changing over time under management and cultural influences that span the period of pre-European Contact to the growth of Silicon Valley as a global hub for some of the largest technology companies in existence. Understanding the influence of each of these time periods is important to understanding the conditions on the landscape today, and how these conditions will change in the future. A short summary of each of these time periods and associated vegetation conditions is provided here. This section also identifies the temporal scales of monitoring.

Summary of Historic Conditions in the Region

Understanding the historic condition of various indicators is important in understanding current conditions, trends in conditions, and how those vary from the Historic Range of Variability (HRV) of vegetation cover. For the purposes of this monitoring plan, the periods of history are defined further to align with major changes in human occupation and land use culture occurring prior to the formation of Midpen. The major historical periods include:

- **Pre-Spanish/European Contact Period (Up to 1768):** The first documented exploration of the area by Europeans is in 1769 by Gaspar De Portola, which is assumed to be the first contact between local indigenous persons and Europeans (Portola 1770).
- **Contact through The Mission Era (1769- ~1833):** Father Junipero Sera was documented as traveling with General Portola on his expedition to the region.
- **Post Mission "Ranchero Era" (~1821-1844):** Mexico gained independence from Spain in 1821. Following this independence there was an effort to remove control of the Missions from the Franciscans and distribute land to local indigenous families who lived on those lands. "Although each [indigenous] family was to receive a small allotment from the former mission lands, the few who tried to make

a living from these plots gave up after [a] few years…..Most of the missions' lands were disposed of in large grants to white Californians or recently-arrived, well-connected immigrants from Mexico. In the ten years before the missions were dismantled, the Mexican government had issued only 50 grants for large ranchos. In the dozen years after the missions were secularized, 600 new grants were made." (Library of Congress 2019). Detailed descriptions of the Mexican ranching industry can be found in Richard Henry Danas' journal "Two Years Before the Mast" of his experience along the California Coast on a two-year leather trading expedition (Dana 2009).

- **Early United States Exploration and the Gold Rush and Comstock Silver Mining Era (1844-1874):** Early exploration of California followed by the Gold Rush and Comstock Era Silver mining in Nevada brought thousands of people into the San Francisco Bay Area, creating many of the towns that became the major cities seen today.
- **Agricultural/Timber Era (1769 - ~1960s)**: Western agricultural practices arrived with the missions, and the region was an important area for food and timber production into the 20th century. The area was simultaneously growing as a technology hub with the foundation of the Ames Research Center in 1939, followed by major growth during the 1970s with the addition of companies such as Atari, Apple, and Oracle. Today, the region is known less for food production and more for being the home of many established technology companies and startups (Stuart et al. 2017).
- **Midpen Establishment (1972):** Midpen was established in 1972.
- **Since Midpen Acquisition of Individual OSPs (Varies): The** OSPs were acquired at different years. New OSPs may be acquired in the future. As of 2020, Midpen has preserved nearly 65,000 acres on the peninsula.
- **Recent Past Condition (Since 1984):** 1984 is the first year that 30-meter (m) resolution LANDSAT satellite data was available. Using Google Earth Engine (See Section 7.5.1) this imagery can be processed to look at trends in cover by vegetation type from 1984 to the present.

Images that demonstrate the appearance of the landscape through each of these periods is shown in the following graphics in Figure 7-1.

Figure 7-1 Images of the Landscape at Different Historic Time Periods

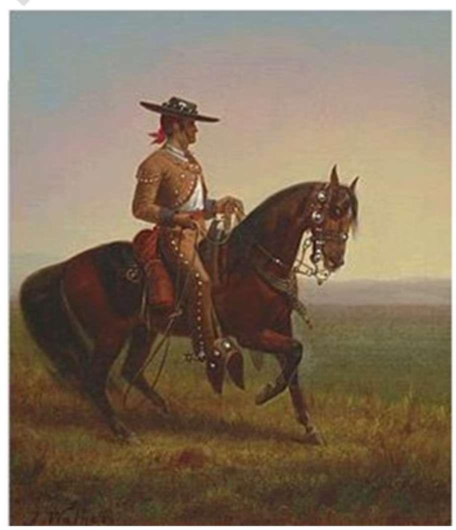
Pre-Spanish/European Contact Period (Up to 1768)

Depiction of Pruristac, a Ramaytush village in what is now Pacifica in 1769.

Source: Hosa and Yamane 2019

European contact through The Mission Era (1769-~1833) and Post Mission "Ranchero Era" (~1821-1844)

Source: Deppe 1832



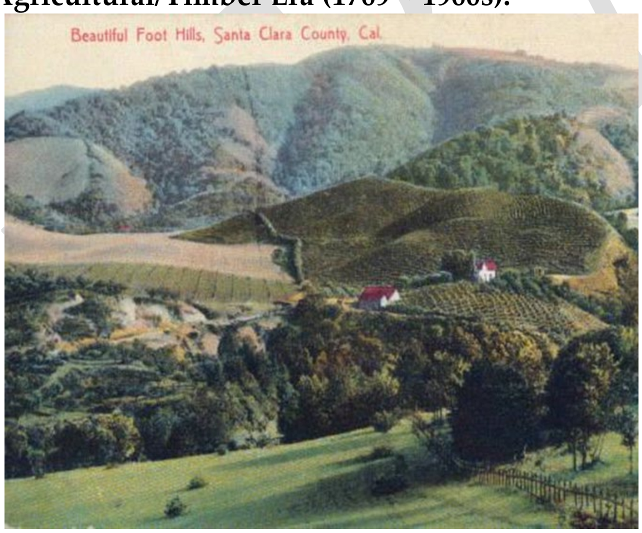
Source: Walker 1885

Early United States Exploration and the Gold Rush and Comstock Silver Mining Era (1844-1874)

San Francisco ~1850

Source: Burgess 1878

Agricultural/Timber Era (1769- ~1960s):



Santa Clara Agricultural Landscape

Source: San José Public Library nd.

San Vicente Redwoods near Davenport at the turn of the 20th century.

Source: *Environmental Science Associates 2001*

Temporal Considerations

Temporal considerations used in this Monitoring Plan are described in Table 7-2.

Table 7-2 Temporal Consideration

Time Period	Description
Historic Condition	Describes the condition of the landscape at a particular timeframe in the past.
Current Condition	Describes the condition at the time a baseline monitoring effort is started.
Changes in Condition from Historic to Present or Recent Past to Current	Includes longer term assessments of changes over time.
Changes in Condition Resulting from Planned Treatment	Includes assessments of changes before and/or after treatments, where pre-treatment baseline information is available.
Changes in Condition Resulting from Unplanned Disturbance (fire, landslide, wind throw, mortality)	Includes assessments of changes before and/or after treatments, where pre-disturbance baseline information is available.

7.3 Monitoring Parameters

7.3.1 Overview

This section describes the various monitoring parameters, the indicators that comprise each parameter, why each parameter is important, and the useful input that the parameter provides to assess Program effectiveness and overall ecosystem management and health. Some parameters are specific to certain components of the Program, or specific to a post-fire event. Methods for monitoring these parameters are presented in Section 7.4. The application of each monitoring parameter to each Program component is provided in Section 7.5.

7.3.2 Biodiversity and Wildlife Presence

This monitoring parameter includes wildlife indicator species that can be used to monitor the changes in wildlife presence and overall biodiversity resulting from planned treatments or disturbances, including positive and negative outcomes. The indicators selected for monitoring should be consistent with the scale of the treatment and desired information needs resulting from the monitoring effort.

The key indicator animals for monitoring include woodrats, badgers, avian species, butterfly species, and reptiles and amphibians, which are the most likely species to experience impacts from various vegetation treatments and that can be readily observed either directly or indirectly in the field. Indicator animals should typically be monitored for:

- Species presence and abundance (both pre-, during, and post-treatment);
- Conservation status (understand the need for special permitting or reporting); and

- Species distribution and density.

Monitoring can evaluate presence of the species through middens, droppings, nesting/denning structures, and recording of animal sightings. Existing wildlife camera arrays can also be used to collect this data or can be set up pre- and post-treatment. In some instances, monitoring can be performed through specific surveys, such as for songbirds or woodrats.

This parameter should also include any species of wildlife that begins utilizing an area after treatment or a fire event that may not have been there before or when a whole population has increased after treatments or events.

7.3.3 Wildlife Mortality

This parameter includes identifying any dead wildlife by species and potential cause of mortality, if identifiable, while monitoring areas during Program activities as well as pre- and post-treatments or events. If patterns in mortality emerge for listed species, closer examination and modification of treatment methods will be necessary.

7.3.4 Special-Status Species

Monitoring of special-status species is important by virtue of the fact that these populations are vulnerable. Potential impacts to these species often require additional permitting requirements. Special-status species include:

- Designated (rare, threatened, or endangered) and candidate species for listing by the CDFW.
- Designated (threatened or endangered) and candidate species for listing by the USFWS.
- Species considered to be rare or endangered under the conditions of Section 15380 of the CEQA Guidelines, such as those identified on lists 1A, 1B, and 2 in the 2001 Inventory of Rare and Endangered Plants of California by the CNPS.
- And possibly other species, which are considered sensitive or of special concern due to limited distribution or lack of adequate information to permit listing or rejection for state or federal status, such as those included on list 3 in the CNPS Inventory or identified as animal “California Special Concern” (CSC) species by the CDFW. Species designated as CSC have no legal protective status under the California Endangered Species Act but are of concern to the CDFW.

Special-status species should typically be monitored for:

- Species presence and abundance (both pre-, during, and post-treatment),
- Conservation status (understand the need for special permitting or reporting), and
- Species distribution and density.

Special-status species to be monitored include species such as San Francisco garter snake. Similar to other wildlife, signs and observance of species may be used, but also specific protocol surveys could be conducted, depending on the special-status species to be monitored.

7.3.5 Vegetation and Habitat, and Rare Plants

Monitoring changes in plant cover and diversity is important to understand how treatments or fire events are changing diversity and health of plant populations or of rare plant populations. Some changes may be acceptable. Monitoring can occur through botanical surveys performed before and after treatments or fire events. The indicators described below can be used to monitor the cover, condition, extent, or change in vegetation.

- **Species:** The common name, genus, species, and if applicable sub-species of the herbaceous plant, grass, shrub, or tree(s) being monitored.
- **Conservation Status:** The individual plant taxa as well as certain vegetation communities may have changing conservation status. Individual plant taxa may have been given conservation status by the federal or State Endangered Species Acts, Native Plant Protection Act, by the CNPS, the California Coastal Act, or through various CEQA Guidelines. These taxa may not only be considered rare at a statewide scale, but also locally. The CDFW also assigns conservation status to specific vegetation communities, at the alliance or association level, based on their rarity and endangerment. Midpen also treats specific natural communities as Biologically-Highly Significant.
- **Pyrophytic Plants:** Most often referred to as fire followers, these are early successional plant species that are fire adapted to the point where fire-related effects (smoke, heat, charate, etc.) are required to complete their life cycle. In some vegetation types, fire followers are short-lived on the landscape and often includes species that are considered rare, either locally or statewide. Of the vegetation types in California, fire followers are most often associated with chaparral. Various categories of these species have been defined (i.e., Native Postfire Endemics, Native Postfire Specialists, and Native Postfire Opportunities) (Keeley and Davis 2007). Most often, native plants that meet this criterion are included on county-level locally rare plants lists.

7.3.6 Soils and Erosion

Soils are the substrate for plant growth. Understanding changes to soils can help understand how treatments or fire events may affect vegetation communities and/or create indirect impacts related to erosion. The indicators described below can be used to monitor a range of soil characteristics.

- **Soil Temperature:** The temperature of soil at the surface soil or varying depths of the soil profile.
- **Soil Moisture:** The amount of water stored in the soil. The moisture content can be affected by several variables, including soil type, aspect, slope, vegetative cover, compaction, and disturbance.
- **Compaction (Bulk Density):** Bulk density is an indicator of soil compaction and is the weight of soil in a given volume. Typically, bulk density is reported in units of kilograms per meter cubed (kg/m^3).
- **Sedimentation:** See "Turbidity and Total Suspended Solids" in Section 7.4.4.

- **Infiltration:** The process by which water on the ground surface enters the soil, typically measured in inches per hour or millimeters per hour.

7.3.7 Water-Related Indicators

Impacts to water quality can have effects on plants and animals that populate an area or region. Water quality should also be monitored for the potential to impact human health and safety, and the potential for causing regulatory impairment of waters. It should be noted that some of the water-related indicators listed below may only merit monitoring under certain circumstances.

- **Stream Flow (Hydrology):** Defined as the volume of water moving past a cross-section of a stream over a set time period. Removal of foliage from woody plants and grassland vegetation decreases interception and storage capacity of the watershed along with hydrophobic soils. Reduction in soil permeability can increase runoff and stream flow (Aregai Tecle and Daniel Neary 2015).
- **Water Temperature:** The primary way fire impacts water temperature is via vegetation removal both in the surrounding watershed and in the stream corridor. The exact magnitude of increased water temperature due to fire depends on a multitude of factors, including pre-fire vegetation density, fire intensity and extent, proximity to the water body, volume of water affected, and the degree of mixing with unaffected drainages (Cilimburg, A. C., and K. C. Short 2005).
- **Dissolved Oxygen:** Defined as the amount of oxygen that is present in water. Fire can reduce dissolved oxygen in local drainages in a couple of ways. First, increased nutrients and reduced shade can increase algal blooms, depleting the supply of dissolved oxygen as they decay and are consumed by bacteria. Secondly, the amount of dissolved oxygen may also drop as a result of increased water temperatures as cold water generally holds more oxygen than warm water (as dictated by the laws of thermodynamics).
- **pH:** A measure of the acidity or alkalinity of a solution as determined from the hydrogen ion concentration.
- **Turbidity and Total Suspended Solids:** Turbidity and total suspended solids (TSS) are both used to measure particles suspended in the water column, including organic and inorganic matter. Turbidity uses light scattering as a proxy, while TSS is a direct laboratory measurement of suspended solids. Increased erosion of fine sediments, organic matter, ash, and increased algal blooms following a fire have the potential to increase these values.
- **Metals:** The concentration of total and dissolved metals in solution. The Southern California Coastal Water Research Project (2009) guidance for post-fire water quality monitoring recommends testing of Aluminum (Al), Iron (Fe), Cadmium (Cd), Copper (Cu), Lead (Pb), Manganese (Mn), Nickel (Ni), and Zinc (Zn).
- **Polyaromatic Hydrocarbons:** Organic compounds containing only carbon and hydrogen composed of multiple aromatic rings. Formed by the incomplete combustion of wood and biomass. The Southern California Coastal Water Research

Project (2009) guidance for post-fire water quality monitoring recommends testing for polyaromatic hydrocarbons as part of a successful regional monitoring program.

7.3.8 Fuel Loads

Fuel loads should be monitored to ensure that the desired final conditions of reduced loads are reached from treatments and to better understand growth patterns of fuel loads. The indicators that can be monitored under this parameter include:

- **Status of Vegetation:** Categorize if the individual vegetation specimen being monitored is alive or dead.
- **Surface Fuels:** Includes downed woody material, such as dead twigs, branches, stems, and boles of trees and shrubs that have fallen and lie on or above the ground (Brown et al 1982). These fuels are broken into the categories below and typically reported on a tons per acre basis.
  - ***1-hour fuels:*** very fine fuels (such as needles and leaves) that are easily ignited and burn quickly. Less than 0.25 inch in diameter.
  - ***10-hour fuels:*** larger, less combustible fuels (such as small branches and woody stems). These can readily carry fire when moisture is low. From 0.25 to 1.0 inch in diameter.
  - ***100-hour fuels:*** typically twig and branch material from 1.0 to 3.0 inches in diameter.
  - ***1,000-hour fuels:*** larger limbs and tree boles that are greater than 3.0 inches in diameter and classified as "sound" or "rotten".
- **Litter:** The top layer of the forest, shrubland, or grassland floor, directly above the duff layer, including freshly fallen leaves, needles, bark flakes, cone scales, fruits (including acorns and cones), dead matted grass and other vegetative parts that are little altered in structure by decomposition. Does not include twigs and larger stems (NPS 2011).
- **Duff:** The fermentation and humus layer of the forest floor material lying below the litter and above mineral soil; consisting of partially decomposed organic matter whose origins can still be visually determined, as well as the fully decomposed humus layer. Does not include the freshly cast material in the litter layer, nor in the postburn environment and ash (NPS 2011).
- **Coarse Woody Debris**: Defined as dead woody debris (limbs, trunks, or stems) detached from the originating trunk or stem. Previous definitions have included material greater than 15 centimeters (cm) in diameter and at least 1 meter in length (Stephens and Moghaddas 2005).
- **Cover**: The area or percent of a fixed area occupied by a vegetation type or species.
- **Height**: The height of an individual tree, shrub, herbaceous plant, or grass.
- **Diameter:** The tree bole diameter at a height of 4.5 feet aboveground; if on a slope, the diameter is measured at 4.5 feet aboveground on the uphill side of the tree. On shrubs, the stem diameter is measured at the stem base.

- **Canopy Cover (Foliar Cover):** The percentage of ground covered by the vertical projection of the outermost perimeter of the natural spread of foliage of plants. Small openings in the canopy are included (Glossary Revision Special Committee 1989).
- **Canopy Closure:** The proportion of the sky hemisphere obscured by vegetation when viewed from a single point.
- **Density:** The number of individuals over a fixed area (per acre, per square meter).
- **Structure (Physiognomy):** For vegetation, (1) the spatial pattern of growth forms in a plant community, especially with regard to their height, abundance, or coverage within the individual layers (Gabriel and Talbot 1984), and (2) the spatial arrangement of the components of vegetation resulting from plant size and height, vertical stratification into layers, and horizontal spacing of plants (Lincoln et al, 1998, Mueller-Dombois and Ellenberg 1974).
- **Age:** The age of an individual or stand in years. Where age cannot be determined by tree rings, it may be estimated by time since past disturbance
- **Above and Belowground Carbon:** The amount of live or dead above and/or belowground carbon in a given area or per acre basis.
- **Presence or Absence by Location(s)**: The presence or absence of a target species within an area, OSP, or other fixed location.

7.3.9 Disease Presence and Invasive Species

The extent and spread of forest diseases and invasive species can greatly impact fuel loads and flammability and have negative impacts on native vegetation and ecosystem health. Monitoring of invasive species and forest disease conditions is important to understand where to focus treatments and to design effective treatments. Disease presence and invasive species parameters should also be monitored to ensure that vegetation treatments are not increasing or exacerbating existing issues or creating new problems.

In conjunction with monitoring as part of the Midpen’s Integrated Pest Management Program (IPMP), monitoring of these parameters in areas of vegetation managed under the Program includes:

- Identifying the pest or diseases that are occurring and understanding the life cycle (invasive species) or mode of spread (disease)
- Determining the extent of the problem or infestation
- Evaluating the site conditions and susceptibility to invasive species or forests disease spread

7.3.10 Intensity and Severity of Fire

The indicators described below can be used to assess disturbances such as wildland fire, landslides, or flooding and should also be monitored during prescribed fire to ensure that methods to reduce intensity are effective.

- **Geographic Location and Extent:** The basic geographic location and extent (acres) of a disturbance can be used to determine several potential effects at course scale.
- **Vegetation Burn Severity:** Typically assessed as the percentage of live vegetation or live vegetation canopy cover directly killed by fire.
- **Soil Burn Severity:** The effect of a fire on ground surface characteristics, including char depth, organic matter loss, altered color and structure, and reduced infiltration. The classification of post-fire soil condition is based on fire-induced changes in physical and biological soil properties (Parsons et al. 2010).
- **Frequency:** The number of times a disturbance event happens in a given time period, both in terms of average, historical, and current frequency.

7.3.11 Ignition Sources

Understanding the source and locations of wildland fire ignitions (human, intentional, accidental, or lighting caused) is an important part of mitigating potential future ignitions. This parameter includes identifying and understanding the ignition source and where else on Midpen lands similar ignition sources are found. Understanding these areas of additional risk for wildland fire can help Midpen plan and prioritize fuel treatments that reduce risks. Quality of historical ignition sources can vary but generally human and lighting-caused ignitions since 1970 are available statewide for further analysis.

7.3.12 Weather and Fuel Moisture

The indicators described below can be used to assess weather and fuel moisture typically at multiple time scales (hourly, daily, yearly, point in time). Weather monitoring may be important to better understand when conditions could result in a higher fire threat or when planning post fire erosion control treatments, that may merit taking additional precautions and implementing high fire threat or danger procedures. Weather is also important to monitor during prescribed fires.

- **Temperature**: Air temperature, which can be expressed as a point in time measurement, hourly average, daily average, maximum, or minimum.
- **Relative Humidity:** The amount of water vapor present in air expressed as a percentage of the amount needed for saturation at the same temperature.
- **Windspeed:** The speed of wind at a selected point or over an area. Remote Access Weather Stations typically provide windspeeds at a height of 20 feet averaged over 10 minutes. Windspeeds may also be measured at point in time or lower or higher heights as appropriate.
- **Wind Direction:** The direction the wind is originating from.

- **Precipitation:** The hourly, daily, monthly, or annual amount of fog or rainfall at a given measured point or extrapolated over an area. Precipitation can be reported as a rate (inches/hour) or total.
- **Dead Fuel Moisture:** The moisture content of dead organic fuels, expressed as a percentage of the oven dry weight of the sample, that is controlled entirely by exposure to environmental conditions.
- **Live Fuel Moisture:** Fuel moisture is a measure of the amount of water in a fuel (vegetation) and is expressed as a percent of the dry weight of that specific fuel.

7.4 Methods of Monitoring and Monitoring Protocols

This section describes the methods and protocols that may be applied to monitor the parameters and indicators identified in Section 7.3. These methods and protocols are summarized in Table 7-3. The detailed methods are included in Appendix G. The order of methods described in the table and in Appendix G generally follows the order of the parameters as presented in Section 7.3.

Prior to undertaking any of these protocols, it is essential to first identify the monitoring or research question, the appropriate time and geographic scale(s) for that question, and the indicators that may most efficiently be assessed to provide the desired information. How these monitoring methods are applied to each Program components (e.g., PFP, Vegetation Management Plan, or fire event) is provided in Section 7.5.

Table 7-3 Monitoring Methods and Protocols

Monitoring Parameter		Monitoring Methods and/or Protocols	Sources
Biodiversity and Wildlife Presence	Avian	Point Count	Ralph et al. 1993, Ralph et al 1995, Fancy et al. 2009, Coonan et al. 2011, Coonan and Dye 2016, Hall et al. 2018
		Area Search	Ralph et al. 1993, Loges et al. 2017, Stephens et al. 2010
		Regional Landbird Monitoring	NPS 2018
	Butterfly	Transect Identification	Kadlec et al. 2012
	American Badger	Trapping and radiotelemetry Camera traps and identification	Gould and Harrison 2018, Brehme et al. 2014
	Dusky-footed woodrat	Locating woodrat houses, trapping, and identification	Innes et al. 2007, Sakai and Noon 1993
	Reptile and Amphibians	Time-constrained searches Surveys of coarse woody debris Pitfall trapping	USFS 1990
	Mammals	Trail cameras	--
Wildlife Mortality	--	Mapping using GIS	--
Special-Status Wildlife Species	Numerous	Numerous	CDFW 2018, Kim et al. 2017, USFWS 2005b, Seltenrich and Pool 2002, USFWS 2003, USGS 2006a, USGS 2006b, Gorresen et al. 2008, Weller and Lee 2007, etc.
Vegetation and Habitat, Rare Plants, and Soils	Vegetation and Habitats	Vegetation (Species and Guild) Cover by Plot	Keeley and Davis 2007, Bartosh and Peterson 2014, Corelli and Bartosh 2019, Neubauer 2013, CNPS 2001
		Relevé Vegetation (Alliances and Associations) Sampling	FDGC 2008, Sawyer et al. 2009, CNPS and CDFW 2019

	Monitoring Parameter	Monitoring Methods and/or Protocols	Sources
		Belt Transects for Measuring Fire Severity, Species Richness, and Vegetative (Pyrophtic) Cover	Bartosh and Peterson 2014
	Rare Plants and Communities: Rare Annual Plants	Ground or Field-Based Methods	ICF 2012
		Direct Count (Small Area of Occupancy)	--
		Simple Random Coordinate Method (Moderate Sized Area of Occupancy)	Elzinga et al. 1998
		Grid Cell Method (Large Area of Occupancy)	Elzinga et al. 1998
		Remote Sensing Method Using Multispectral Imagery Analysis (Landscape-scale Area of Occupancy)	Nomad 2017
	Rare Plants and Communities: Rare Geophyte	Geophyte Population Monitoring	Elzinga et al. 1998
	Rare Plants and Communities: Rare Herbaceous Perennial	Rhizomatous Herbaceous Perennial Monitoring	Nomad 2017
		Biennial Monitoring	Elzinga et al. 1998, Nomad 2017
	Rare Plants and Communities: Rare Shrub	Aerial Imagery Supported Monitoring	Nomad 2016
		Seedling and Stump Sprout Monitoring	Elzinga et al. 1998
	Rare Plants and Communities: Rare Tree	Seedling and Stump Sprout Monitoring	Elzinga et al. 1998
Soils and Erosion	Hydrology	Stage measurement at gaging stations	Sauer, V.B., and Turnipseed, D.P., 2010

Monitoring Parameter	Monitoring Methods and/or Protocols	Sources
	Discharge measurements at gaging stations	Turnipseed, D.P., and Sauer, V.B., 2010
	V-notch weirs	Rantz, S.E., and others. 1982
	Water Erosion Prediction Project (WEPP)	Elliot et al 2000–2002
	Models	Foltz et al 2009, USDA 2016, Kinoshita et al 2013
Soil Infiltration	Soil Hydrophobic Conditions	USDA 2016
	Single-ring infiltrometer	Herrick et al. 2005
Sedimentation	Visual indicators of erosion	Ypsilantis, W.G. 2011
	Erosion bridge	Ypsilantis, W.G. 2011
	Erosion plots	Ypsilantis, W.G. 2011
	Close-range photogrammetry	Ypsilantis, W.G. 2011
	Silt fence catchments	Robichaud, P. R. and R. E. Brown. 2002, Robichaud, P. R. 2005
	Water Erosion Prediction Project (WEPP) Erosion Risk Management Tool (ERMT)	Elliot et al. 2000–2002
	Erosion Risk Management Tool (ERMT)	Robichaud et al. 2006
Soil Temperature	Surface and Subsurface Monitoring Using Infrared Thermometer or Soil Thermometer	
Soil Moisture	Equipment	--
	Soil Moisture Active Passive (SMAP) satellite	--

Monitoring Parameter		Monitoring Methods and/or Protocols	Sources
	Compaction (Bulk Density)	Soil Core Sampler and Weighed	--
		Soil Penetrometer and Statistical Analysis	Moghaddas and Stephens 2008, Moghaddas and Stephens 2007
Water-Related Indicators		Create a water quality sampling plan	OWEB 2000
		Collect water quality data	OWEB 2000, USGS 2019, NRCS 2003 (part 614)
		Post-fire water quality monitoring	SCCWRP 2009
		Data quality, storage, and analysis	OWEB 2000, NRCS 2003 (part 615)
Fuel Loads		Ground-based or Terrestrial LiDAR Systems	-
		Photo Points Monitoring	Hall 2001
	Forest Inventory	Common Stand Exam (CSE) Protocols and Forest Visualization Simulator (FVS)	USDA 2019a, USDA 2019b
	Surface Fuel	Plot-Level Assessments	Brown 1974, Brown and Johnston 1982
	Large Woody Debris	Plot-Level Assessments	Stephens and Moghaddas 2005
	Forest Carbon	--	Climate Action Reserve 2019
Disease Presence and Invasive Species	Forest Disease	Data Review of Tree Mortality or Aerial Surveys	CAL FIRE 2018
	Invasive and Non-native Species	Early Detection Rapid Response and IPMP	Midpen 2014
Intensity and Severity of Fire	Flame Length	Cameras or Passive Flame Height Sensors	Ryan 1981, Kobziar and Moghaddas 2007
	Fire Detections	Moderate Resolution Imaging Spectroradiometer (MODIS)	NASA 2019

Monitoring Parameter		Monitoring Methods and/or Protocols	Sources
Ignition Sources		Historical Patterns	Keeley and Syphard 2018
		Historical and Recent Ignition Data	FAM 2019
Weather and Fuel Moisture	Weather	Equipment Monitoring	--
		Remote Access Weather Stations (RAWS)	Main et al. 1990, NOAA 2019a
		Windspeeds and Directions	Earth 2019, Windmap 2019
		Fire Danger	USFS 2019b, NOAA 2019b
	Fuel Moistures (Live and Dead)	Field Measurements and Satellite Imagery	USFS 2019a, USFS 2019b, NOAA 2019a

7.5 Monitoring Prescriptions

The following tables provide guidance on how monitoring parameters, and methods and protocols, are applied to each component plan of the Program as follows.

- **Table 7-4. Vegetation Management Plan – Fire Management**: The actions under the Monitoring Plan include vegetation management actions for fire management. These actions include creation and maintenance of shaded and non-shaded fuelbreaks, ingress/egress/evacuation routes, disclines, defensible space, and emergency staging areas and emergency landing zones.
- **Table 7-5. Vegetation Management Plan – Ecosystem Resiliency**: The actions under the Monitoring Plan includes vegetation management and the creation of fuel reduction areas for ecosystem health.
- **Table 7-6. Prescribed Fire Plan:** The Monitoring Plan includes the actions for prescribed fire. Prescribed fire is performed to reduce fuel loads in areas away from roads and structures, and to improve ecosystem health and resiliency.
- **Table 7-7. Unplanned Wildland Fire Event**: The last table is not directly correlated to a plan but describes monitoring actions following an unplanned fire event.

The tables identify how the desired conditions and the monitoring objectives should be established for each relevant monitoring parameter. The monitoring prescriptions include the scales of monitoring, method and protocol to use in monitoring when it should be used, and the timing of monitoring (i.e., before, during, or post activity). It should be noted that additional specific criteria should also be established at the time of monitoring, depending on specific activities and site conditions, and in accordance with the reporting requirements outlined in Section 7.6.

Table 7-4 Vegetation Management Plan – Fire Management Monitoring Prescriptions by Relevant Parameter

Parameter/Indicator	Considerations for Establishing Desired Conditions	Monitoring Objectives	Scale of Monitoring	Method/Protocol	Timing of Monitoring
Wildlife Presence	Creation and maintenance of VMAs will have some effects on the presence and use of the VMAs by wildlife. Woodrats may be more exposed in areas of thinner vegetation and therefore, may not nest as frequently in these areas. Ground nesting birds may experience reduced cover that could affect nesting success. The tolerance for impacts to wildlife should be established based on balancing the benefits of the VMA with potential reduced use of VMA areas by wildlife, including avian species, badgers, and woodrats.	Gather and synthesize data to allow Midpen to better understand if patterns of wildlife use and presence are affected by VMA creation and maintenance.	**Geographic:** Typically, specific to a particular managed area and specific to the treated areas within the managed areas. Monitoring across multiple managed areas and habitats to identify larger patterns would be most beneficial to understand the overall impacts of VMA creation and maintenance on wildlife presence and use of VMAs. **Temporal:** Changes in condition resulting from planned treatments.	**Avian Monitoring** can be implemented periodically or in specific testing areas. **Woodrat Assessments** may also be performed through specific surveys of VMA areas. **Trail Camera Monitoring** to understand different mammalian species' use or migration through treated areas.	Performed on a cyclical and on-going basis.
Wildlife Mortality	Direct wildlife mortality would be avoided through careful use and timing of equipment. Indirect mortality can be tracked through monitoring to determine if adaptive changes need to be made to protect wildlife.	Observe and record any mortality of wildlife during and after treatments and to identify the reason for the mortality.	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments.	**Mortality data collection** to understand species killed and how it died.	During and after treatment activity.
Special-Status Wildlife and Plant Species	The tolerance for impacts to special-status wildlife and plant species is low and, generally, impacts should be avoided.	Understand the potential for presence of special-status species prior to performing treatment, ensuring that if any are present, they are not impacted during or after treatments (in accordance with permits or CEQA mitigation).	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments.	**Habitat Reconnaissance and in some cases Protocol Surveys** for the special-status species of concern.	Prior to conducting the activity, while the activity is being conducted, and after the activity is completed.
Habitat and Vegetation Types	Changes to vegetation composition will occur from the creation of the various types of VMAs under the Vegetation Management Plan. The desired condition established for each treatment or treatment area to be monitored should minimize loss of diversity of plant species and loss of habitat functions in the larger surrounding areas. Habitat types should remain generally the same and should not transition, except in some cases like for creation of new unshaded fuelbreaks to protect property.	Monitor the surrounding composition of vegetation before and after treatments, and to understand any changes in composition or health as a result of treatments.	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments.	**Habitat Reconnaissance Field Surveys and Mapping** to map vegetation community-level changes and specific plant species composition changes. **Remote Sensing, Unmanned Aerial Systems (UAS), and GIS Methods for Monitoring Vegetation Condition, Distribution, and Change,** although use of these techniques would be specific to the smaller scale considerations of habitat impacts from creation of fuelbreaks, defensible space, etc.	Prior to conducting the activity and after it is completed.
Rare Plants	The tolerance for impacts to rare plants is low and, generally, impacts should be avoided.	Understand the potential for presence of rare plants prior to performing treatments, ensuring that if any are present, they are not impacted during or after treatments (in accordance with permits or CEQA mitigation).	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments.	**Ground or Field Based Methods for Monitoring Vegetation Condition, Distribution, and Change in Rare Plants**	Prior to conducting the activity, while the activity is being conducted, and after the activity is completed.

Parameter/Indicator	Considerations for Establishing Desired Conditions	Monitoring Objectives	Scale of Monitoring	Method/Protocol	Timing of Monitoring
Soils and Erosion	The desired conditions should include minimization of soil and erosion impacts through the use of best management practices.	Verify the effectiveness of erosion control measures implemented.	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments.	**Sedimentation Monitoring Methods**	Prior to conducting the activity, while the activity is being conducted, and after the activity is completed.
Fuel Loads	The desired conditions will reflect the type of fuelbreak or defensible space created and must reduce fuel loads to meet the specification of the VMA type. Desired conditions may also be established for carbon stock as a result of treatments. Generally, carbon stock losses should be neutral in VMA areas, but may take time to reach such a condition.	Understand the fuel loads before and after treatment to ensure that the specifications of the VMA are achieved and to understand the timeframe for retreatment as fuel loads regrow	**Geographic:** At the level of the activity being performed. Monitoring across multiple managed areas and habitats to identify larger patterns would be most beneficial to understand the overall impacts of VMA creation and maintenance on habitats and vegetation. **Temporal:** Changes in condition resulting from planned treatments.	**Common Stand Exam Protocols** to understand changes at a small scale. **Photo Points** **Browns Methods and CDW Methods** **Forest Carbon Inventory** to understand changes in carbon stock.	Before treatments, after treatments, and on a cyclical and on-going basis to understand trends.
Invasive Species	The desired condition should reflect control, reductions, or removal of invasive species and avoidance of expanded invasive species populations.	Understand where invasive species are found before initiating work to minimize potential for spread. To verify that work completed has not resulted in increases in invasive species over the long-term.	**Geographic:** At the level of the activity being performed if it is forested. Monitoring across multiple managed areas to identify larger patterns would be most beneficial to understand the overall impacts of VMA creation and maintenance on forest disease spread or where forest diseases are spreading. **Temporal:** Changes in condition resulting from planned treatments.	**Habitat Reconnaissance Field Surveys for Invasive Species** **EDRR**	Before treatments and on-going basis to understand if invasive species are spreading.
Forest Disease	The desired conditions should reflect reductions in forest diseases and restoration of diseased areas to resilient tree types.	Understand locations of forest disease to focus treatments to these areas and ensure that activities and treatments are not resulting in the spread of forest diseases.	**Geographic:** At the level of the activity being performed if it is forested. Monitoring across multiple managed areas to identify larger patterns would be most beneficial to understand the overall impacts of VMA creation and maintenance on forest disease spread or where forest diseases are spreading. **Temporal:** Changes in condition resulting from planned treatments.	**Tree mortality maps available via the California Tree Mortality Task Force** **UAV Monitoring of smaller areas (<250 acres)**	Cyclical and on-going basis to understand trends in disease spread at a larger scale.

Table 7-5 Vegetation Management Plan – Ecosystem Resiliency Monitoring Prescriptions by Relevant Parameter

Parameter/Indicator	Considerations for Establishing Desired Conditions	Monitoring Objectives	Scale of Monitoring	Method/Protocol	Timing of Monitoring
Wildlife Presence	Creation and maintenance of FRAs could have some effects on the presence and use of these areas by wildlife, but impacts are expected to be minor. FRAs include reducing fuel loads, but to a lesser degree than is performed to create other types of VMAs.	Gather and synthesize data to allow Midpen to better understand if patterns of wildlife use and presence are affected by FRA creation and maintenance.	**Geographic:** Typically, specific to a particular managed area and specific to the treated areas within the managed areas. Monitoring across multiple managed areas and habitats to identify larger patterns would be most beneficial to understand the overall impacts of FRA creation and maintenance on wildlife presence. **Temporal:** Changes in condition resulting from planned treatments.	**Avian Monitoring** can be implemented periodically or in specific testing areas. **Woodrat Assessments** may also be performed through specific surveys of VMA areas. **Trail Camera Monitoring** to understand different mammalian species' use or migration through treated areas.	Performed on a cyclical and on-going basis.
Wildlife Mortality	Direct wildlife mortality would be avoided through careful use and timing of equipment. Indirect mortality can be tracked through monitoring to determine if adaptive changes need to be made to protect wildlife.	Observe and record any mortality of wildlife during and after treatments and to identify the reason for the mortality.	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments.	**Mortality data collection** to understand species killed and how it died.	During and after treatment activity.
Special-Status Wildlife and Plant Species	The tolerance for impacts to special-status wildlife and plant species is low and, generally, impacts should be avoided.	Understand the potential for presence of special-status species prior to performing treatment, ensuring that if any are present, they are not impacted during or after treatments (in accordance with permits or CEQA mitigation).	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments.	**Habitat Reconnaissance and in some cases Protocol Surveys** for the special-status species of concern.	Prior to conducting the activity, while the activity is being conducted, and after the activity is completed.
Habitat and Vegetation Types	Changes to broader surrounding vegetation composition are not anticipated with the creation of FRAs. Habitat types should remain generally the same and should not transition.	Monitor the composition of surrounding vegetation before and after treatments, and to understand any changes in composition or health as a result of treatments.	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments.	**Habitat Reconnaissance Field Surveys and Mapping** to map vegetation community-level changes and specific plant species composition changes. **Remote Sensing, Unmanned Aerial Systems (UAS), and GIS Methods for Monitoring Vegetation Condition, Distribution, and Change,** although use of these techniques would be specific to the smaller scale considerations of habitat impacts from creation of fuelbreaks, defensible space, etc.	Prior to conducting the activity and after it is completed.
Rare Plants	The tolerance for impacts to rare plants is low and, generally, impacts should be avoided.	Understand the potential for presence of rare plants prior to performing treatments, ensuring that if any are present, they are not impacted during or after treatments (in accordance with permits or CEQA mitigation).	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments	**Ground or Field Based Methods for Monitoring Vegetation Condition, Distribution, and Change in Rare Plants**	Prior to conducting the activity, while the activity is being conducted, and after the activity is completed.

Parameter/Indicator	Considerations for Establishing Desired Conditions	Monitoring Objectives	Scale of Monitoring	Method/Protocol	Timing of Monitoring
Fuel Loads	The desired conditions reflect a reduced fuel load, reduced forest disease, and reduced invasive species. Desired conditions may also be established for carbon stock as a result of treatments. Generally, carbon stock losses should be neutral in VMA areas, but may take time to reach such a condition.	Understand the fuel loads before and after treatment to ensure that the specifications of the FRA are achieved and to understand the timeframe for retreatment as fuel loads regrow.	**Geographic:** At the level of the activity being performed. Monitoring across multiple managed areas and habitats to identify larger patterns would be most beneficial to understand the overall impacts of FRA creation and maintenance on habitats and vegetation. **Temporal:** Changes in condition resulting from planned treatments.	**Common Stand Exam Protocols** to understand changes at a small scale. **Photo Points** **Browns Methods and CDW Methods** **Forest Carbon Inventory** to understand changes in carbon stock.	Before treatments, after treatments, and on a cyclical and on-going basis to understand trends.
Invasive Species	The desired condition should reflect control, reductions, or removal of invasive species and avoidance of expanded invasive species populations.	Understand where invasive species are found before initiating work to minimize potential for spread. To verify that work completed has not resulted in increases in invasive species over the long-term.	**Geographic:** At the level of the activity being performed if it is forested. Monitoring across multiple managed areas to identify larger patterns would be most beneficial to understand the overall impacts of FRA creation and maintenance on forest disease spread or where forest diseases are spreading. **Temporal:** Changes in condition resulting from planned treatments.	**Habitat Reconnaissance Field Surveys for Invasive Species** **EDRR**	Before treatments and on-going basis to understand if invasive species are spreading.
Forest Disease	The desired conditions should reflect reductions in forest diseases and restoration of diseased areas to resilient tree types.	Understand locations of forest disease to focus treatments to these areas and ensure that activities and treatments are not resulting in spread of forest diseases.	**Geographic:** At the level of the activity being performed if it is forested. Monitoring across multiple managed areas to identify larger patterns would be most beneficial to understand the overall impacts of VMA creation and maintenance on forest disease spread or where forest diseases are spreading. **Temporal:** Changes in condition resulting from planned treatments.	**Tree mortality maps available via the California Tree Mortality Task Force** **UAV Monitoring of smaller areas (<250 acres)**	On-going basis to understand trends in disease spread at a larger scale.

Table 7-6 Prescribed Fire Plan – Monitoring Prescriptions by Relevant Parameter

Parameter/Indicator	Considerations for Establishing Desired Conditions	Monitoring Objectives	Scale of Monitoring	Method/Protocol	Timing of Monitoring
Wildlife Presence	Prescribed fire could have some effects on the presence and use of these areas by wildlife. Areas subject to prescribed fire are expected to experience some changes in forage and cover, and some changes in usage patterns by wildlife is expected in the short term. Over the long-term usage of these areas by wildlife should increase with improvements in ecosystem health through the use of prescribed fire.	Gather and synthesize data to allow Midpen to better understand if patterns of wildlife use and presence are affected positively or negatively by areas where prescribed fire is used and to understand the duration of impacts.	**Geographic:** Typically, specific to a particular managed area and specific to the treated areas within the managed areas. Monitoring across multiple managed areas and habitats to identify larger patterns would be most beneficial to understand the overall impacts of prescribed fire on wildlife presence. **Temporal:** Changes in condition resulting from planned treatments.	**Avian Monitoring** can be implemented periodically or in specific testing areas. **Woodrat Assessments** may also be performed through specific surveys of treated areas. **Trail Camera Monitoring** to understand different mammalian species' use or migration through treated areas.	Performed on a cyclical and on-going basis.
Wildlife Mortality	Direct wildlife mortality would be avoided through careful use and timing of equipment. Indirect mortality can be tracked through monitoring to determine if adaptive changes need to be made to protect wildlife.	Observe and record any mortality of wildlife during and following prescribed fire treatments and to identify the reason for the mortality.	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments.	**Mortality data collection** to understand species killed and how it died.	During treatment activity.
Special-Status Wildlife Species	The tolerance for impacts to special-status wildlife species is low and, generally, impacts should be avoided.	Understand the potential for presence of special-status species prior to performing treatment, ensuring that if any are present, they are not impacted during or after prescribed fire treatments (in accordance with permits or CEQA mitigation).	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments.	**Habitat Reconnaissance and in some cases Protocol Surveys** for the special-status species of concern.	Prior to conducting the activity, while the activity is being conducted, and after the activity is completed.
Vegetation and Habitat Types	Changes to vegetation densities are expected from prescribed fire and should be positive over a longer period by reducing invasive species, increasing the health of native species, and supporting the re-emergence of fire-dependent native species and rare plants.	Monitor the composition of vegetation before and after treatments, and to understand any changes in composition or health as a result of prescribed fire.	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments	**Habitat Reconnaissance Field Surveys and Mapping** to map vegetation community-level changes and specific plant species composition changes. **Remote Sensing, Unmanned Aerial Systems (UAS), and GIS Methods for Monitoring Vegetation Condition, Distribution, and Change,** for larger-scale areas in particular. **Aerial LiDAR**	Prior to conducting the activity and after it is completed.

Parameter/Indicator	Considerations for Establishing Desired Conditions	Monitoring Objectives	Scale of Monitoring	Method/Protocol	Timing of Monitoring
Rare Plants	Impacts to some rare plants is expected to be positive, but others may have low tolerance for fire and impacts to these species should be avoided.	Understand the potential for presence of rare plants prior to performing a prescribed fire, ensuring that if any are present, they are not impacted during or after treatments (in accordance with permits or CEQA mitigation). Another component of monitoring of rare plants is to understand how prescribed fire may improve populations of fire-following species.	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments	**Ground or Field Based Methods for Monitoring Vegetation Condition, Distribution, and Change in Rare Plants**	Prior to conducting the activity, while the activity is being conducted, and after the activity is completed.
Soils and Erosion	The desired conditions should include minimization of soil and erosion impacts from prescribed fire, through the use of best management practices, pre-treatments, and planning.	Verify the effectiveness of erosion control measures implemented and to determine if additional measures need to be taken to reduce erosion.	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments	**Sedimentation Monitoring Methods**	Prior to conducting the activity, while the activity is being conducted, and after the activity is completed.
Water Quality	The desired condition is to have minimal impacts on water quality after prescribed fire.	Ensure that downstream waterways are not impacted by prescribed fire, including for various constituents that could impact water quality or public health.	**Geographic:** At the level of the activity being performed. **Temporal:** Changes in condition resulting from planned treatments	**Water Quality Sampling Methods**	Cyclical or on-going basis, only if other indicators suggest impacts to water quality downstream of a prescribed fire has occurred.
Fuel Loads	The desired conditions reflect a reduced fuel load, reduced forest disease, and reduced invasive species. Desired conditions may also be established for an expanded carbon stock as a result of prescribed fire.	Understand the fuel loads before and after treatment to evaluate the effectiveness of the prescribed fire. To understand the treatment interval needed to maintain desired conditions.	**Geographic:** At the level of the activity being performed. Monitoring across multiple managed areas and habitats to identify larger patterns would be most beneficial to understand the overall benefits of prescribed fire. **Temporal:** Changes in condition resulting from planned treatments but potentially also as compared with historic conditions.	**Common Stand Exam Protocols** to understand changes at a small scale. **Photo Points** **Forest Carbon Inventory** to understand changes in carbon stock. **Plot Level Vegetation Monitoring Using Terrestrial LiDAR Systems** **Common Stand Exam Protocols**	Before treatments and on a cyclical and on-going basis to understand fuel loads.

Parameter/Indicator	Considerations for Establishing Desired Conditions	Monitoring Objectives	Scale of Monitoring	Method/Protocol	Timing of Monitoring
Invasive Species	The desired condition should reflect reductions in invasive species through prescribed fire.	Understand where invasive species are found before initiating work to minimize potential for spread. To verify that the prescribed fire has not resulted in increases in invasive species over the long-term.	**Geographic:** At the level of the activity being performed if it is forested. Monitoring across multiple managed areas to identify larger patterns would be most beneficial to understand the overall impacts of prescribed burning on forest disease spread or where forest diseases are spreading. **Temporal:** Changes in condition resulting from planned treatments.	**Habitat Reconnaissance Field Surveys for Invasive Species** **EDRR**	Before treatments and on-going basis to understand if invasive species are spreading.
Forest Disease	The desired conditions should reflect reductions in forest diseases, where possible.	Understand locations of forest disease in general and how disease may be reduced through prescribed fire.	**Geographic:** At the level of the activity being performed if it is forested. Monitoring across multiple OSPs to identify larger patterns would be most beneficial to understand the overall impacts of prescribed fire on forest disease. **Temporal:** Changes in condition resulting from planned treatments.	**Tree mortality maps available via the California Tree Mortality Task Force** **UAV Monitoring of smaller areas (<250 acres)**	Cyclical and on-going basis to understand trends in disease spread at a larger scale.
Intensity and Severity of Fire	The desired condition is a controlled fire with lower intensity. Use of pre-treatments, firelines, and planning should reduce intensity of prescribed fire.	Understand and adapt in the field to prevent a fire from escaping or burning out of control.	**Geographic:** At the level of the activity being performed. **Temporal:** During event.	**Fire Severity can be monitoring using the Relative Differenced Normalized Burn Ratio (RdNBR)** **Fire intensity (flame length) can be measured using stationary cameras, passive flame height sensors, and field observations during wildland fires or prescribed fires**	During treatment activity.
Weather and Fuel Moisture	The desired condition is to only perform a prescribed fire during the appropriate weather conditions	Ensure that weather conditions are appropriate to prevent a fire from escaping or burning out of control.	**Geographic:** At the level of the activity being performed. **Temporal:** During event.	**Point in Time Measures of Weather Indicators** **Fuel Moistures (Live and Dead)** **Remote Access Weather Stations (RAWS)** **Fire Weather Forecast** **Fire Danger and Related Metrics** **Windmap**	Before and during treatment activity.

Table 7-7 Unplanned Wildland Fire Event – Monitoring Prescriptions by Relevant Parameter

Parameter/Indicator	Considerations for Establishing Desired Conditions	Monitoring Objectives	Scale of Monitoring	Method/Protocol	Timing of Monitoring
Wildlife Presence	N/A	Understand how wildlife use burned areas.	**Geographic:** The area of the wildland fire. **Temporal:** Changes in Condition Resulting from Unplanned Disturbance.	**Reconnaissance Surveys for Wildlife** **Trail Camera Monitoring** to understand different mammalian species' use or migration through treated areas.	Cyclical and on-going basis.
Wildlife Mortality	N/A	Identify the extent of wildlife mortality.	**Geographic:** In the area of the wildland fire, if forested. **Temporal:** Changes in Condition Resulting from Unplanned Disturbance.	**Mortality data collection** to understand species/individuals killed.	After the wildland fire event.
Special-Status Wildlife Species	N/A	Understand the degree of impacts to special-status wildlife habitat or individuals.	**Geographic:** The area of the wildland fire. **Temporal:** Changes in Condition Resulting from Unplanned Disturbance.	**Habitat Reconnaissance and in some cases Protocol Surveys** for the special-status species of concern.	After the wildland fire event and potentially on an on-going and cyclical basis as part of recovery efforts.
Habitat and Vegetation Types	N/A	Identify the degree of impacts to habitat and vegetation.	**Geographic:** The area of the wildland fire. **Temporal:** Changes in Condition Resulting from Unplanned Disturbance.	**Habitat Reconnaissance Field Surveys and Mapping** to map vegetation community-level changes and specific plant species composition changes. **Remote Sensing, Unmanned Aerial Systems (UAS), and GIS Methods for Monitoring Vegetation Condition, Distribution, and Change,** for larger-scale areas in particular. **Aerial LiDAR**	After the wildland fire event.
Rare Plants	N/A	Understand how the wildland fire may improve populations of fire-following species.	**Geographic:** The area of the wildland fire. **Temporal:** Changes in Condition Resulting from Unplanned Disturbance.	**Ground or Field Based Methods for Monitoring Vegetation Condition, Distribution, and Change in Rare Plants**	After the wildland fire event and potentially on an on-going and cyclical basis as part of recovery efforts.
Soils and Erosion	To reduce erosion after a wildland fire event, where possible.	Understand the potential cause and extent of erosion, to put in place erosion control measures, if feasible.	**Geographic:** The area of the wildland fire. **Temporal:** Changes in Condition Resulting from Unplanned Disturbance.	**Sedimentation Monitoring Methods**	After the wildland fire event.

Parameter/Indicator	Considerations for Establishing Desired Conditions	Monitoring Objectives	Scale of Monitoring	Method/Protocol	Timing of Monitoring
Water Quality	To reduce impacts on water quality after a wildland fire event, where possible.	Understand impacts on water quality and take actions, as feasible, to reduce any impacts detected.	**Geographic:** The area of the wildland fire. **Temporal:** Changes in Condition Resulting from Unplanned Disturbance.	**Water Quality Sampling Methods**	After the wildland fire event.
Invasive Species	To prevent spread of invasive species after a wildland fire event, where possible.	Monitor recovery in burned areas to ensure that invasive species do not take hold and spread.	**Geographic:** The area of the wildland fire. **Temporal:** Changes in Condition Resulting from Unplanned Disturbance.	**EDRR**	After the wildland fire event.
Forest Disease	N/A	Understand locations of forest disease in general and how disease may spread or reduce as a result of wildland fire.	**Geographic:** The area of wildland fire impact, if forested. **Temporal:** Changes in condition resulting from planned treatments.	**Tree mortality maps available via the California Tree Mortality Task Force** **UAV Monitoring of smaller areas (<250 acres)**	Cyclical and on-going basis to understand trends in disease spread at a larger scale.
Ignition	To reduce the likelihood of a future fire elsewhere form a similar ignition source.	Understand the source of ignition.	**Geographic:** In the area of wildland fire. **Temporal:** N/A	**Investigative Methods**	After the wildland fire event.
Intensity and Severity of Fire	N/A	Understand the extent of impacts from the intensity of the wildland fire.	**Geographic:** In the area of wildland fire. **Temporal:** N/A	**Fire Severity can be monitoring using the Relative Differenced Normalized Burn Ratio (RdNBR)** **Fire intensity (flame length)** can be measured using stationary cameras, passive flame height sensors, and field observations during wildland fires or prescribed fires	After the wildland fire event and on a cyclical and on-going basis to reduce risks of similar ignitions in other areas.
Weather and Fuel Moisture	N/A	Understand how weather affected the fire behavior.	**Geographic:** In the area of wildland fire. **Temporal:** N/A	**Point in Time Measures of Weather Indicators** **Fuel Moistures (Live and Dead)** **Remote Access Weather Stations (RAWS)** **Fire Weather Forecast** **Fire Danger and Related Metrics** **Windmap**	After an event and on an on-going and cyclical basis.

7.6 Reporting and Adaptive Management

7.6.1 Development of Monitoring Plans for Each Project/Activity

This Monitoring Plan identifies the tools needed to create a specific monitoring plan for each project or activity undertaken, as well as to define on-going and cyclical monitoring activities that will help Midpen better understand the wildland fire risks and ecosystem health of the OSPs on a larger scale. Monitoring results will be used to understand the effectiveness of the activities undertaken across multiple parameters and to refine the activities to achieve the desired conditions.

Table 7-4 through Table 7-7 should be utilized to develop an individual monitoring plan for each project or activity. Forms and templates are provided in Appendix F to streamline the process for developing these monitoring plans. The individual monitoring plan should address the species, habitats, methods, and protocols specific to the area where the monitoring is to occur. The monitoring plans should also address the qualifications of the required monitors.

7.6.2 Results Reporting

Reporting will be performed on a project-by-project basis and also in an Annual Monitoring Report to the Board ~~of Directors~~. Individual reports should be prepared after each project or activity is complete. The Annual Monitoring Report will be a synthesis of individual monitoring reports over the calendar year, fire event monitoring (if occurred), and reporting on larger-scale, on-going, or cyclical monitoring. Adaptive management recommendations should be made in the Annual Monitoring Report. An Annual Monitoring Report template is provided in Appendix F.

7.6.3 Adaptive Management Based on Monitoring Results

The Monitoring Plan will identify areas where Midpen needs to proactively seek out information. Similarly, Midpen will need to be continually responsive to changes in laws and regulations pertaining to endangered species protections, noxious species quarantines, greenhouse gas emissions, and wildland fire treatments. Midpen also needs to conduct enough monitoring of both its natural resources and the effects of its actions to detect and respond to critical changes, optimize its activities, and ensure that overall goals are being met.

Adaptive management is comprised of the following actions:

- **Monitoring biological stressor indicators.** Recognizing that large-scale changes, such as SOD and global climate change, are occurring, Midpen will study these macro-processes to develop and adopt appropriate long-term management strategies.
- **Monitoring management activities and, if warranted, revise approaches or actions.** Through the reporting described in this Monitoring Plan, each individual activity will include a monitoring component. The results of each monitoring effort

will be described. At the individual and annual reporting phase, Midpen staff will identify whether the activities being undertaken are meeting the overall objectives of the work and will make recommendations to modify methods in the planning of future activities. For example, if monitoring identifies that erosion persists as a result of an activity, the recommendation may be to increase the erosion control efforts and/or to avoid certain areas that have systematically shown erosion problems after certain types of treatments. Another example is if monitoring shows reduced usage of certain treatment areas by woodrats, additional measures may be taken in how the treated areas are maintained or to move woodrat nests in these areas in the future.

- **Continuing to work with surrounding land management agencies and the public to foster education, research, and volunteer efforts**. Midpen has an active volunteer program, and coordinates with many sister agencies and organizations regarding vegetation management and wildland fire risk reduction. Midpen will continue to improve regional ecosystem health and reduce wildland fire risks.
- **Utilizing new methods and technologies that increase efficiency, reduce costs, and reduce impacts on the environment from fuel management activities**. Midpen will adapt the Program over time through adoption of new methods and technologies.

8 Maximum Acreage of Annual Treatment

8.1 Overview

This chapter identifies the anticipated maximum treatment acres in any one year of Program implementation as well as the method for evaluating and amending the Program, as needed. Actual annual acreages of fuel treatment projects that are included as part of Midpen's annual capital improvement and action plan will depend on annual staffing capacity, funding availability, partnerships, and other resources and must also consider other priorities and projects that further the mission and the Board's strategic goals and objectives.

8.2 Maximum Acreage of Annual Treatment

Table 8-1 shows the maximum acres of treatment per activity that may be performed in any given year. Up to 1,230 acres of new land could be treated in a single year and an additional up to 1,400 acres of previously treated areas could be maintained. This maximum envelope allowed is likely much greater than the amount that will be actually treated, given the circumstances of need, funding, and staffing in any one year.

Midpen will prepare an Annual Work Plan, with input from surrounding fire agencies, identifying those areas to be created and maintained in each coming year, with consideration for the higher prioritization areas. Midpen staff will then bring the anticipated budgets to the Board for review and approval as part of the annual capital improvement and action plan development process. The objective is to gradually increase annual treatment areas, depending on funding sources and availability of work crews, while minimizing negative impacts to the natural resources. The total areas treated annually will vary based on the aforementioned factors but will not exceed the maximum annual treatment by activity, as indicated in the table, below.

Table 8-1 Maximum Annual Treatment Areas

Activity	Treatment Type ~~Tools~~	Unit	Create New or Maintain Existing	Maximum Annual Treatments
Shaded Fuelbreaks	Manual, mechanical, herbicide, ~~pile burn,~~ prescribed herbivory	Acre	New	50
			Maintain	100
Non-Shaded Fuelbreaks	Mechanical, ~~pile burn,~~ herbicide, prescribed herbivory	Acre	New	5
			Maintain	80

Activity	Treatment Type ~~Tools~~	Unit	Create New or Maintain Existing	Maximum Annual Treatments
Evacuation Routes, Critical Infrastructure, Fire Management Logistics Fuelbreaks	Manual, mechanical, herbicide, ~~pile burn,~~ prescribed herbivory	Acre	New	400
			Maintain	400
Target Hazards Fuelbreaks	Manual, mechanical, herbicide, ~~pile burn,~~ prescribed herbivory	Acre	New	20
			Maintain	20
Fire Agency New Recommended Fuelbreaks	Manual, mechanical, herbicide, ~~pile burn,~~ prescribed herbivory	Acre	New	100
			Maintain	N/A
Ingress/Egress Route Fuelbreaks	Mechanical, herbicide, ~~pile burn,~~ prescribed herbivory	Acre	New	25
			Maintain	25
Disclines	Mechanical, herbicide	Acre	New	10
			Maintain	60
Midpen Structures and Facilities Defensible Space	Manual, mechanical, herbicide~~, pile burn~~	Acre	New	As needed
			Maintain	175
Emergency Staging Areas, Emergency Landing Zones, and Other Fire Management Logistics Areas	Manual, mechanical	Acre	New	100
			Maintain	30
Eucalyptus and Acacia Removal	Manual, mechanical, herbicide	Acre	New	20
			Maintain	10
Fuel Reduction Areas	Manual, mechanical, herbicide, ~~pile burn,~~ prescribed herbivory	Acre	New	500
			Maintain	500
Total			**New**	**1,230 acres**
			Maintain	**1,400 acres**

Note: Monitoring actions will be determined by Midpen staff annually. Prescribed burning units and maximum burns per year will be defined through development of the PFP.

8.3 Assessing the Program

Chapter 7: Monitoring Plan identifies the monitoring and reporting under the Program that would occur to understand the effectiveness of the work. Through the evaluation of work performed in previous years, Midpen will continuously improve methods and approaches over time. Adaptive management recommendations, if any, will be identified in in the Annual Monitoring Report. The Annual Monitoring Report, as approved by the General Manager and accepted/approved by the Board, will be the basis for making changes to the Program, including ~~If~~ changes to the maximum acreages or methods ~~are needed, an addendum to this Program may be prepared~~.

8.4 Updates and Modifications to the Program

This Program is intended to be a "living document," in which minor changes that do not trigger additional environmental effects can be made without needing to complete additional environmental analysis. The document may be updated, and as necessary, supplemental CEQA or other environmental analysis prepared.

Each year following Board review of the Annual Monitoring Report, the appropriate Vegetation Management Coordinator or staff Coordinator will implement recommended changes to the Program. The appropriate Vegetation Management Coordinator or staff Coordinator will review proposed changes and updates to determine if changes to adopted RM Policy is necessary. This review will include an assessment of changes to the maximum acreages of treatment, methods of treatment, and types of activities covered under the Program.

When changes to the Program are required, the appropriate Vegetation Management Coordinator or staff Coordinator will initiate a review process to determine whether the proposed changes are minor (as defined under the CEQA approval process for a project as not resulting in substantial new information or new significant environmental impacts). If the changes are confirmed to be minor, these changes can be addressed through the Vegetation Management Coordinator or staff Coordinator review and approval process. Examples of minor changes that would not likely trigger a new environmental review include process updates and use of different equipment to conduct the identified activities.