PRESCRIBED FIRE PLAN

Refuge-wide Broadcast Burn

Programmatic Plan Name

Arapaho National Wildlife Refuge

Administrative Unit(s)

Multiple units

Prescribed Fire Name (should match FMIS naming)

Prepared By: John Ashcraft, RXB2 — Date

Reviewed By: Kevin Beck, RXB2 — Date

Concurrence: Tracy Swenson; Rocky Basin ZFMO — Date

Complexity Rating **Moderate**

Minimum Burn Boss Qualification **RXB2**

Project Leader / Refuge Manager

As the line officer who will be ultimately responsible for the outcome of the implementation of this prescribed fire project, I certify that I have reviewed this Prescribed Fire Plan and certify that all related planning documents are complete, and that the prescribed fire conditions will, to the best of my knowledge meet the planned objectives when carried out according to this plan. **This plan is valid for up to five years following my signature below.**

Approved:

Project Leader / Refuge Manager — Date

Re-Certification for Multiple Years

During the period it is valid a Plan may be executed more than once, but it must be re-approved by the Project Leader/Refuge Manager prior to each ignition.

I certify that I have re-reviewed this Prescribed Fire Plan, that conditions described in this plan are substantially still the same, and that the plan is still valid.

Project Leader / Refuge Manger	Date
Project Leader / Refuge Manager	Date
Project Leader / Refuge Manager	Date
Project Leader / Refuge Manager	Date

Contents

Element 2A: Agency Administrator Ignition Authorization

Agency Administrator Ignition Authorization, PMS 485

The Agency Administrator Ignition Authorization form is a separate PDF file that must be printed and signed. <http://www.nwcg.gov/pms/RxFire/rx.htm>

The Agency Administrator Ignition Authorization must be completed before a prescribed fire can be implemented. If ignition of the prescribed fire is not initiated prior to expiration date determined by the agency administrator, a new authorization will be required. A copy of the signed Agency Administrator Ignition Authorization will be placed in the project file for each ignition unit that is completed under the Authorization.

Element 2B: Prescribed Fire Go/No-Go Checklist

Prescribed Fire Go/No-Go Checklist, PMS 486

The Prescribed Fire Go/No-Go Checklist form is a separate PDF file that needs to be printed and signed by the Burn Boss. <http://www.nwcg.gov/pms/RxFire/rx.htm>

The Prescribed Fire Go/No-Go Checklist must be completed before a prescribed fire can be implemented. The Prescribed Fire Go/No-Go Checklist will be placed in the project file for each ignition unit that is completed under this Plan.

Element 3: Complexity Analysis Summary

Sound risk management is a foundation for all fire management activities. Risks and uncertainties relating to fire management activities must be understood, analyzed, communicated, and managed as they relate to the cost of either doing or not doing an activity (USDA, USDI, et al, 2009).

Prescribed fire should be assessed in terms of values that could be impacted, how severe the threat may be, and the likelihood of undesirable effects. Actions should be developed to minimize or eliminate threats and manage risk. Risk management is the process whereby management decisions are made and actions taken concerning control of hazards and acceptance of remaining risk.

Prescribed fires present an inherent level of risk. Risk is at all levels, from decision-makers to on-the-ground fire-fighters and the public. The overall prescribed fire planning process includes a risk assessment, and reflects an understanding of the interaction of objectives and implementation limitations for the project.

Risk management consists of mitigation strategies and implementation activities to improve outcomes and minimize negative consequences. For prescribed fire, the risk assessment is accomplished by completing the complexity analysis process that identifies, analyzes and characterizes the potential hazards, threats, causes and consequences. The complexity analysis process identifies critical items, mitigation measures, and implementation actions to be addressed in the prescribed fire plan and will acknowledge any remaining unmitigated risk in the final rating.

During the implementation phase of prescribed fires, personnel may encounter uncertain and dynamic conditions, where they must continuously evaluate risks with an eye towards maintaining a safe working environment, meeting the prescribed fire objectives (on time, within budget and with available resources) and addressing social and political concerns.

The risk management process identified in the Incident Response Pocket Guide, PMS 461 (National Wildfire Coordinating Group, 2010), helps identify, evaluate and mitigate time-sensitive risks and hazards associated with prescribed fire.

ELEMENT	RISK	POTENTIAL CONSEQUENCE	TECHNICAL DIFFICULTY
1. Potential for escape	**MODERATE**	**MODERATE**	**MODERATE**
2. The number and dependence of activities	**MODERATE**	**MODERATE**	**MODERATE**
3. Off-site values	**MODERATE**	**MODERATE**	**LOW**
4. On-site values	**LOW**	**LOW**	**LOW**
5. Fire behavior	**MODERATE**	**MODERATE**	**LOW**
6. Management organization	**MODERATE**	**LOW**	**MODERATE**
7. Public and political interest	**MODERATE**	**MODERATE**	**LOW**
8. Fire treatment objectives	**LOW**	**MODERATE**	**LOW**

ELEMENT	RISK	POTENTIAL CONSEQUENCE	TECHNICAL DIFFICULTY
9. Constraints	**MODERATE**	**MODERATE**	**LOW**
10. Safety	**LOW**	**LOW**	**LOW**
11. Ignition procedures/methods	**MODERATE**	**MODERATE**	**MODERATE**
12. Interagency coordination	**LOW**	**MODERATE**	**MODERATE**
13. Project logistics	**LOW**	**LOW**	**LOW**
14. Smoke management	**MODERATE**	**MODERATE**	**MODERATE**

COMPLEXITY RATING SUMMARY	OVERALL RATING
RISK	**MODERATE**
CONSEQUENCES	**MODERATE**
TECHNICAL DIFFICULTY	**MODERATE**
SUMMARY COMPLEXITY DETERMINATION	**MODERATE**

Rationale:

This plan was rated a moderate complexity broadcast burn due to a number of elements. Off-site Values and Public & Political Interest both had preliminary ratings of one factor rate at a high complexity. This was due to the refuge being located on the Walden, CO town limits, and the broad nature of the valley that the town and refuge are located in. These were mitigated due to public being familiar with fire management activities in the valley, the nature of the fuels around the homes in town, and the short time frame that smoke should be visible from town.

The other elements which rated the plan a moderate complexity were due to fire behavior, organizational size, constraints, and smoke management. The fuels at this refuge are best described as light and flashy with high rates of spread. This necessitates a great deal of coordination during ignition operations due to the impact that a sudden wind shift can have across the entire project area. These fuels also increase the likelihood that any slop-over can become established quickly and burn onto private lands. This necessitated an increase in holding resources to two Type 6 engines and two UTVs. The UTVs do not add much to line building capacity, but the resources are highly mobile so they can actively patrol long sections of fire line thus increasing the likelihood that they will catch a slop-over before it becomes more established.

The constraints and smoke management issues are minimal, but still rated moderate. The constraint that the refuge is most concerned about is the loss of willow habitat due to fire damage. The refuge staff is studying the current information on fire effects to willows, so these constraints may become minimized on some of the ignition units when the staff completes the review of the information. The smoke management issues are rated moderate due to the state of Colorado's smoke management program requirements. These requirements do not cause an undue burden on the implementation of this project, but can cause other issues if information is not reported back to the state in a timely manner.

Element 4: Description of Prescribed Fire Area

A. Physical Description

1. **Location:** Arapaho NWR is located in Jackson County, Colorado just south of the town of Walden. This burn plan will include all ignition units occurring within the boundary of the refuge. Legal description to the Sixth Principal Meridian Township and Range are as follows: T11N R79W; T9N R79W; T8N R80W; T8N R79W; T7N R81W; T7N R80W; T7N R79W. The Center of the refuge is located at 40° 38' 57.6"N (40° 38.960'N) by 106° 17' 7.85"W (106° 17.131'W) (NAD83).

2. **Size:** 25,521 acres

3. **Topography:** The majority of the refuge can be described as rolling hills intersected by numerous braided rivers, streams, and ditches. The transition from the river bottoms to the uplands can contain rapid changes in elevation, which can be described as a bluff. These bluffs tend to channel the local winds through the river bottoms and can lead to sudden changes in wind direction due to the eddying of the wind. All aspects are represented, and elevations range from 7,896 to 9,052 feet. Slopes range from flat to 70% with an average slope of 3% being found on the refuge.

4. **Project area**: The Project area for this plan is the lands within the refuge boundary which the refuge staff has identified as treatment (ignition) units.

5. **Ignition units**:

Ignition Unit	Acreage
Hampton	149
Home - Northwest	61
Home - Southeast	61

B. Vegetation/Fuels Description:

1. On-site fuels data:

   The following table displays the percentage of land cover at Arapaho NWR based on the 2001 National Land Cover Database. The GIS dataset that was used for this analysis is based on a 30x30 meter square so all percentages are approximations based on total cell count within the extracted dataset.

Land Cover	Percentage
Shrub/Scrub	49.26
Herbaceous	30.69
Hay/Pasture	10.25
Woody Wetlands	2.93
Emergent Herbaceous Wetlands	2.81
Open Water	1.60
Deciduous Forest	1.13
Developed Open Space	1.04

Evergreen Forest	0.25
Barren Land	0.03
Mixed Forest	0.02

The Open Water, Developed Open Space, and Barren land cover types are best described as fuel model NB8, NB1, and NB9 respectively

The Shrub/Scrub land cover type areas consist of a mix of Mountain Big Sagebrush, Wyoming Big Sagebrush, Alkali Sagebrush, Black Greasewood, various rabbitbrushes, and other shrubs. Interspersed through the various shrub communities are various drought–tolerant perennial bunchgrasses and forbs. The fuel model that best described this cover type is GS2, with some sheltered areas in drainages being better described as SH2

The Herbaceous and Hay/Pasture land cover types were combined for this discussion. Both land cover types are primarily found in riparian and wetland management units of the refuge. They consist of a mix of sedges, grasses, rushes, and various forbs. This land cover type is best described by fuel model GR2.

The Woody Wetlands land cover type is associated with the willow/riparian habitat on the refuge. The willows are not dense enough to become the primary carrier of fire, so fuel model GR2 best describes this land cover type. In the areas where the stands are dense enough, the shrub component of this land cover type contributes more to spotting then surface spread of fire due to amount of grass fuels present in these riparian units.

The Emergent Herbaceous Wetlands land cover type is associated with natural and man-made impoundments up to the high water mark. The vegetation associated with this land cover type consists of common cattail, spike rush, and bulrush. This land cover type is best described by fuel model GR8.

2. Adjacent fuels data:

   The fuels surrounding the refuge are similar to those on the refuge. The main unit of the refuge is primarily surrounded by the Shrub/Scrub and Herbaceous land cover types (GS2 and GR2).

   The Evergreen, Deciduous, and Mixed Forest land cover types which consist of varying percentages of lodgepole pine and aspen. The forest fuels are best described by fuel model FM8 from Anderson's original 13 fuel models.

3. Percent of vegetative type and fuels model(s):

   Please see Appendix I for percentage of fuel model per each ignition unit.

C. Description of Unique Features, Natural Resources, Values:

Arapaho National Wildlife Refuge is located immediately south of the town of Walden, CO. There are numerous private residences located near the north boundary of the refuge. The headquarters area of the refuge is located near the center of the refuge and consists of various buildings including staff residences. There are a number of other buildings located on the refuge in various locations, and will be identified in Appendix I as critical holding points.

Cultural resource studies have been completed on approximately 50 percent of the refuge. Significant cultural resources have been located, including prehistoric stone circles and open campsites, and historic ranches, graves, and other features associated with Euro-American settlement of North Park. Future efforts will continue to identify existing cultural resources and protect them from degradation. A detailed cultural resource overview of North Park (Larson and Letts 2003) is available from the Service's regional archaeologist. (CCP 2004)

The following species have been listed under the Endangered Species Act or are a Species of Special Concern for the Colorado Division of Wildlife, and are found on the refuge: Bald Eagle, North Park phacelia, River Otter, American Peregrine Falcon, Western Burrowing Owl, Ferruginous Hawk, Northern Sage Grouse, Long Billed Curlew, White Pelican, Northern Leopard Frog, and Western Boreal Toad. The Intra-Service Section 7 Biological Evaluation, which was completed May 17, 2004, determined that implementation of the Comprehensive Conservation Plan stated goals would have no impact on the species listed previously. The implementation of this prescribed fire burn plan will assist

the refuge in meeting its stated goals in the CCP.

There are a few other features that are found randomly across the refuge. One is a "Soaphole". This feature is identified by a bare earth surface in the meadows and riparian areas. These areas have very soft soil and will entrap vehicles and foot travelers alike. Another is organic soils which will sustain fire under the surface of the ground. Both of these features will be identified and communicated to the burn crew via the pre-burn briefing. Other features to note would be the fences and irrigation ditches. These will also be identified and communicated to burn crew personnel during the pre-burn briefing.

D. Maps - Attach in Appendix A

1. Vicinity
2. Project/Ignition Unit(s)
3. Ignition Sequence Map (Required – Ground Ignition Pattern can be shown on Ignition Unit Map)
4. Contingency Planning Map
5. Smoke Trajectory Map
6. Fuels or Fuel Model(s)

Element 5: Objectives

The resource objectives listed below are from the Management Direction chapter of the Arapaho NWR Comprehensive Conservation Plan (2004). Refuge staff will be responsible for the long term monitoring of the prescribed fire program to ensure that the program is meeting the requirements of these objectives.

A. Resource objectives:

1) Riparian Habitats
   a) Restore 50–100 acres of dense (40–100 percent) willow in patches greater than 0.5 acre and 20 meters wide in the central third of the Illinois River (from the north end of the island to the confluence with Spring Creek), to connect existing willow patches by 2014. Maintain 535 acres of dense willow in patches in the upper third of the Illinois River to benefit nesting Neotropical migratory songbirds and resident moose, river otter, and beaver.
   b) Provide 3,630–3,845 acres, over a 5-year average, of a grass:forb (75:25) plant community composed primarily of native plants (rushes, sedges, grasses, and forbs) characterized by 10–30 centimeters visual obstruction reading, 0–10 centimeters duff layer, minimal (less than 5-percent) bare ground, and less than 40-percent (canopy closure) willow by 2019, to benefit nesting waterfowl and sage grouse broods.
   c) Provide 210–425 acres, over a 5-year average, of a grass:forb (75:25) plant community composed primarily of native species (grasses, sedges, forbs, and rushes) characterized by greater than 30 centimeters visual obstruction reading, 10–20 centimeters duff layer, minimal (less than 5-percent) bare ground, and less than 40-percent (canopy closure) willow, from mid-April through August, by 2009, to benefit nesting waterfowl and songbirds.
2) Wetland Habitats
   a) Maintain 10 acres of, and attempt to establish in one other wetland basin, tall (greater than 60 centimeters visual obstruction reading) emergent vegetation in water depths greater than 4 centimeters over a 5-year period, to provide nesting habitat for over-water nesting birds.
   b) Provide 10 percent of the wetland acres, over a 5year average, in short (less than 10 centimeters), sparse (less than 10 centimeters visual obstruction reading) emergent vegetation in water depths less than 4 centimeters, from April to August, to provide foraging habitat for shorebirds and waterfowl, as well as nesting and brood-rearing habitat for shorebirds.
   c) Provide 20 percent of the wetland acres, over a 5-year average, of emergent vegetation greater than 25 centimeters tall with visual obstruction reading greater than 80 percent of vegetation height in water depths 4–18 centimeters, to provide escape cover and foraging habitat for dabbling duck broods and molting

ducks, and foraging habitat for water birds.

3) Meadow Habitats
   a) Provide 20–50 acres, over a 5-year average, of a grass:forb (75:25) plant community composed primarily of native plants (rushes, sedges, grasses, and forbs) characterized by less than 20 centimeters height, less than 10 centimeters visual obstruction reading, with dry to moist soils (no standing water), adjacent to (within 50 meters) or intermingled with sagebrush (10- to 25-percent sage canopy cover), from early-June to late-July, to benefit sage grouse broods.
   b) Provide 1,650–1,850 acres, over a 5-year average, of a grass:forb (75:25) plant community composed primarily of native species (grasses, sedges, forbs, and rushes) characterized by 10–30 centimeters visual obstruction reading, 0–10 centimeters duff layer, and minimal (less than 5-percent) bare ground from mid-April to the end of July, to benefit nesting waterfowl and sage grouse broods.
4) Upland Habitats
   a) Provide 630–790 acres, over a 5-year average, of a grass:forb (75:25) plant community composed primarily of native plants (grasses, sedges, forbs, and rushes) characterized by greater than 30 centimeters visual obstruction reading, 10–20 centimeters duff layer, and minimal (less than 5-percent) bare ground, to benefit nesting waterfowl and songbirds.

B. Prescribed fire objectives:

1) Refuge Wide
   a) Remove a minimum of 80% of the thatch layer over a minimum of 75% of the ignition unit immediately following post-burn.
   b) Provide training opportunities to refuge and partner staff to increase prescribed fire qualifications.
2) Ignition Unit Specific
   Please see Unit Specific Attachment in Appendix I for Ignition Unit Specific objectives.

Element 6: Funding

A. Cost:

See attached cost calculation sheet Appendix F for estimated individual project cost calculations.

B. Funding source:

Accounting codes for Fuels Projects or from other sources provided by Zone FMO or Regional Office.

Element 7: Prescription

A. Prescription Narrative:

The fire behavior that is desired using this prescription is a backing or flanking fire which is capable of greater consumption of the available standing vegetative material and thatch layer at a lower rate of spread. This is desired so that the thatch does not impede any future management actions such as disking or spraying, and to allow the new vegetative growth to happen without being impeded by thatch. At the upper limits of the prescription, the Burn Boss will need to consider constraining the upper wind speed parameter to a speed which minimizes the potential of spotting and the fire burning though any of the wet lines if the adjacent fuels are available for ignition. The fuels located outside the refuge boundaries consist of areas of GR2, GS2, and FM8; and should exhibit fire behavior similar to that of the fuels on the Refuge (Refer to Appendix E)

B. Prescription Parameters:

1. Environmental and fire behavior:

Temperature:	30-89 degrees F
Relative humidity:	10-59 %
Eye Level Winds:	0-15 mph
Wind Direction:	SW – N – SE, (SSW – S – SSE is excluded)
Calculated 1Hr. Fuel Moisture:	2-12%
Flame Length - Observed along Perimeter:	0- 5 ft

Please consult the Smoke Management Permit for additional considerations.

2. **Fire Modeling or empirical documentation (or both):** Please see Appendix E for fire modeling outputs.

Element 8: Scheduling

A. Implementation Schedule:

Broadcast burning maybe done anytime compliance with all regulatory agencies, policies, and prescriptive parameters are met. Implementation scheduling of prescribed fire will be consulted with refuge staff. *Reference Colorado Smoke Permit for project specific permit conditions.*

B. Projected Duration:

Ignition units will generally be completed within one operational period, but may require mop-up and monitoring for several days after ignition.

C. Constraints:

- Must have current smoke permit from State of Colorado Department of Health and Environment.
- May not burn when a burn ban is declared that includes the area of Arapaho NWR.
- Consult with Refuge Management in regards to times of hunting seasons, special wildlife/ habitat considerations.
- Reference the USFWS Fire Management Handbook for current guidance on prescribed fire operations during National or GACC Preparedness Level 4 or 5.

Element 9: Pre-burn Considerations and Weather

A. Considerations:

1. On-site

- Control lines will be prepared as follows:
  - Mowed Lines: 20ft wide minimum
  - Roads and Two-tracks: Minimum 3ft outside unit and 10ft inside unit
- Control lines must be evaluated by Burn Boss within 3 days prior to ignition for perceived viability.
- All structures or infrastructure within the unit will have sufficient vegetation removed from around them to facilitate adequate control lines.
- Deciduous timber and shrub stands will be prepared based on guidance from refuge staff and fire management staff to limit mortality in willows, or other desired fire sensitive species.
- Water source and refill sites will be identified prior to ignition. These sites will be located within 1 mile of the ignition unit. Access and operational feasibility will be communicated to all prescribed fire personnel. Additional water source and refill sites outside of 1 mile may be identified and if so made known to prescribed fire personnel.

2. Off-site

- Refuge Staff will be responsible for making all necessary contacts and notify Burn Boss as to the current status of those contacts.
- Applicable prescribed fire signs will be placed along refuge roadways and public roadways off refuge to alert public of possible areas that may be impacted by smoke.
- Cultural/ Historic site preparation must be evaluated for prevention of adverse effects.
- Prolonged drought will cause the drying of the organic soil layers which do not normally burn. Fuel modeling does not account for these factors. Resulting fire behavior could be highly increased fire line intensity and resistance to control. Wet areas that normally act as barriers may no longer be safe to use as containment buffers. Wetland areas may become more susceptible to increased fire activity. If the PDSI (Palmer Drought Severity Index) is -3, consider the need for additional resources to safely complete prescribed burns. If drought conditions are severe enough, prescribed burns may need to be postponed based on PDSI greater than -4. State or area wide burn bans may be imposed if drought conditions warrant. The Palmer Drought Severity Index will be checked via the following Internet address http://www.wrcc.dri.edu/wwdt/index.php?region=co. This site will allow Fire Management Staff to gauge possible drought conditions.

B. Method and Frequency for Obtaining Weather and Smoke Management Forecast(s):

- Ignition will not occur until the Burn Boss has received a current spot weather forecast and prescription parameters are met.
- A spot weather forecast will be requested from the National Weather Service, the office is in Boulder, CO. The Burn Boss or designee (this may be Craig Dispatch Center) will contact this office at: voice 303-494-3877. Contact on the day before or day of ignitions. Forecast may be posted on the Internet at the following address: http://spot.nws.noaa.gov/cgi-bin/spot/spotmon?site=bou
- Weather observations will be taken periodically throughout ignitions as determined by the Burn Boss. Observations will be recorded and added to the project file.

C. Notifications:

See Notification list in Appendix H.

Element 10: Briefing

All personnel assigned to incident will be briefed at the beginning of each operational shift. Briefing topics include, but are not limited to, identifying the Incident Organization, Objectives, Current and Expected Weather, Firing/Holding Plans, Medical Plan, any Constraints, Job/Hazard Analysis, etc. Briefings will be facilitated by the creation of an Incident Action Plan (IAP) which will contain appropriate ICS forms and maps of the ignition unit.

A. Briefing Checklist; including, but not limited to: (additional items may be added)

- ☐ Burn organization and assignments

  Organizational Chart/ Personnel Assignments
  Equipment Assignments
  Other Resources

- ☐ Prescribed Fire objectives and prescription

- ☐ Description of prescribed fire project area

  Review Map of Project
  Values at Risk

Critical Areas
Fuel Types (Both inside and outside the Ignition Unit)
Roads / Access
Water Sources
Natural / Constructed Barriers

- Expected weather and fire behavior

  Temperature
  Relative Humidity
  Wind (Speed & Direction)
  Fuel Moistures
  Atmospheric Stability
  Predicted / Anticipated Changes
  Flame Length
  Rate of Spread
  General Expected Fire Behavior

- Communications

  Procedures
  Frequencies / Channels

- Ignition plan

  Test Burn Location
  Ignition Resources
  Ignition Sequence / Pattern

- Holding plan

  Resource Assignments
  Water Sources
  Critical Areas

- Contingency plan and assignments

  Available Resources / ETA's
  Assignments / Organizational Plan
  Strategy

- Wildfire declaration

  Organizational Assignments
  Strategy

- Safety and medical plan

  LCES
  PPE
  Known Hazards
  Pertinent JHA's

Element 11: Organization and Equipment

A. Positions:

The attached organization chart is a basic organization. The Burn Boss has the option to change the organization if they have properly qualified personnel or additional equipment available while implementing the project. As the prescribed fire organization will change dependent upon daily resource use/ availability, the daily burn organization will be given and shown on the individual unit/ daily IAP. This IAP should follow the standard forms used (i.e. ICS Forms 203, 204, 205, 206) in order to maintain continuity and clear understanding of organization and assignments.

For black-lining operations a reduction of workforce option maybe selected. This option is not intended to facilitate burning of entire unit without adequate operational forces. Black lining is a preparation measure to increase opportunity for broadcast burning of unit. The intent is to allow greater flexibility for prescribed fire. Also, this is to be considered a minimum and greater resource numbers for black-lining are acceptable at Burn Boss's discretion.

The person who will assume the role of initial attack incident commander (ICT4) in the event of a fire escape must be identified at the pre-ignition briefing, but this role is not part of the minimum organization required for the burn.

BROADCAST BURN

At a minimum, 11 people must be assigned to these roles (minimum qualification as specified):

- Burn Boss, qualified at minimum as RXB2
- Firing Boss, qualified as FIRB
- Holding Specialist, qualified at minimum as SRB (engine or crew) and ICT5
- 2 Ignition crewmembers
- Holding resources: adequately qualified personnel to adequately staff equipment.

BLACKLINE OPERATION

At a minimum, 7 people must be assigned to these roles (minimum qualification as specified):

- Burn Boss, qualified at minimum as RXB2
- 2 Ignition Crewmembers
- Holding resources: adequately qualified personnel to adequately staff equipment.

Figure 1: Broadcast Burn Organization Chart

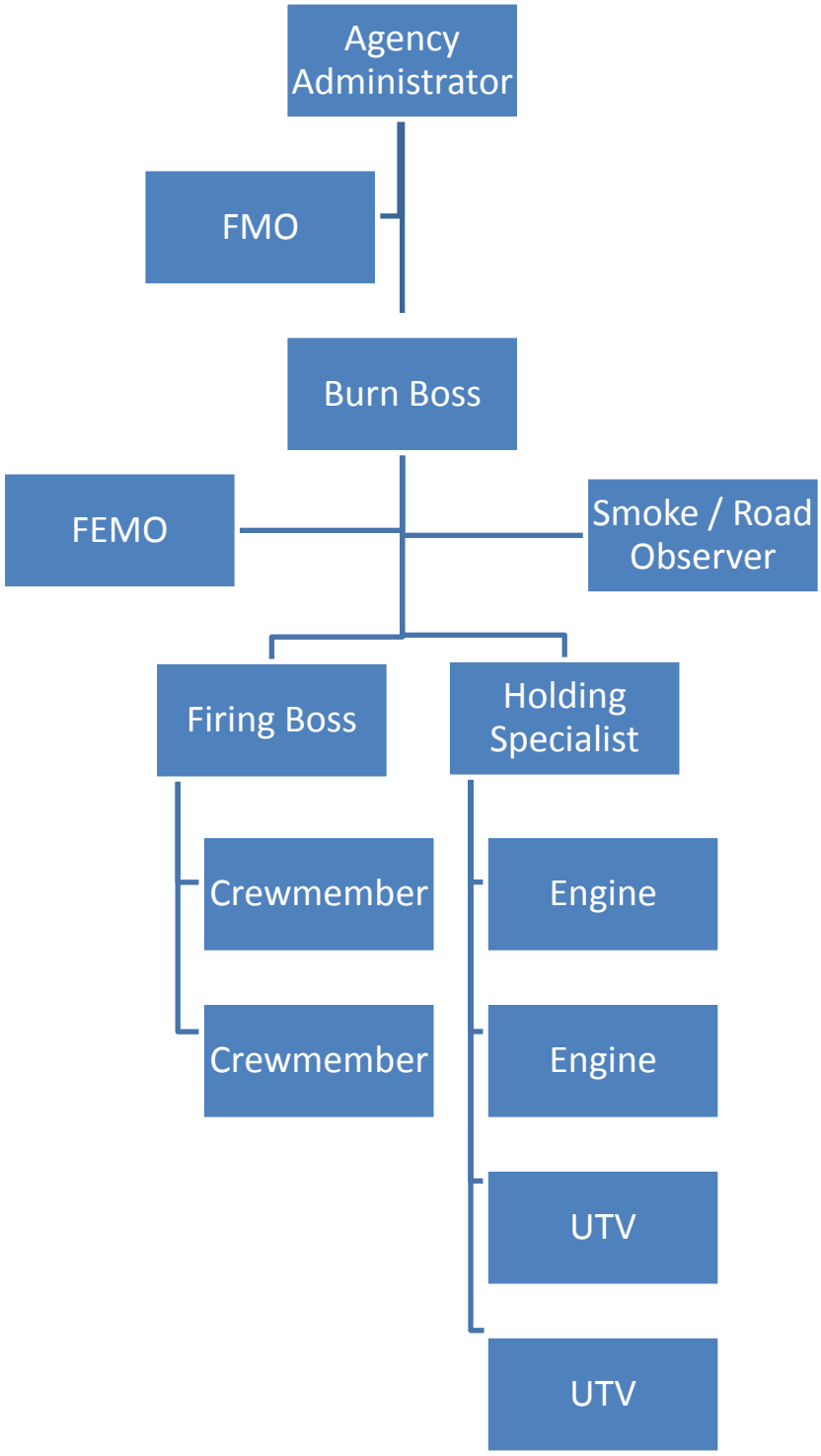
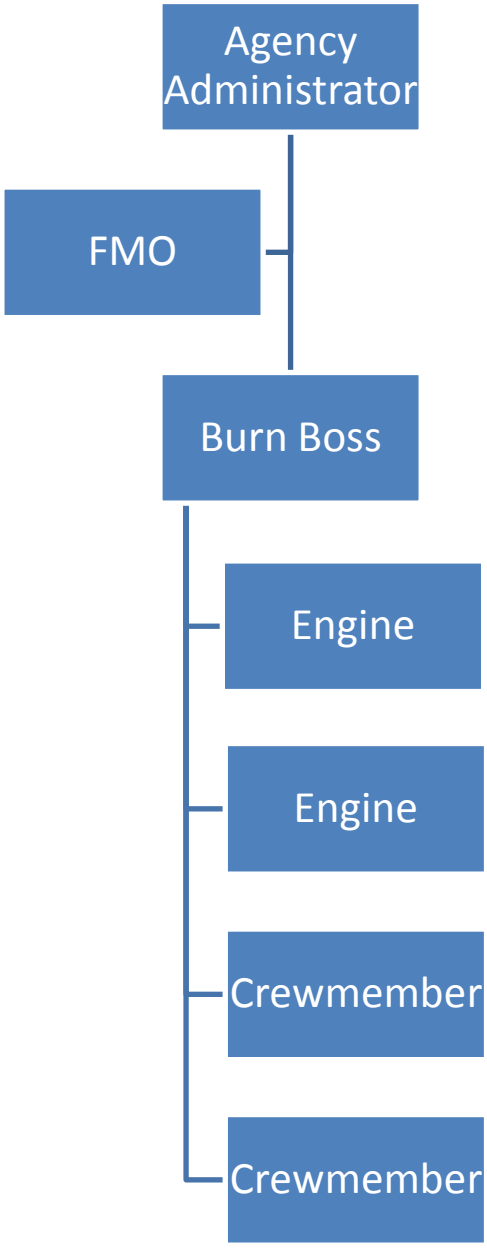


Figure 2: Blackline Operation Organization Chart



B. Equipment:

BROADCAST BURN

At a minimum, there must be at least four pieces of equipment on-site, with a minimum of four qualified operators (one for each piece of equipment). Holding resources must meet minimum staffing requirements set forth by their agency's policy. Additional equipment may be ordered as determined by Burn Boss based on expected weather, anticipated fire behavior, socio-political factors, or current planning levels/ situation. A Specialty Tracked Vehicle (Marsh Master) is available at Bear River MBR, and should be considered whenever soil conditions within the control lines preclude the use of wheeled engines. If the Marsh Master is required for implementation please contact the Rocky Basin Zone FMO to arrange for its use (See Appendix H for contact information).

- Two Type 6 or larger Engines (a water tender1,000 gal., and pump & roll capability minimum) may be substituted for 1 engine if appropriate given burn day and unit specific conditions)
- Two UTV w/ water tank (50 gal. min.)

BLACKLINE OPERATION

At a minimum, there must be on-site at least two pieces of equipment, with a minimum of two qualified operators (one for each piece of equipment). Holding resources must meet minimum staffing requirements set forth by their agency's policy.

- Two Type 6 Engines (or larger engine), with minimum staffing of 1 ENOP and 1 FFT2 for each engine. (A water tender (1,000 gal., and pump & roll capability minimum) or UTV{w/ water 50 gal. minimum} may be substituted for 1 engine if appropriate given burn day and unit specific conditions.)

C. Supplies:

- Ignition devices and necessary supplies
- Pumps and hose as needed for the specific unit
- Warning signs as needed
- Portable tanks as needed

Element 12: Communication

A. Radio Frequencies:

Coordinate with Craig Interagency Dispatch Center to receive approval for the use of command, tactical, and air to ground frequencies. Radio frequencies and communication specifics will be addressed in the IAP for the specific project implementation.

B. Telephone Numbers:

See attached Appendix H for a list of contacts and their telephone numbers.

Element 13: Public and Personnel Safety, Medical

A. Safety Hazards:

- Please refer to Appendix D and I for general and site specific safety hazards.

B. Mitigation: Measures Taken to Reduce the Hazards:

- Personnel involved with this project will be required to wear all required Personal Protective Equipment (PPE) while assigned to the project. Adhering to 10 Standard Firefighting orders, 18 Watchout Situations, and LCES during all fire operations will help to mitigate safety issues.
- Personnel will only be assigned tasks for which they are qualified and properly trained or will be with a qualified trainer.
- Smoke may impact roads in the vicinity of the project area. Traffic safety personnel and/or Pilot Cars may be utilized to mitigate the smoke impacts on local traffic. Signs will be placed on all applicable routes warning the public of potential smoke impacts to roadways.
- The Arapaho NWR staff will be notified in advance of any ignition. Potentially effected trails or visitor areas may be closed at Burn Boss or Refuge Staff discretion.
- Should evacuations be necessary, Burn Boss will coordinate with Refuge Staff to alert the public. Law Enforcement personnel will evacuate effected public via their procedures; this may include help from refuge or burn staff.
- A Medical Plan will be included with an IAP (Incident Action Plan) and available to all prescribed fire personnel prior to ignition. The Medical Plan will cover topics such as identifying EMT's, location of ambulances, life-flight availability, location of clinics/hospitals and procedures to follow in case of injury.
- Job Hazard Analysis for Prescribed Fire Projects will be included in Appendix D. All personnel will be required to sign a copy of it prior to ignition.

C. Emergency Medical Procedures:

Please refer to the Medical Plan in Appendix G.

D. Emergency Evacuation Methods:

Depending on severity of injury, air evacuation may be the preferred method of evacuation. The Burn Boss will need to identify an appropriate Landing Zone (identify coordinates in IAP), and identify on-site medical responders during the briefing. Please refer to the Medical Plan in Appendix G for a listing of available service providers.

E. Emergency Facilities:

Please refer to the Medical Plan in Appendix G.

Element 14: Test Fire

A. Planned Location:

A test fire will be conducted on each unit for each day of implementation. The Burn Boss will evaluate the test fire to determine the likelihood that fire behavior, smoke management, and resource objectives can be met. Generally the test fire will be conducted at the most secure downwind corner of the unit, as long as the location is representative of the rest of the unit. If the test fire location does not have control lines separating it from the rest of the unit, then holding resources will be immediately available to extinguish the test fire if the results are not acceptable. If the results are acceptable, the test fire may be extinguished and the main ignition effort resumed elsewhere or ignition may simply proceed from the test fire.

B. Test Fire Documentation:

The on-site weather conditions and test fire behavior will be recorded on the appropriate Fire Effects Monitoring forms and a copy will be included in the project folder. The acceptance of the Test Fire results will be documented on the Prescribed Fire Go/No-Go Form.

Element 15: Ignition Plan

Important Note: The following descriptions are only examples of likely ignition techniques, sequences, and

patterns. The actual safe and efficient possibilities vary widely based on burn-day conditions such as wind direction, fuel moisture, number and experience of available resources, number and type of ignition tools, the precise composition of the vegetation, and other factors. **The actual ignition techniques, sequences, and patterns will be selected on-site at discretion of the Burn Boss**, in consultation with the Firing Boss and Holding Specialists, and are likely to differ from those presented here or change during the execution of the burn.

A. Firing Methods:

Normally the downwind control lines are ignited first and the fire is allowed to back into the unit to widen the control line. Once the control lines are secure, the remainder of the unit is ignited. Often fire is backed through areas with heavier fuel loading to minimize fire intensity and spotting; these areas may be burned after control lines are secure and before firing the main body of the unit, or during the firing of the main body. Igniters will generally walk through the unit along existing breaks in the vegetation, such as ditches or control lines. Personnel may not actively light while using an ATV with a handheld ignition device. Personnel may actively light , using a handheld ignition device, while using a UTV with a designated driver and a separate designated lighter in the passenger position.

B. Devices:

Walking with drip torches will be the primary ignition method. Other methods that may be used are igniting with a drip torch from a UTV, with fusees from a UTV or on foot, with a platform-mounted ignition device, by throwing lit fusees or flare rounds by hand into the interior of the unit, or by firing flare rounds from an ignition device such as a Veri-pistol. All appropriate ground ignition devices may be used, the preceding list is not entirely inclusive.

C. Minimum Ignition Staffing:

As described in Element 11.A. Organization, a Firing Boss, qualified as single resource FIRB will be designated to direct the ignition operation during the ignition of the main body of the project. The Firing Boss may have two or more firefighters (minimum qualification FFT2) to assist with actual ignition. If the project is only being black-lined, then the Burn Boss may directly supervise the ignition operation.

Element 16: Holding Plan

A. General Procedures for Holding:

Holding will be directed by the Holding Specialist, minimally qualified at the single resource boss level, engine or crew, and incident commander type 5. Holding may utilize engine, handcrew, and equipment, wet lining prior to ignition, suppression of any unwanted fire (location or behavior), patrolling control lines to maintain and verify security and containment of fire. In certain cases holding may necessitate ignition of boundaries to stop unwanted fire spread or behavior, this will be closely conducted with FIRB and only after consultation with Burn Boss. When not actually lighting, ignition personnel may be used to augment holding forces. In the event of a spot fire or slop-over, the nearest holding forces will notify the appropriate fire line supervisor immediately and extinguish the spot or slop over as efficiently as possible. The fire line supervisor will report the event to the Burn Boss. Specific strategies for holding will be determined by Holding Specialist and Burn Boss.

Mop-Up / Patrol Standards:

- Prior to release of all resources at end of shift, all smokes within 30 feet of unit control lines will be mopped up.
- A minimum of a qualified ICT5 must patrol the fire the day following burn, patrolling at a minimum twice daily. Thereafter, necessary patrol will be determined by Burn Boss with patrols done by personnel at minimum of qualified FFT1. Burn Boss is responsible for making designations of resources for patrol from ignition until burn is declared out. Resources are responsible to report to Burn Boss immediately after patrol. Should more than 1 unit be burned in a single day, a minimum of one qualified FFT2 will remain at the unit to monitor until unit is secure and controlled, determination

to be made by Burn Boss. After ignition day, multiple units maybe patrolled by an individual resource.

- Each unit will be checked at least once every third day during the afternoon burning period until it is declared out. A burn may be declared out when no evidence of continued burning, such as smoke or new white ash (residue from smoldering), is seen on three consecutive checks. The Burn Boss is responsible for ensuring that the unit is checked and for declaring the unit out. Should the burn escape onto private property, it will be patrolled daily by SRB or higher qualified until declared out.

B. Critical Holding Points and Actions:

Any identified critical holding points for a specific unit will be described in the unit-specific attachment (Appendix I). Created/ improved control lines should be established to reduce possibilities of escape and reduce number of critical holdings points. Individual units will need to be evaluated for critical holding points particularly around improvements or adjacent land ownership areas. These points will be discussed and evaluated with Burn Boss and respective overhead prior to ignition. Consultation between Burn Boss, Firing Boss, Holding Specialist, and any additional overhead deemed necessary, will be conducted prior to implementation to consider adjacent fuels and feasibility of containment of prescribed burn.

- Mowed lines
- Downwind perimeter of treatment unit.
- Any downwind corners or bends in control line.
- Wet lines or compression lines
- Areas along the treatment unit perimeter with heavy fuel concentrations
- Infrastructure and/or structures in or adjacent to burn unit

C. Minimum Organization or Capabilities Needed:

Please see Element 11.B and 16.A for minimal organization and capabilities needed. Ignition units are small enough that response times to slop-overs or spots are minimized. The use of the UTV's to provide a constant patrol behind wet lining operations will reduce detection and response times to fire outside of the ignition unit boundaries.

Element 17: Contingency Plan

A. Management Action Points or Limits:

If any of the following situations occur, contingency actions will take place:

1. Fire threatens the project boundary.
2. More than three simultaneous spot fires and/or slop overs occur, in more than one adjacent Refuge unit.
3. Fire outside of the Refuge unit boundary.
4. Smoke management objectives being impacted.
5. Prescription parameters are exceeded.
6. Potential for costs to control exceed available project funds.

Management Action Points for declaring a Wildfire:

- If lives are threatened, private property, resources, or other structures are threatened, regardless of pre-determined time frames for control determination.
- If a slop-over or multiple slop-overs occur on private lands outside the burn unit.
- If a slop over/spot fire or multiple slop overs/spot fires occur in areas outside the burn unit on U.S. Fish and Wildlife Service Lands and are not able to be contained within 3 hours after sundown with an appropriate management response from on-site resources.
- Prescription parameters have been exceeded, and holding and contingency actions cannot secure the fire within 3 hours after sundown.

- Burn Boss decides to convert the prescribed fire to wildfire status based on their experience and intuitive sense for a variety of reasons.

B. Actions Needed:

If the prescribed fire objectives are not being met the Contingency Plan is implemented. If the contingency actions are successful at bringing the project back within the scope of the Prescribed Fire Plan, the project may continue. Contingency actions may include flanking the fire with the engines or conducting a burn out from created foam lines or from existing roads/dikes. Ignition crews may be utilized as holding resources. If contingency actions are not successful by the end of the next burning period, then the prescribed fire may be converted to a wildfire.

C. Minimum Contingency Resources and Maximum Response Time(s):

Contingency resources (minimum of 2 Type 6 or larger engines) must be contacted and verified to be available, within 2 hours, at a maximum of 24 hours prior to ignition. Contingency resources must be available during entire ignition phase. Contingency resources may be ordered, utilized, or on-site without the need for conversion to a wildfire. With given fuel types and conditions it may often be the most logical course of actions to have contingency resources on-scene prior to ignition.

Element 18: Wildfire Declaration

A. Wildfire Declared By:

Burn Boss

Wildfire Declaration Criteria: Wildfire must be declared if any of the following criteria are met.

- Prescription parameters are exceeded, and holding and contingency actions cannot secure the fire by the end of the next burn period.
- The fire has spread outside the project area or is likely to do so, and the associated contingency actions have failed or are likely to fail and the fire cannot be contained by the end of the next burning period.
- The fire has spread off of USFWS property unless a previous agreement is in place.
- The fire is or may imminently threaten life, resources, or other structures or infrastructure.

B. IC Assignment:

Generally the Burn Boss will become the initial attack incident commander in the event of an escape or wildfire. S/he may delegate this role to another qualified on-site resource, as long as the delegation is made clear to all participants at the pre-ignition briefing. In particular, pre-designated organization responsibilities should be discussed and made known to all personnel in pre-ignition briefing.

C. Notifications:

If the burn has declared a wildfire, Craig Dispatch will be contacted by radio or phone, (970) 826-5037, to notify them and to order the appropriate resources to contain the fire. The Rocky Basin Zone FMO will also be notified as soon as possible. The Refuge Manager or Acting Manager will be notified by the Rocky Basin Zone FMO, or Burn Boss, as soon as possible. (See Appendix H for contact numbers.)

D. Extended Attack Actions and Opportunities to Aid in Fire Suppression (Optional):

In the event a fire continues beyond the initial shift into an extended attack operation, the Project Leader, in consultation with the Fire Management Officer and other qualified advisors, will complete a Wildland Fire Decision Support Documentation or equivalent decision-making tool. Additional suppression resources will be

drawn from adjacent Refuges, States, other Federal partners, and local cooperators through appropriate dispatch center. ICT4 will remain incident commander until relieved by ICT3 or higher qualified personnel.

Element 19: Smoke Management and Air Quality

A. Compliance:

A Colorado Smoke Permit will be obtained from the state per requirements of state law. A new permit will be needed each year. The conditions set in the permit will dictate smoke management. Permits and smoke form may be submitted by refuge staff, fire management or Burn Boss, or designee. A copy of the Colorado Smoke Permit must be on site during burning operations.

B. Permits to be Obtained:

Permit Address: Colleen Campbell
Department of Health & environment, APCD-TS-B1
4300 Cherry Creek South
Denver, CO 80246-1530
Fax: 303.782.5493
E-mail: colleen.campbell@state.co.us

The State of Colorado requires an application for open burning for planned ignition. A number of forms are required. The Department of Health and Environment has up to 30 days following the application receipt to issue the Smoke Permit. Following is a list of required forms for the project:

- For SMP-A (Permit Application of Open Burning for Prescribed Fire Projects)
- Form SMP-B (Smoke risk Rating Worksheet for Prescribed Fire Projects)
- Form SMP-C (Evaluation of Non-burning Fuel Treatments and Smoke Mitigation Techniques Used)
- Form SMP-D (Notification of Ignition)
- Form SMP-E (Daily Actual Fire Activity)
- Form SMP-F (Annual Fire Activity)

Forms SMP-A, SMP-B, SMP-C, Smoke Management portion of Burn Plan, for the Smoke permit. For SMP-D can be submitted up to 48 hours prior to ignition but must be received at least 2 hours prior to ignition. Form SMP-E must be submitted by 1000 hours the day following ignition. SMP-F must be submitted by March1 indication all prescribed fire activity that occurred during the previous year (whether burned or not burned). Forms and instructions are available at the following web site:
Http://www.cdphe.state.co.us/ap/smoke/Index.html

C. Smoke-Sensitive Receptors:

Please refer to Appendix I for a list of Smoke-Sensitive Receptors, and their distance and bearing from individual ignition units. The Mount Zirkel, Platte River, and Rawah wildernesses are all Type 1 airsheds which are located within 25 miles of ignition units addressed by this plan. No additional mitigation measures are necessary in relation to the Type 1 airsheds.

D. Potential Impacted Areas:

Please see Appendix A for a map of Potential Smoke Impact Areas within 25 miles of the refuge boundaries.

E. Mitigation Strategies and Techniques to Reduce Smoke Impacts:

- Coordination of all activities occurs through state wide submission of a permit.
- Burn areas consist mainly of short duration, fine fuels indicating impacts should be minimal.
- Signs on impacted roadways, and law enforcement or public safety personnel notified of potential smoke

impacts to public roads which may pose limited visibility problems.

- Identify refuge staff employee to serve as a smoke observer for local roadway impacts.
- Identify with complex Project Leader or their designee the availability of pilot cars, and how to request their use when smoke is likely to impact a public road.
- Smoke dispersion and plume characteristics will be monitored by Burn Boss, or designee, to aid in decision making to mitigate smoke hazards. (i.e. adjust firing techniques, alert law enforcement, initiated pilot cars, road closure, etc.)
- Wind speed and direction prescriptive elements are designed to reduce impacts to receptors.

Element 20: Monitoring

A. Fuels Information Required and Procedures:

Drought Indices and vegetation greenness will be monitored prior to burning through following internet websites:
Drought Monitoring: www.drought.unl/dm/
Greenness Factors: www.wfas.net

B. Weather Monitoring (Forecasted and Observed) Required and Procedures:

Weather will be taken hourly, or more frequently as determined by Burn Boss, to check prescription adherence. On-site weather observations will be recorded and added to fire report (DI-1202).

C. Fire Behavior Monitoring Required and Procedures:

Each time the weather is recorded, the observer should make observations about the fire behavior, including direction of spread (backing, flanking, or heading), estimated flame length or height, and significant fire behavior such as torching or multiple spots. Probability of Ignition may be calculated from on-site observations. Photos should be taken during the unit ignition to document fire behavior.

D. Monitoring Required to Ensure that Prescribed Fire Plan Objectives are Met:

Additional monitoring activities may be conducted by Refuge staff in accordance with habitat management protocols and procedures.

E. Smoke Dispersal Monitoring Required and Procedures:

Each time the weather is recorded, the observer may make general observations about the smoke column, including the color of the smoke, the direction the column is dispersing, and any significant events such as an inversion settling in or smoking significantly impacting a road or residence.

Element 21: Post-burn Activities

A. Post-Burn Activities that must be Completed:

The Burn Boss will organize and hold a debriefing (AAR) session as soon as practical after the firing and holding operations are completed for ignition day.

It is not expected that any post-burn rehabilitation will be needed. If rehabilitation is needed, determination and activities for mitigation will be made by refuge staff and fire management staff.

The Burn Boss will submit the Colorado APCD Form SMP-E by 1000 the morning following the burn implementation.

A final report will be completed within 30 days of the fire's being declared out. The Burn Boss is responsible for ensuring that it is completed. The report will include:

- All of the information required for entry into the Fire Management Information System
- Unit-specific attachments
- A copy of the weather forecast(s) for each day of the burn
- Signed Agency Administrator Ignition Authorization and Prescribed Fire Go/No-go forms
- Results of the test burn
- Burn-day observations of weather, fire behavior, first-order fire effects, and smoke dispersal
- List of resources
- Narrative and chronology of major events, including all 214 Unit Logs
- Map showing the final test fire location and perimeter of the unit
- An estimate of what percentage of the unit was burned

Prescribed Fire Plan Appendices

Appendix A: Maps: Vicinity, Project or Ignition Units (or both), Optional: Significant or Sensitive Features, Fuels or Fuel Model, Smoke Impact Areas

Appendix B: Technical Reviewer Checklist

Appendix C: Complexity Analysis

Appendix D: Agency-Specific Job Hazard Analysis or Risk Assessment

Appendix E: Fire Behavior Modeling Documentation

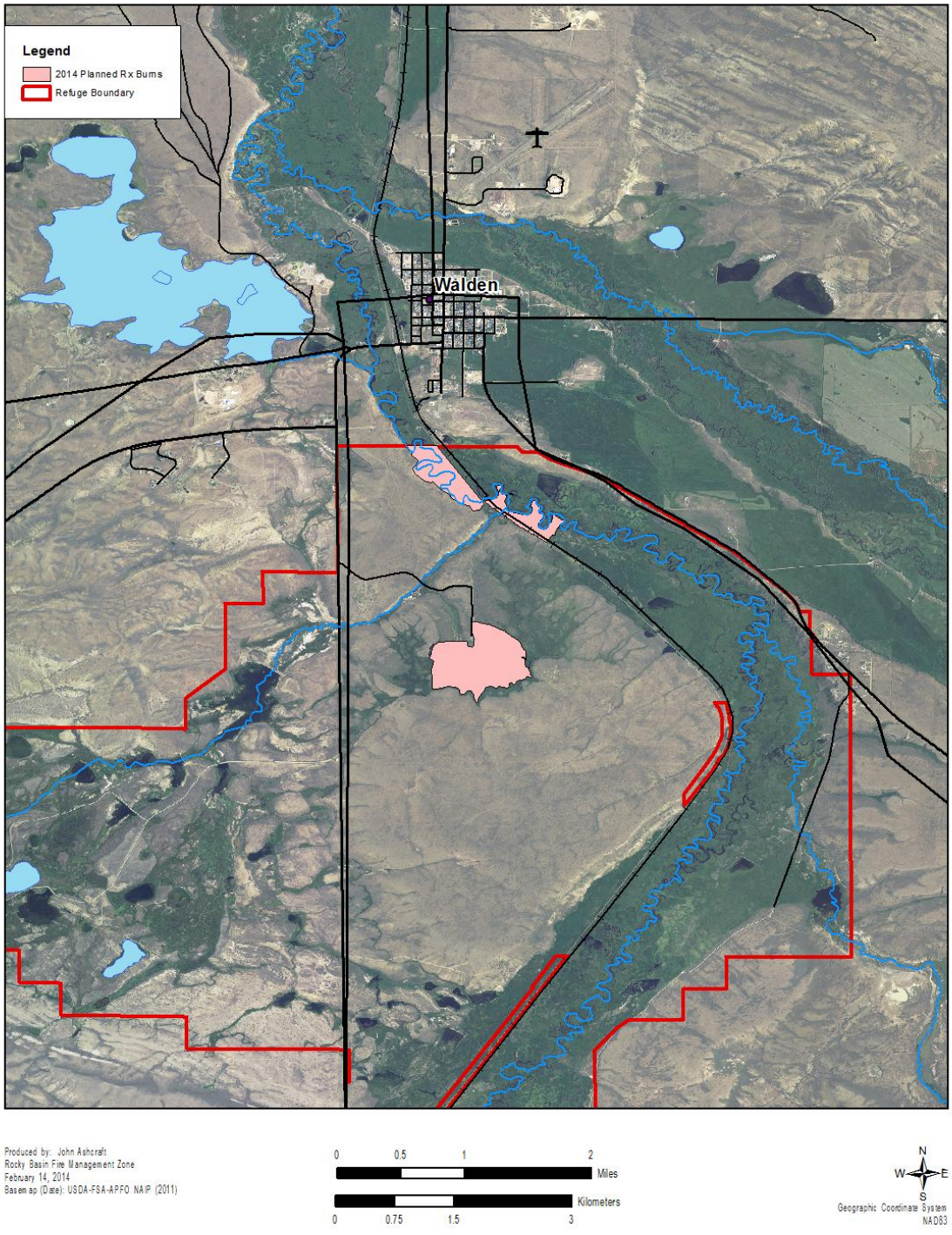
Appendix F: Cost Calculation

Appendix G: Medical Plan (ICS-206)

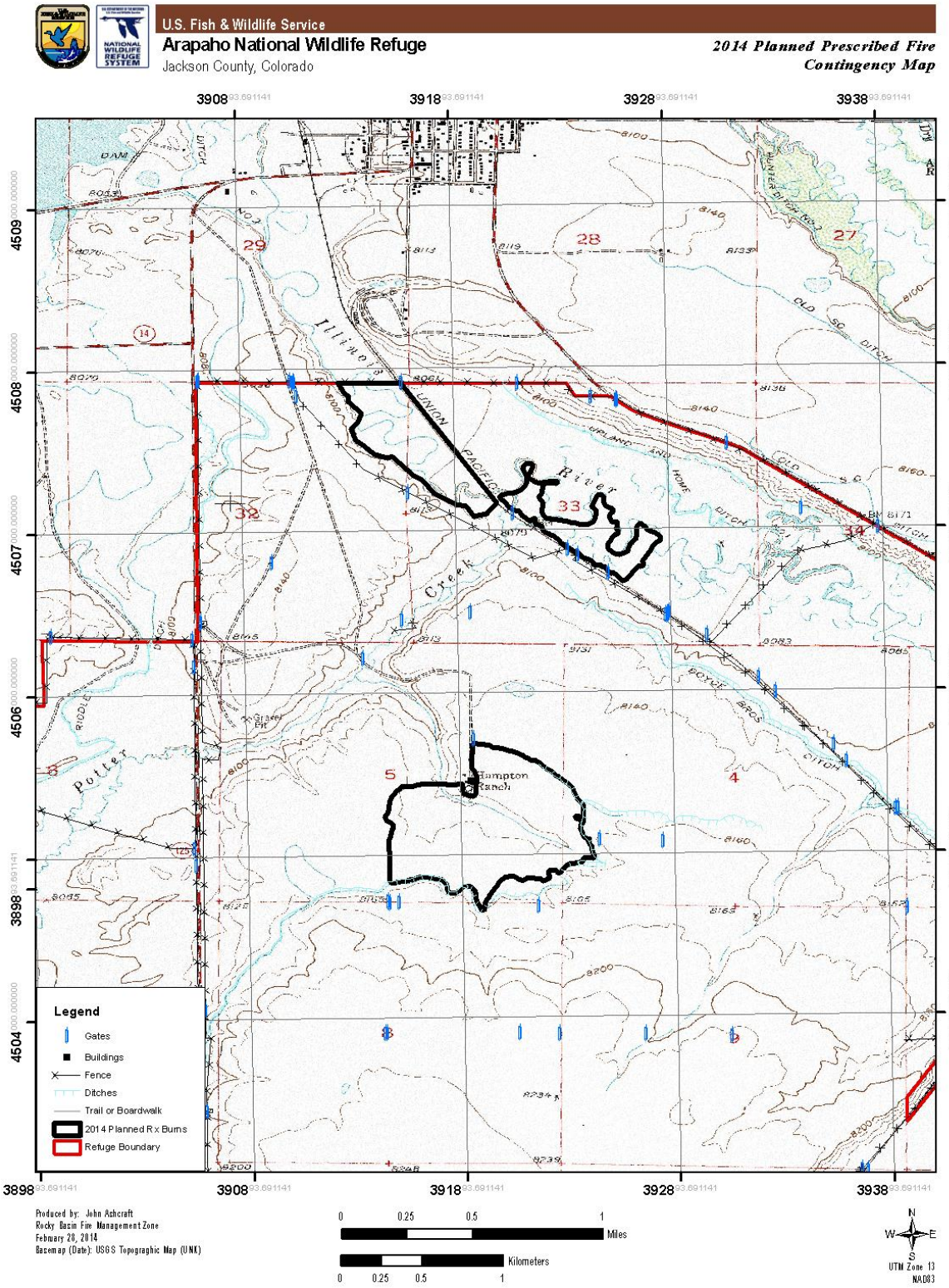
Appendix H: Contact / Notification List

Appendix I: Ignition Unit Specific Documentation

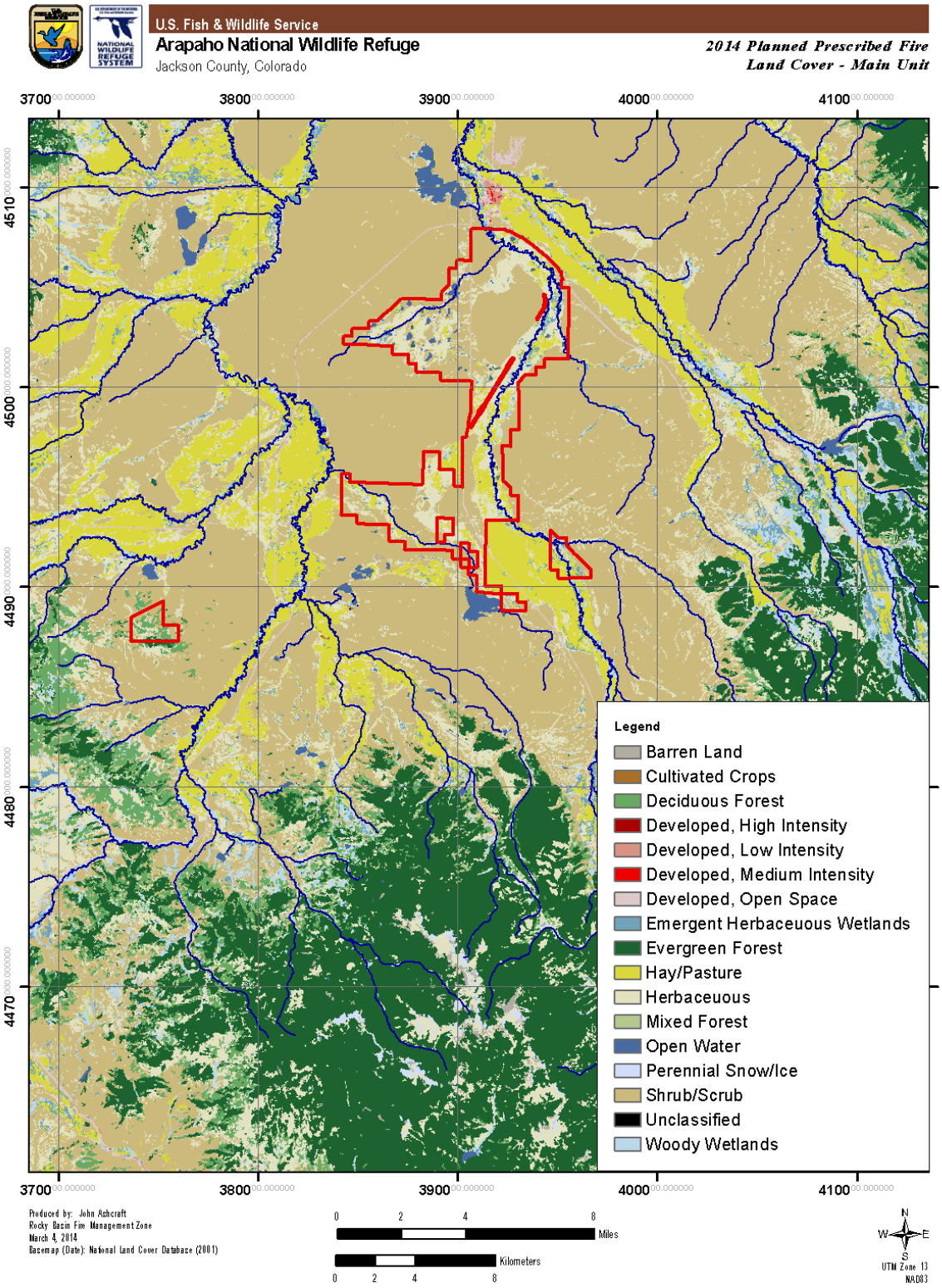
Appendix A: Vicinity Map

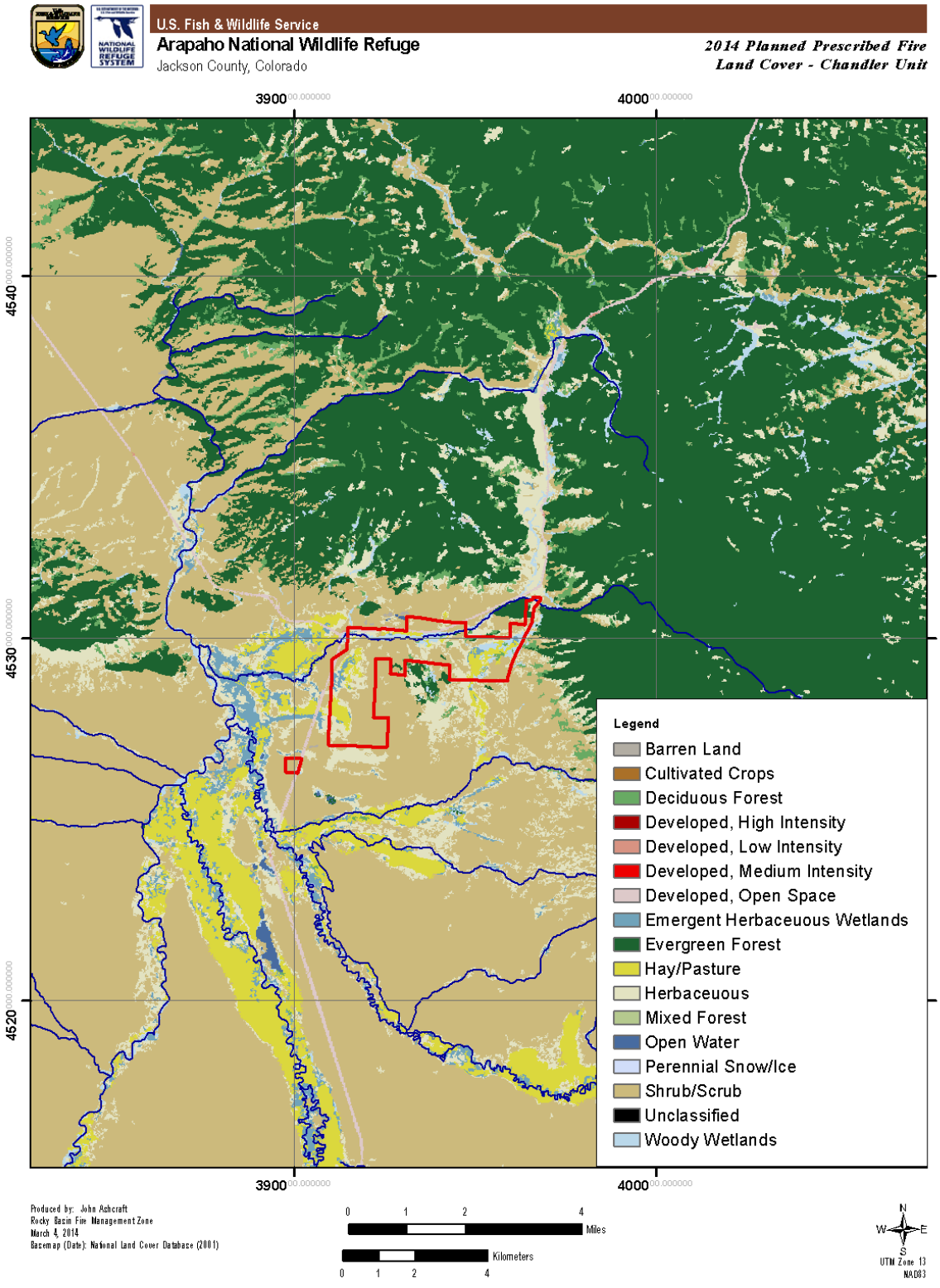


Appendix A: Project (Ignition Units) / Contingency Maps

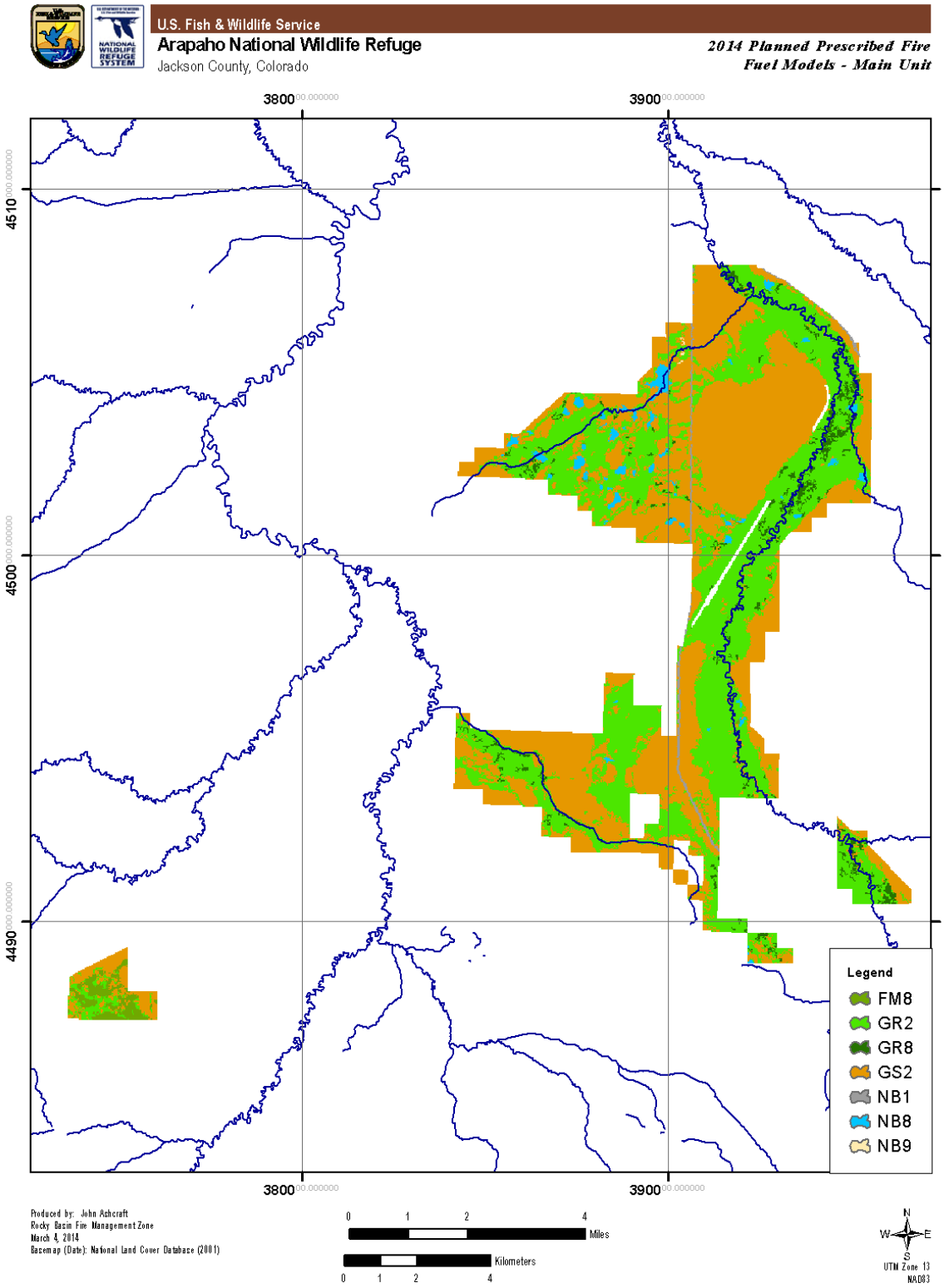


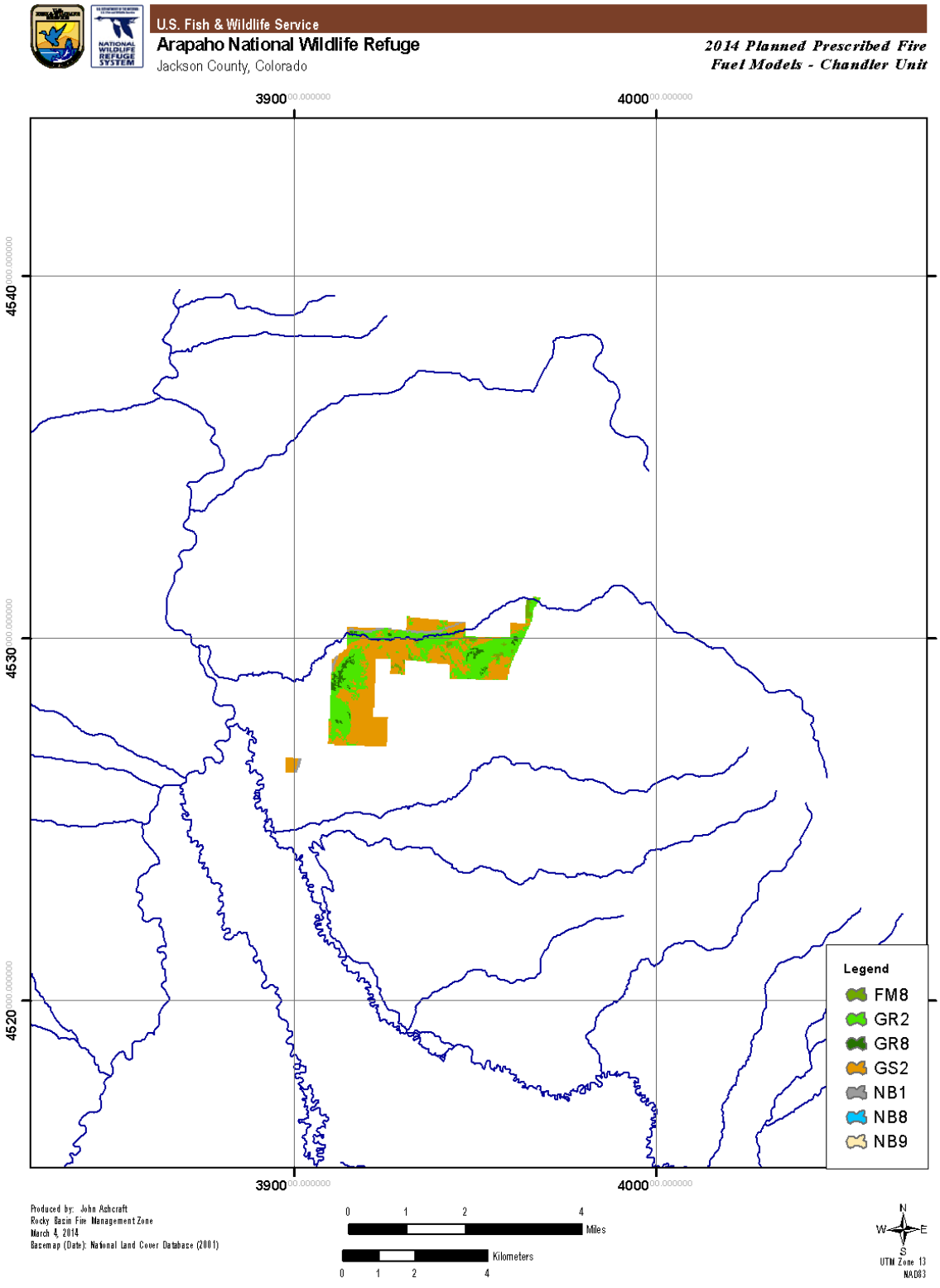
Appendix A: Vegetation Maps



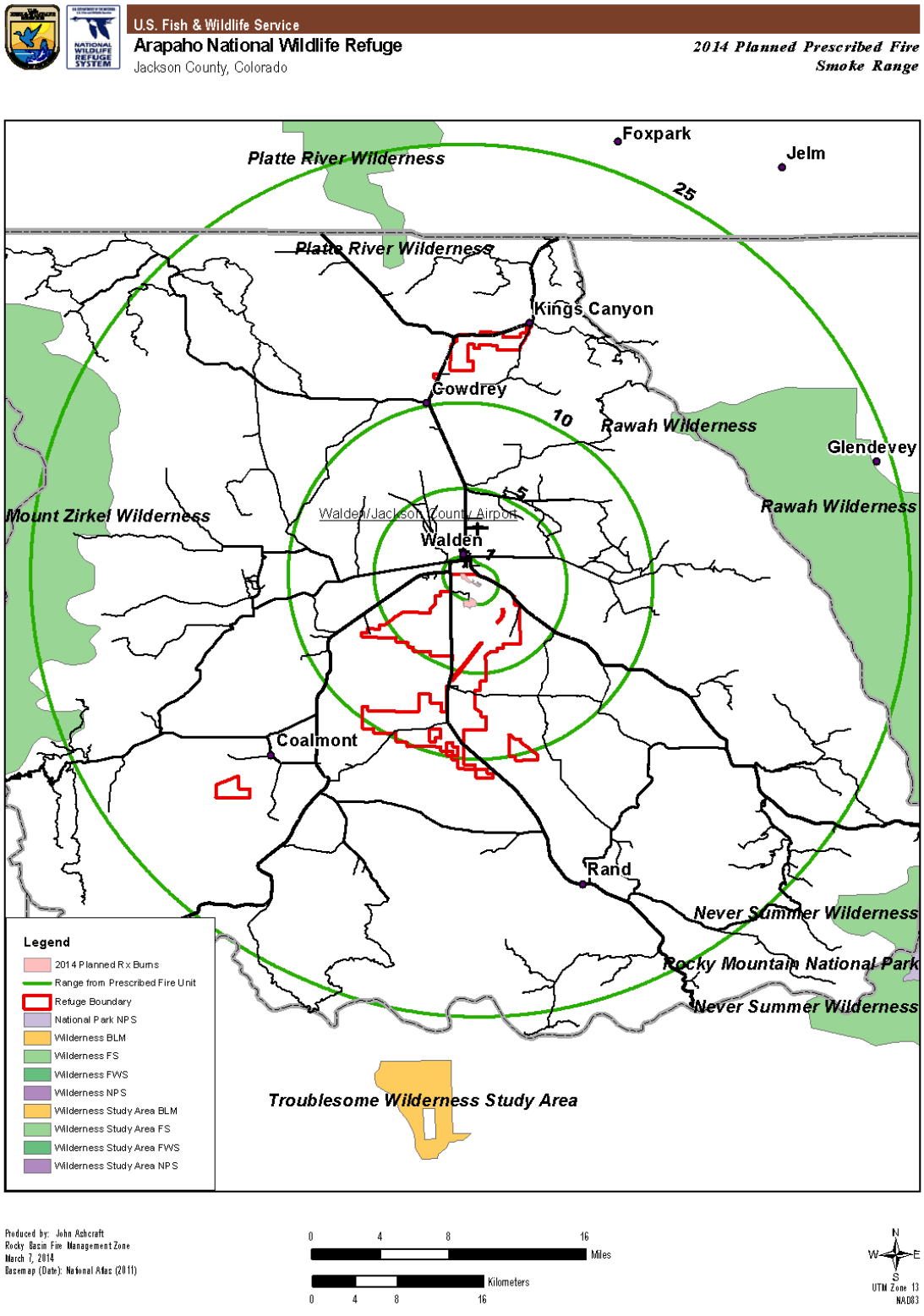

U.S. Fish & Wildlife Service
Arapaho National Wildlife Refuge
Jackson County, Colorado
2014 Planned Prescribed Fire
Land Cover - Chandler Unit
3900
4000
4540
4530
4520
Legend
Barren Land
Cultivated Crops
Deciduous Forest
Developed, High Intensity
Developed, Low Intensity
Developed, Medium Intensity
Developed, Open Space
Emergent Herbaceuous Wetlands
Evergreen Forest
Hay/Pasture
Herbaceuous
Mixed Forest
Open Water
Perennial Snow/Ice
Shrub/Scrub
Unclassified
Woody Wetlands
Produced by: John Ashcraft
Rocky Basin Fire Management Zone
March 4, 2014
Basemap (Date): National Land Cover Database (2001)
0 1 2 4
Miles
Kilometers
0 1 2 4
N
W E
S
UTM Zone 13
NAD83

Appendix A: Fuels or Fuel Model: (Optional) Maps




U.S. Fish & Wildlife Service
Arapaho National Wildlife Refuge
Jackson County, Colorado
2014 Planned Prescribed Fire
Fuel Models - Chandler Unit
3900000.000000
4000000.000000
4540000.000000
4530000.000000
4520000.000000
Legend
FM8
GR2
GR8
GS2
NB1
NB8
NB9
Produced by: John Ashcraft
Rocky Basin Fire Management Zone
March 4, 2014
Basemap (Date): National Land Cover Database (2001)
0 1 2 4
Miles
Kilometers
0 1 2 4
N
W E
S
UTM Zone 13
NAD83

Appendix A: Smoke Impact Areas: (Optional) Maps



Appendix B: Technical Reviewer Checklist

Please see attached USFWS Region 6 Technical Reviewer Checklist.

Appendix C: Complexity Analysis

1. Potential for Escape

Risk	Rationale
Preliminary Rating: *Low* ***Moderate*** *High*	At the upper end of prescription, the probability of ignition (PIG) is 100%, but under conditions that are normally experienced during a spring burn the PIG is normally in the 60-80% range. Some of the ignition units rely on mowed lines and wet lining to contain burn so possibility exists for fire to creep through lines and escape.
Final Rating: *Low* ***Moderate*** *High*	No Change
Potential Consequences	**Rationale**
Preliminary Rating: *Low* ***Moderate*** *High*	Due to size of refuge and nature of fuels, there is a possibility of escape unto private lands for some of the ignition units. Ignition units near the north end of the refuge do have a significant WUI exposure.
Final Rating: *Low* ***Moderate*** *High*	No Change
Technical Difficulty	**Rationale**
Preliminary Rating: *Low* ***Moderate*** *High*	Normal holding operations in these fuel types require at least 2 type 6 engines and multiple UTV's. Use of a specialty tracked vehicle (STV) in wetlands and wet meadows adds additional complexity for Holding Specialist that is not familiar with capabilities of the STV. Operations can be handled by experienced single resource boss who is also ICT5 or ICT4 qualified.
Final Rating: *Low* ***Moderate*** *High*	No Change

2. The Number and Dependency of Activities

Risk	Rationale
Preliminary Rating: *Low* ***Moderate*** *High*	Due to size of units and nature of fuels, successful achievement of concurrent actions is necessary.
Final Rating: *Low* ***Moderate*** *High*	The organization chart requires a qualified Firing Boss so that the Burn Boss can focus on the coordination of both holding and ignition operations
Potential Consequences	**Rationale**
Preliminary Rating: *Low* ***Moderate*** *High*	Due to nature of fuels and size of ignition units, any issues with coordination between ignition teams and holding forces can lead to increased risk of escape, and create safety issues.
Final Rating: *Low* ***Moderate*** *High*	The organization chart requires a qualified Firing Boss so that the Burn Boss can focus on the coordination of both holding and ignition operations
Technical Difficulty	**Rationale**

Preliminary Rating: *Low* ***Moderate*** *High*	Due to nature of fuels and size of ignition units, any issues with coordination between ignition teams and holding forces can lead to increased risk of escape, and create safety issues. Most units are of a size and layout that Burn / Firing Boss can see majority of unit from one location, so moderate coordination skill level is necessary.
Final Rating: *Low* ***Moderate*** *High*	The organization chart requires a qualified Firing Boss so that the Burn Boss can focus on the coordination of both holding and ignition operations

3. Off-Site Values

Risk	**Rationale**
Preliminary Rating: *Low Moderate* ***High***	Northern Boundary of refuge is adjacent to the city of Walden, CO.
Final Rating: *Low* ***Moderate*** *High*	The nature of the fuels surrounding the city of Walden are such that the risk of structural involvement due to spotting is negligible. The wind direction prescription was written so that the project could not be implemented if the wind is going to directly carry smoke into Walden.
Potential Consequences	**Rationale**
Preliminary Rating: *Low* ***Moderate*** *High*	Surrounding private land is used for domestic grazing, so escape unto private land followed by drought could lead to loss of productivity of the land causing monetary losses to the owner of the land.
Final Rating: *Low* ***Moderate*** *High*	No Change
Technical Difficulty	**Rationale**
Preliminary Rating: ***Low*** *Moderate High*	Off-site values are maintained so that no special management, equipment, or skills are necessary for their protection.
Final Rating: ***Low*** *Moderate High*	No Change

4. On-Site Values

Risk	**Rationale**
Preliminary Rating: ***Low*** *Moderate High*	Refuge facilities are easily protected from damage due maintenance around the facilities.
Final Rating: ***Low*** *Moderate High*	No Change
Potential Consequences	**Rationale**

Preliminary Rating: ***Low*** ***Moderate*** ***High***	Implementation problems will not adversely affect on-site resources.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change
Technical Difficulty	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Resources values within the unit are easily protected, requiring no more than normal annual grounds maintenance for protection.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change

5. Fire Behavior

Risk	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Fire Behavior modeling requires the use of 3 fuel models, basically transitioning from wetland vegetation to short grass to short stature shrub. Local winds following the river channels and bluffs along river corridor may cause notable shifts in fire behavior, specifically battling winds and differing directions of fire spread.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change
Potential Consequences	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Fire behavior outside the unit would be less then inside the unit during a spring burn window, but may become equivalent during fall burn windows and if a long term drought is impacting the area.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change
Technical Difficulty	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Most of the spots and slopovers fire behavior can be controlled using direct attack tactics from the heel of the fire. Standard safety precautions are adequate to ensure personnel safety.
Final Rating: ***Low*** ***Moderate*** ***High***	No change

6. Management Organization

Risk	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Due to nature of fuels and size of ignition units, two levels of supervision are necessary so as to coordinate operations between ignition and holding personnel.

Final Rating: *Low* ***Moderate*** *High*	The Organization chart requires the use of qualified Firing Boss. Holding operations are of a technical level that a Single Resource Boss (Engine or Crew) who is also qualified as an Incident Commander Type 5 can coordinate holding resources across the ignition units.
Potential Consequences	**Rationale**
Preliminary Rating: ***Low*** *Moderate High*	Supervision and communication problems are expected to be minimal.
Final Rating: ***Low*** *Moderate High*	No change
Technical Difficulty	**Rationale**
Preliminary Rating: *Low* ***Moderate*** *High*	Arapaho NWR has limited qualified personnel available within their organization. The refuge requires assistance from local USFS and BLM personnel, plus off-unit USFWS to implement prescribed fire operations.
Final Rating: *Low* ***Moderate*** *High*	No Change

7. Public and Political Interest

Risk	**Rationale**
Preliminary Rating: *Low Moderate* ***High***	Due to the topography of North Park, any prescribed fire operations at Arapaho NWR is visible to the surrounding public especially the town of Walden, CO.
Final Rating: *Low* ***Moderate*** *High*	The prescribed fire program at Arapaho NWR has not experienced any adverse events in it's history. The issuance of news releases discussing the implementation of prescribed fire operations at the refuge satisfies most public interest about the project implementation.
Potential Consequences	**Rationale**
Preliminary Rating: *Low* ***Moderate*** *High*	Adverse events will attract public, political, and media attention. News releases are required by the State of Colorado to be incompliance with smoke permit requirements.
Final Rating: *Low* ***Moderate*** *High*	No Change
Technical Difficulty	**Rationale**
Preliminary Rating: ***Low*** *Moderate High*	Routine media releases needed, but no dedicated PIO is needed to assist with implementation of prescribed fire operations.
Final Rating: ***Low*** *Moderate High*	No Change

8. Fire Treatment Objectives

Risk	**Rationale**

Preliminary Rating: ***Low*** ***Moderate*** ***High***	Objectives are easily accomplished with a range of fire behavior. Objectives mostly focus on herbaceous plant regeneration, and the prevention of woody fuel encroachment into the ignition unit.
Final Rating: ***Low*** ***Moderate*** ***High***	No change
Potential Consequences	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Other opportunities to meet objectives are very limited in a given year. Due to nature of fuels, use of mowing in wetlands has no impact on thatch removal, and may actually increase issues related to thatch impeding herbaceous vegetation growth
Final Rating: ***Low*** ***Moderate*** ***High***	No Change
Technical Difficulty	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Measures to achieve objectives are easy to complete and there are few restrictions on techniques.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change

9. Constraints

Risk	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Some of the constraints on project implementation include the prevention of fire damage to willow stands, and restriction on implementation operations during nesting season.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change
Potential Consequences	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	The requirement of minimizing fire damage to willow stands places limits on ignition tactics. The delay in firing operations necessary to ensure willow stand protection may lead to an increase of adverse event such as fire escape from refuge lands or fire spotting across the river into areas which are not scheduled for project implementation.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change
Technical Difficulty	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Constraints do not increase the difficulty of completing the project

Final Rating: ***Low*** ***Moderate*** ***High***	No Change

10. Safety

Risk	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Safety issues are easily identifiable and mitigated. Activities can be characterized as high frequency/low risk.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change
Potential Consequences	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Minimal potential for serious accidents/injuries to firefighters or the public. Outside common transportation safety and burn injuries, most significant potential accident involves falling into river and stream channels without flotation device during high water flow.
Final Rating: ***Low*** ***Moderate*** ***High***	Safety briefing will draw attention to a staying a safe distance from edges of stream and river channels, so as to avoid possibility of falling into water due to bank collapse.
Technical Difficulty	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Safety concerns can be easily mitigated through LCES. A standard safety briefing as part of the project briefing should be sufficient to cover safety concerns.
Final Rating: ***Low*** ***Moderate*** ***High***	No change

11. Ignition Procedures/Methods

Risk	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Due size of units and nature of fuels, firing sequence and timing are somewhat critical to meet project objectives. Most of the project area is readily visible to Burn and Firing Bosses.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change
Potential Consequences	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Firing methods must be coordinated to provide for adequate safety and reduce risk of an adverse event. Opportunities for remedial actions or corrections are available in the event of problems.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change
Technical Difficulty	**Rationale**

Preliminary Rating: *Low* ***Moderate*** *High*	Firing procedures are somewhat complex in at least some portions of the project are and require the ignition team to be broken into two or more teams. The use of two different types of ignition devices is planned. The ignition pattern requires direct control of the lighters to manage safety concerns.
Final Rating: *Low* ***Moderate*** *High*	No Change

12. Interagency Coordination

Risk	**Rationale**
Preliminary Rating: ***Low*** *Moderate High*	The project does not involve the lands of another land management agency or jurisdiction. Restrictions related to National or regional preparedness levels are not expected.
Final Rating: ***Low*** *Moderate High*	No Change
Potential Consequences	**Rationale**
Preliminary Rating: *Low* ***Moderate*** *High*	Due to limited USFWS fire staffing in the zone, interagency coordination issues may delay project implementation.
Final Rating: *Low* ***Moderate*** *High*	No Change
Technical Difficulty	**Rationale**
Preliminary Rating: *Low* ***Moderate*** *High*	Project requires use of one special agreement. Implementation may require special attention to certain interagency details such as communications. Interagency resources are generally available but some restrictions on their use may be present.
Final Rating: *Low* ***Moderate*** *High*	No Change

13. Project Logistics

Risk	**Rationale**
Preliminary Rating: ***Low*** *Moderate High*	The project requires minimal logistical support with no specific logistic function assigned. Supplies needed to conduct the burn are readily available. No special equipment or communication equipment needs have been identified. Project duration is two days or less.
Final Rating: ***Low*** *Moderate High*	No Change
Potential Consequences	**Rationale**
Preliminary Rating: ***Low*** *Moderate High*	Problems related to logistics will not increase the risk of escape, affect the completion of the project, or create a safety concern.

Final Rating: ***Low*** ***Moderate*** ***High***	No Change
Technical Difficulty	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	No special logistical support issues. Supervisors normally handle their own support needs. Supplies and personnel are readily available and easy to obtain.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change

14. Smoke Management

Risk	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Heavy smoke production from wetland fuels can lead to smoke exposure which will likely cause some health and safety concerns that will require special mitigation. Smoke may be visible to the public for several days in areas where public roads are near to the ignition units.
Final Rating: ***Low*** ***Moderate*** ***High***	No Change
Potential Consequences	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	A few health related complaints may occur. Minor smoke intrusions may occur into smoke sensitive areas, but below levels that trigger regulatory concern. Project personnel may be exposed to dense smoke for short periods of time.
Final Rating: ***Low*** ***Moderate*** ***High***	Smoke permit from CO APCD requires a minimum of a Fair Smoke Dispersion Adjective Rating, so intrusions into smoke sensitive areas are further minimized.
Technical Difficulty	**Rationale**
Preliminary Rating: ***Low*** ***Moderate*** ***High***	Some considerations are needed in the prescription portion of the plan. Burn window/opportunities are reduced by the required weather/dispersion conditions. Normal conditions with air quality officials is required. Some mitigation measures may be needed to address potential concerns with smoke impacts. Rotating project personnel out of dense smoke is necessary but easy to accomplish.
Final Rating: ***Low*** ***Moderate*** ***High***	Smoke permit from CO APCD is issued using standard conditions, and a wind limit of no winds from SW – S – SE when forecasted Smoke Dispersion Adjective Rating is only for fair.

COMPLEXITY RATING SUMMARY		
RISK	**OVERALL RATING**	**MODERATE**
POTENTIAL CONSEQUENCES	**OVERALL RATING**	**MODERATE**
TECHNICAL DIFFICULTY	**OVERALL RATING**	**MODERATE**
SUMMARY COMPLEXITY RATING		**MODERATE**

RATIONALE:

This plan was rated a Moderate complexity plan due to a number of elements. Off-site Values and Public & Political Interest both had preliminary ratings of one factor rate at a high complexity. This was due to the refuge being located on the Walden, CO city limits, and the broad nature of the valley that the city and refuge are located in. These were mitigated due to public being familiar with fire management activities in the valley, the nature of the fuels around the homes in the city, and the short time frame that smoke should be visible from the city.

The other elements which rated the plan a moderate complexity were due to fire behavior, organizational size, constraints, and smoke management. The fuels at this refuge are best described as light and flashy with high rates of spread. This necessitates a great deal of coordination during ignition operations due to the impact that a sudden wind shift can have across the entire project area. These fuels also increase the likelihood that any slop-over can become established quickly and burn onto private lands. This necessitated an increase in holding resources to two Type 6 engines and two UTVs. The UTVs do not add much to line building capacity, but they are highly mobile so they can actively patrol long sections of fire line thus increasing the likelihood that they will catch a slop-over before it becomes better established.

The constraints and smoke management issues are minimal, but still rated out at the moderate level. The constraint that the refuge is most concerned about is the lost of willow habitat due to fire damage. The refuge staff is studying the current information on fire effects to willows, so these constraints may become minimized on some of the ignition units when the staff completes the review of the information. The smoke management issues are rated moderate due to the state of Colorado's smoke management program requirements. These requirements do not cause an undue burden on the implementation of this project, but can cause other issues if information is not reported back to the state in a timely manner.

Prepared By: _____ Date: _____

Approved By: _____ Date: _____
(Agency Administrator)

Appendix D: Agency-Specific Job Hazard Analysis or Risk Assessment

United States Department of Interior **US Fish & Wildlife Service**	**1. WORK PROJECT/ACTIVITY** **Prescribed Fire**	**2. LOCATION** **CO-ARR Broadcast Burn Units**	**3. UNIT** **Arapaho NWR**
JOB HAZARD ANALYSIS (JHA)	**4. NAME OF ANALYST** **John Ashcraft**	**5. JOB TITLE** **Rocky Basin FMZ AFMO**	**6. DATE PREPARED** **04/03/2014**
7. TASKS/PROCEDURES	**8. HAZARDS**	**9. ABATEMENT ACTIONS** **ENGINEERING CONTROLS – SUBSTITUTION – ADMINISTRATIVE CONTROLS – PPE**	
*Travel to, from and on Project.	Motor vehicle accidents, Slippery road surfaces, soft shoulders, unimproved and narrow roadways. Weather darkness, smoke.	Driving Defensively. Use seat belts. Identify road conditions during briefings. Post Road Guards. Mark hazards. Use Headlights. Perform pre-use inspections on equipment. Scout roads and identify turnouts before ignition of project. Maintain communications. Provide road system map for project. Use Backers and chock vehicle tires. Have vehicles facing out.	
*Qualifications For assigned Position	Lack of Experience, Injuries	Workers recruited for burn assignments shall meet age,health, and physical requirements established for regular firefighting duties. Also meet Prescribed Burn qualifications. (310-1, FWS Handbook)	
*Briefing	Lack of communications	Provide project briefing before burning will clarify firing order, organization responsibilities, communications, hazards, weather, and expected fire behavior.	
*Protective Clothing and equipment	Injuries, burns, and death	Wear Hard hat with chin strap, safety glasses, Nomex Fire resistant pants and shirts NFPA 1977 compliant. Keep sleeves rolled down. Wear leather, lace type, boots with skid resistant soles, and tops at least 8 inches high. Carry drinking water and fire shelter. Wear OSHA approved firefighting gloves. Wear hearing	

		protection when working around equipment where noise level exceeds 90 dba. Wear additional protective equipment as dictated by local conditions and exposure to special equipment.
*Lighters	Injuries, death, falls,snags,bees, snakes, smoke, burns, rolling material.	Always have an escape route . Maintain LCES. Follow the Standard Fire Orders and Watch Out Situations. Maintain communications with other Lighters and Firing Boss. Hand held radios shall be provided to all lighters. Do not fill drip torches near ignition sources. Do not spill burn mix on clothing.
*Fuel Mixing	Burns, spills, fuel saturated clothing and boots.	No smoking within 25 feet of mixing and filling area. Do not fill or mix in pick up beds with bed liners. Avoid the use of cellular telephones in and around fill or mixing area. Avoid fuel contact with bare hands, clothing and boots. Provide pour spouts. Use only approved fuel containers. Follow fuel mixture ratio in the Health and safety Code Handbook.
*Holding/Mop Up/Patrol Crews	Smoke,burns,Falls, back injuries, bees, posion oak,snags, rolling material, eye injuries, Heat Stress, Dehydration, CO Poisoning	Wear PPE's listed above. LCES, Follow Standard Fire Orders and Watch out Situations. Receive briefing from Holding Boss. Identify hazards in work area. Flag hazards for others. Use warning lights and provide traffic control on roadways during smoky and nights operations. Drink lots of fluids before,during and after work. Periodically rotate crews from work sites with high smoke levels to areas of less smoke or smoke free areas. Protective clothing and equipment shall be the same as required for firefighting. Maintain communications with supervisors.
*Emergency Evacuation Procedures (EEP)	Serious illness and injuries	Notify Burn Boss, request medical response from the responsible medical first responders. Provide type of injury,location,access, number of patients. Identify EMT's and available medical equipment on project during briefing. Follow medical in burn plan.

10. SUPERVISOR'S SIGNATURE	11. TITLE	12. DATE

Appendix E: Fire Behavior Modeling Documentation

BehavePlus 5.0.5 (Build 307)

Prescription High End Scenario
Tue, Mar 04, 2014 at 15:20:42

Input Worksheet

Inputs: SURFACE, IGNITE

Input Variables	Units	Input Value(s)
Administrative Unit		Arapaho National Wildlife Refuge
Prescribed Fire Name		Refuge Wide Broadcast Burn Plan
Prepared By		John Ashcraft
Fuel/Vegetation, Surface/Understory		
Fuel Model		GR8, GR2, GS2, 8
Fuel Moisture		
1-h Moisture	%	2
10-h Moisture	%	4
100-h Moisture	%	6
Live Herbaceous Moisture	%	30
Live Woody Moisture	%	80
Weather		
Midflame Wind Speed (upslope)	mi/h	15
Air Temperature	oF	89
Fuel Shading from the Sun	%	0
Terrain		
Slope Steepness	%	3
Fire		
Spread Direction (from upslope)	deg	0, 90, 180

Notes

This run is to show the Flame Length, Rate of Spread, and Probability of Ignition during the high end of this plan's prescription.

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].

Calculations are for the specified spread directions [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Wind is blowing upslope [SURFACE].

Results for: Surface Rate of Spread (ch/h)

Fuel	Spread Direction (from upslope)		
Model	deg		
	0	90	180
gr8	842.2	18.9	9.5
gr2	335.2	8.3	4.2
gs2	163.8	3.7	1.9
8	10.3	0.3	0.2

Results for: Flame Length (ft)

Fuel	Spread Direction (from upslope)		
Model	deg		
	0	90	180
gr8	65.7	11.5	8.4
gr2	14.1	2.6	1.9
gs2	13.9	2.4	1.8
8	2.6	0.5	0.4

Results for: Probability of Ignition from a Firebrand (%)

Fuel	Spread Direction (from upslope)		
Model	deg		
	0	90	180
gr8	100	100	100
gr2	100	100	100
gs2	100	100	100
8	100	100	100

End

BehavePlus 5.0.5 (Build 307)

Prescription Low End Scenario

Tue, Mar 04, 2014 at 15:23:46

Input Worksheet

Inputs: SURFACE, IGNITE

Input Variables	Units	Input Value(s)
Administrative Unit		Arapaho National Wildlife Refuge
Prescribed Fire Name		Refuge Wide Broadcast Burn Plan

Prepared By		John Ashcraft
Fuel/Vegetation, Surface/Understory		
Fuel Model		GR8, GR2, GS2, 8
Fuel Moisture		
1-h Moisture	%	12
10-h Moisture	%	14
100-h Moisture	%	16
Live Herbaceous Moisture	%	300
Live Woody Moisture	%	200
Weather		
Midflame Wind Speed (upslope)	mi/h	0
Air Temperature	oF	50
Fuel Shading from the Sun	%	75
Terrain		
Slope Steepness	%	3
Fire		
Spread Direction (from upslope)	deg	0, 90, 180

Notes

This run is to show the Flame Length, Rate of Spread, and Probability of Ignition during the high end of this plan's prescription.

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].

Calculations are for the specified spread directions [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Wind is blowing upslope [SURFACE].

Results for: Surface Rate of Spread (ch/h)

Fuel	Spread Direction (from upslope)		
Model	deg		
	0	90	180
gr8	0.0	0.0	0.0

gr2	0.0	0.0	0.0
gs2	0.1	0.1	0.0
8	0.2	0.1	0.1

Results for: Flame Length (ft)

Fuel	Spread Direction (from upslope)		
Model	deg		
	0	90	180
gr8	0.2	0.2	0.2
gr2	0.0	0.0	0.0
gs2	0.2	0.1	0.1
8	0.3	0.3	0.3

Results for: Probability of Ignition from a Firebrand (%)

Fuel	Spread Direction (from upslope)		
Model	deg		
	0	90	180
gr8	18	18	18
gr2	18	18	18
gs2	18	18	18
8	18	18	18

End

BehavePlus 5.0.5 (Build 307)

Emergent Wetlands Dead Vs Live Fuels Comparisson - High Wind

Tue, Mar 04, 2014 at 15:41:21

Input Worksheet

Inputs: SURFACE

Input Variables	Units	Input Value(s)
Administrative Unit		Arapaho National Wildlife Refuge
Prescribed Fire Name		Refuge Wide Broadcast Burn Plan
Prepared By		John Ashcraft
Fuel/Vegetation, Surface/Understory		
Fuel Model		GR8
Fuel Moisture		
Dead Fuel Moisture	%	2, 4, 6, 8, 10, 12

Live Fuel Moisture	%	30,60,90,200,300

Weather

Midflame Wind Speed (upslope)	mi/h	15

Terrain

Slope Steepness	%	3

Fire

Spread Direction (from upslope)	deg	0

Notes

This run is to show a comparison of the Flame Length, and Rate of Spread for head fire in the Emergent Wetlands under upper wind speed conditions across a variety of live and dead fuel moistures.

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].

Calculations are for the specified spread directions [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Wind is blowing upslope [SURFACE].

Results for: Surface Rate of Spread (ch/h)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	843.7	485.5	205.6	3.6	2.5
4	677.1	425.5	189.8	2.6	1.8
6	562.0	381.1	178.1	2.1	1.4
8	483.4	348.6	169.3	1.7	1.2
10	429.7	324.8	161.7	1.5	1.1
12	392.2	306.6	152.4	1.4	1.0

Results for: Flame Length (ft)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	65.9	51.0	30.7	1.6	1.4

4	55.8	45.8	28.7	1.3	1.1
6	48.6	42.0	27.2	1.1	0.9
8	43.6	39.2	26.1	1.0	0.8
10	40.3	37.3	25.1	0.9	0.8
12	38.1	35.8	23.9	0.9	0.7

End

BehavePlus 5.0.5 (Build 307)

Emergent Wetlands Dead Vs Live Fuels Comparisson - Low Wind

Tue, Mar 04, 2014 at 15:42:34

Input Worksheet

Inputs: SURFACE

Input Variables	Units	Input Value(s)
Administrative Unit		Arapaho National Wildlife Refuge
Prescribed Fire Name		Refuge Wide Broadcast Burn Plan
Prepared By		John Ashcraft
Fuel/Vegetation, Surface/Understory		
Fuel Model		GR8
Fuel Moisture		
Dead Fuel Moisture	%	2, 4, 6, 8, 10, 12
Live Fuel Moisture	%	30,60,90,200,300
Weather		
Midflame Wind Speed (upslope)	mi/h	0
Terrain		
Slope Steepness	%	3
Fire		
Spread Direction (from upslope)	deg	0

Notes

This run is to show a comparison of the Flame Length, and Rate of Spread for head fire in the Emergent Wetlands under lower wind speed conditions across a variety of live and dead fuel moistures.

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].

Calculations are for the specified spread directions [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread

calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Wind is blowing upslope [SURFACE].

Results for: Surface Rate of Spread (ch/h)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	11.0	6.3	2.7	0.1	0.1
4	8.8	5.5	2.5	0.1	0.1
6	7.3	4.9	2.3	0.1	0.1
8	6.3	4.5	2.2	0.1	0.0
10	5.6	4.2	2.1	0.1	0.0
12	5.1	4.0	2.0	0.1	0.0

Results for: Flame Length (ft)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	8.9	6.9	4.2	0.3	0.3
4	7.6	6.2	3.9	0.3	0.2
6	6.6	5.7	3.7	0.2	0.2
8	5.9	5.3	3.5	0.2	0.2
10	5.5	5.1	3.4	0.2	0.2
12	5.2	4.9	3.2	0.2	0.2

End

BehavePlus 5.0.5 (Build 307)

Grasslands Dead Vs Live Fuels Comparisson - High Wind

Tue, Mar 04, 2014 at 15:44:41

Input Worksheet

Inputs: SURFACE

Input Variables	Units	Input Value(s)
Administrative Unit		Arapaho National Wildlife Refuge
Prescribed Fire Name		Refuge Wide Broadcast Burn Plan
Prepared By		John Ashcraft

Fuel/Vegetation, Surface/Understory

Fuel Model		GR2

Fuel Moisture

Dead Fuel Moisture	%	2, 4, 6, 8, 10, 12
Live Fuel Moisture	%	30,60,90,200,300

Weather

Midflame Wind Speed (upslope)	mi/h	15

Terrain

Slope Steepness	%	3

Fire

Spread Direction (from upslope)	deg	0

Notes

This run is to show a comparison of the Flame Length, and Rate of Spread for head fire in the Grasslands under higher wind speed conditions across a variety of live and dead fuel moistures.

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].

Calculations are for the specified spread directions [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Wind is blowing upslope [SURFACE].

Results for: Surface Rate of Spread (ch/h)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	335.2	210.5	69.2	0.1	0.1
4	192.1	144.3	52.6	0.1	0.1
6	145.0	117.2	35.9	0.1	0.1
8	125.0	101.3	5.1	0.1	0.1
10	98.7	80.3	4.2	0.1	0.0
12	52.5	48.6	2.4	0.0	0.0

Results for: Flame Length (ft)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	14.1	11.5	6.3	0.1	0.1
4	10.0	9.1	5.3	0.1	0.1
6	8.4	8.0	4.1	0.1	0.1
8	7.8	7.3	1.2	0.1	0.1
10	6.7	6.3	1.0	0.1	0.1
12	4.5	4.6	0.7	0.1	0.0

End

BehavePlus 5.0.5 (Build 307)

Grasslands Dead Vs Live Fuels Comparisson - Low Wind

Tue, Mar 04, 2014 at 15:43:32

Input Worksheet

Inputs: SURFACE

Input Variables	Units	Input Value(s)
Administrative Unit		Arapaho National Wildlife Refuge
Prescribed Fire Name		Refuge Wide Broadcast Burn Plan
Prepared By		John Ashcraft
Fuel/Vegetation, Surface/Understory		
Fuel Model		GR2
Fuel Moisture		
Dead Fuel Moisture	%	2, 4, 6, 8, 10, 12
Live Fuel Moisture	%	30,60,90,200,300
Weather		
Midflame Wind Speed (upslope)	mi/h	0
Terrain		
Slope Steepness	%	3
Fire		
Spread Direction (from upslope)	deg	0

Notes

This run is to show a comparison of the Flame Length, and Rate of Spread for head fire in the Grasslands under lower wind speed conditions across a variety of live and dead fuel

moistures.

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].

Calculations are for the specified spread directions [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Wind is blowing upslope [SURFACE].

Results for: Surface Rate of Spread (ch/h)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	3.2	1.9	0.8	0.0	0.0
4	2.4	1.6	0.7	0.0	0.0
6	2.1	1.4	0.6	0.0	0.0
8	1.9	1.3	0.3	0.0	0.0
10	1.6	1.2	0.3	0.0	0.0
12	1.2	1.0	0.2	0.0	0.0

Results for: Flame Length (ft)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	1.7	1.3	0.8	0.1	0.1
4	1.3	1.1	0.7	0.1	0.0
6	1.2	1.1	0.6	0.1	0.0
8	1.1	1.0	0.3	0.1	0.0
10	1.0	0.9	0.3	0.0	0.0
12	0.8	0.8	0.2	0.0	0.0

End

BehavePlus 5.0.5 (Build 307)

Shrub/Scrub Dead Vs Live Fuels Comparisson - High Wind

Tue, Mar 04, 2014 at 15:46:55

Input Worksheet

Inputs: SURFACE

Input Variables	Units	Input Value(s)
Administrative Unit		Arapaho National Wildlife Refuge
Prescribed Fire Name		Refuge Wide Broadcast Burn Plan
Prepared By		John Ashcraft
Fuel/Vegetation, Surface/Understory		
Fuel Model		GS2
Fuel Moisture		
Dead Fuel Moisture	%	2, 4, 6, 8, 10, 12
Live Fuel Moisture	%	30,60,90,200,300
Weather		
Midflame Wind Speed (upslope)	mi/h	15
Terrain		
Slope Steepness	%	3
Fire		
Spread Direction (from upslope)	deg	0

Notes

This run is to show a comparison of the Flame Length, and Rate of Spread for head fire in the Shrub/Scrub lands under higher wind speed conditions across a variety of live and dead fuel moistures.

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].

Calculations are for the specified spread directions [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Wind is blowing upslope [SURFACE].

Results for: Surface Rate of Spread (ch/h)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	299.9	171.5	107.4	5.2	3.7
4	260.8	150.5	95.1	3.3	2.3
6	237.6	139.0	73.1	2.6	1.8

8	218.8	132.1	11.0	2.4	1.7
10	194.2	114.5	9.2	2.0	1.4
12	158.4	13.1	5.2	1.2	0.8

Results for: Flame Length (ft)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	19.4	14.0	10.8	1.5	1.3
4	17.3	12.5	9.7	1.1	1.0
6	16.1	11.7	7.6	1.0	0.8
8	15.1	11.3	2.2	0.9	0.8
10	13.7	10.0	1.9	0.8	0.7
12	11.5	2.3	1.3	0.6	0.5

End

BehavePlus 5.0.5 (Build 307)

Shrub/Scrub Dead Vs Live Fuels Comparisson - Low Wind

Tue, Mar 04, 2014 at 15:46:07

Input Worksheet

Inputs: SURFACE

Input Variables	Units	Input Value(s)
Administrative Unit		Arapaho National Wildlife Refuge
Prescribed Fire Name		Refuge Wide Broadcast Burn Plan
Prepared By		John Ashcraft
Fuel/Vegetation, Surface/Understory		
Fuel Model		GS2
Fuel Moisture		
Dead Fuel Moisture	%	2, 4, 6, 8, 10, 12
Live Fuel Moisture	%	30,60,90,200,300
Weather		
Midflame Wind Speed (upslope)	mi/h	0
Terrain		
Slope Steepness	%	3
Fire		

Spread Direction (from upslope)	deg	0

Notes

This run is to show a comparison of the Flame Length, and Rate of Spread for head fire in the Shrub/Scrub lands under lower wind speed conditions across a variety of live and dead fuel moistures.

Run Option Notes

Maximum reliable effective wind speed limit IS imposed [SURFACE].

Calculations are for the specified spread directions [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Wind is blowing upslope [SURFACE].

Results for: Surface Rate of Spread (ch/h)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	3.1	1.7	1.1	0.2	0.1
4	2.7	1.5	1.0	0.1	0.1
6	2.4	1.4	0.7	0.1	0.1
8	2.2	1.3	0.3	0.1	0.1
10	2.0	1.2	0.3	0.1	0.1
12	1.6	0.4	0.2	0.1	0.1

Results for: Flame Length (ft)

Dead Fuel	Live Fuel Moisture				
Moisture	%				
%	30	60	90	200	300
2	2.4	1.7	1.3	0.3	0.3
4	2.1	1.5	1.2	0.3	0.2
6	2.0	1.4	0.9	0.2	0.2
8	1.8	1.4	0.4	0.2	0.2
10	1.7	1.2	0.4	0.2	0.2
12	1.4	0.5	0.3	0.2	0.1

End

Appendix F: Cost Calculation

The following cost calculation is based on worst case scenario of resources traveling to Arapaho from other units within the Rocky Basin and Montana Fire Management Zones, and attempting project implementation over a weekend.

Unit Prep	Employment Status	#individuals	Cost	Hours	Days	**Sub_TOTAL**	**TOTAL**
	GS-7/5	1	$ 31.92	8	1	$ 255.36	$ 255.36
Implementation	**Employment Status**	**#individuals**	**Cost**	**Hours**	**Days**	**Sub_TOTAL**	**TOTAL**
	GS-7/5	14	$ 31.92	12	2	$ 10,725.12	$ 10,725.12
Travel	**Employment Status**	**Individual Days**	**M&IE**	**Lodging**		**Sub_TOTAL**	**TOTAL**
	GS	48	$ 46.00	$ 83.00		$ 6,192.00	$ 6,192.00
Equipment Cost	**Type**	**# of Vehicles**	**Mileage**	**MPG**	**Fuel per Unit**	**Sub_TOTAL**	**TOTAL**
	Engine	2	1150	10	$ 4.00	$ 920.00	
	Misc	2	1150	18	$ 3.75	$ 479.17	$ 1,399.17

Appendix G: Medical Plan (ICS-206)

1. Incident Name: Prescribed Fire Operations – Arapaho NWR	**2. Operational Period:**	Date From: 1/1/2014	Date To: 12/31/2014
		Time From: HHMM	Time To: HHMM

3. Medical Aid Stations:

Name	Location	Contact Number(s)/Frequency	Paramedics on Site?
TBD			☐ Yes ☐ No

4. Transportation (indicate air or ground)**:**

Ambulance Service	Location	Contact Number(s)/Frequency	Level of Service
North Park EMS	Walden, CO	911/970-723-8427	☒ ALS ☐ BLS
St Anthony's	Denver, CO	911 / 800-332-3123	☒ ALS ☐ BLS
Flight for Life	Frisco, CO	911 / 800-332-3123	☒ ALS ☐ BLS
Wyoming Medical Center	Casper, WY	911 / 800-822-7201	☒ ALS ☐ BLS

5. Hospitals:

Hospital Name	Address, Latitude & Longitude if Helipad	Contact Number(s)/ Frequency	Travel Time		Trauma Center	Burn Center	Helipad
			Air	Ground			
Kremmling Memorial	214 S 4th; Kremmling	970-724-3442	20	75	☐ Yes Level: ____ ☒ No	☐ Yes ☒ No	☒ Yes ☐ No
Yampa Valley Medical	1024 Central Park Dr.; Steamboat Springs	970-879-1322	15	75	☐Yes Level: ____ ☒ No	☐ Yes ☒ No	☒ Yes ☐ No
Ivenson Hospital	255 N 30th St., Laramie, WY	307-742-2141	25	75	☐ Yes Level: ____ ☒ No	☐ Yes ☒ No	☒ Yes ☐ No
Western States Burn Center	1801 16th St, Greeley, CO	970-350-6305	35	180	☒ Yes Level: II ☐ No	☒ Yes ☐ No	☒ Yes ☐ No
_____		_____			☐ Yes Level: ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

6. Special Medical Emergency Procedures:

Notify Craig Dispatch immediately concerning any medical emergency. Dispatch will clear the frequency until the emergency is resolved. Stay calm and provide information to dispatch concerning the nature of the injury(s) and patient(s) information.

o Number of patient(s); Location of patient(s); Type or extent of injury(s); Vitals; Time of injury(s); Age and Gender of patient; Type of medical personnel on scene

Recommend type of medical response (Life Flight, Ground Ambulance, etc). **DO NOT USE PATIENTS NAME**

☐ Check box if aviation assets are utilized for rescue. If assets are used, coordinate with Air Operations.

7. Prepared by (Medical Unit Leader)**:** Name: Signature: _____

8. Approved by (Safety Officer)**:** Name: Signature: _____

ICS 206	**IAP Page**	Date/Time: Date

Appendix H: Contact / Notification List

Table 1: Contact List

NAME/TITLE	CITY/STATE	OFFICE	PAGER/ CELLULAR	HOME
Ann Timberman Project Leader	Walden, CO	970-723-8202 x 3	970-819-0541	970-723-4780
Elizabeth Berkley Biologist	Walden, CO	970-723-8202 x 6	608-215-6896	
VACANT Deputy Project Leader	Walden, CO	970-723-8202 x 4		
Tracy Swenson FMO	Brigham City, UT	435-734-6449	435-740-0572	
John Ashcraft AFMO	Green River, WY	307-875-2187 ext. 18	304-224-5812	
Craig Interagency Dispatch Center	Craig, CO	970-826-5037		
Walden Fire Station	Walden, CO	970-723-4747	970-873-7003	
Jackson County Sheriff's Office	Walden, CO	970-723-8427		
Sarah Gallup; Prescribed Fire Field Liaison, CO APCD	Fort Collins, CO	303-916-1260		

Table 2: Notification List

Who	When[1]	Phone Number and/or e-mail	Responsibility	Date	Contact Type[2]
Craig Interagency Dispatch Center	B,D,A	970-826-5037	Burn Boss		
Jackson County Sheriff's Office	B,D,A	970-723-8427	Refuge Staff		
CO Air Pollution Control Div.	B,A	cdphe_fireactivity@state.co.us	Burn Boss		
NWCO Fire Management Unit PIO	1 week prior	970-826-5096	Refuge Staff		

[1] When to Notify	Before **(B)**: The day prior to burn day. Day of **(D)**: Prior to ignition on burn day. After **(A)**: After burn is completed.	[2] Contact Type	Phone Contact (PC) Phone Message (PM) Direct Contact (DC) E-mail (EM)

Appendix I: Ignition Unit Specific Documentation

Ignition Unit		Hampton		**Acreage**			149		
Latitude		40.69008° (40° 41’ 24.28”)N		**Longitude**			106.2774° (106° 16’ 38.63”)W		
Elevation	**Top**	8,164ft	**Bottom**	8,118ft		**Aspect**	Ridgetop – All Aspect		
7.5’ Quad Name		Walden		**Drainage**			Illinois River		
Percentage of Fuels	**GR2 - HERB**	89.29%		**GS2**	5.35%	**GR2 - WW**	3.09%	**NB8**	2.27%

Element 5: Objectives

B. Prescribed fire objectives:

- No additional objectives

Element 13: Public and Personnel Safety, Medical

A. Safety Hazards:

- Hampton Ranch Site (Cisterns, wells)
- Impoundments
- Irrigation Ditches along South and East boundaries

Element 16: Holding Plan

B. Critical Holding Points and Actions:

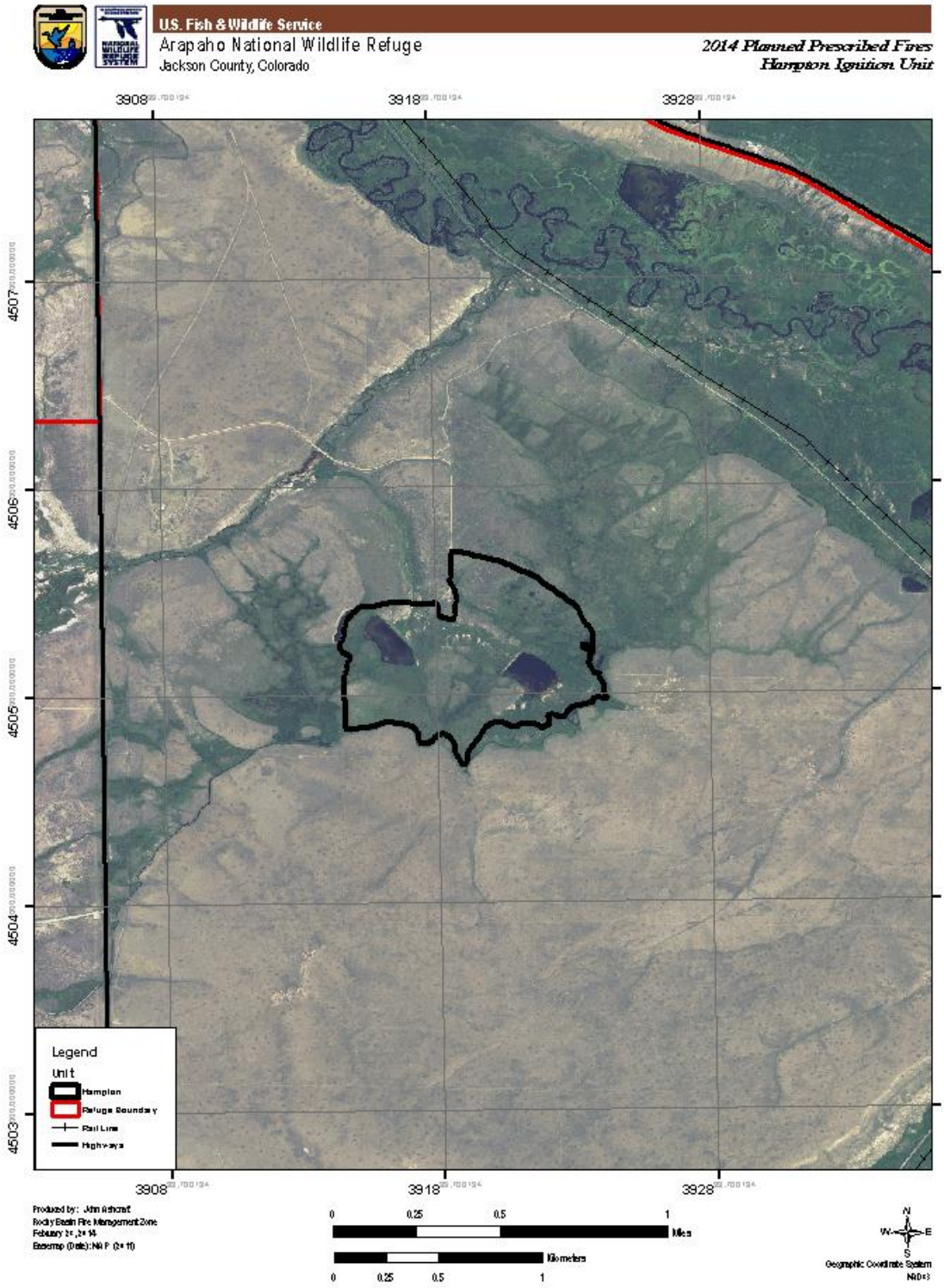
- Hampton Ranch Site – Ensure that buildings and other culturally relevant sites have been prepared before project implementation. Use wet lines and water applied to structures to prevent fire damage to exposed wooden structures / fence posts.
- Mowed Lines – Ensure that lines are mowed to width standard in Element 9. Use of low concentration foam solution during wet line operation is very effective especially if applied in front of vehicle wheel so has to improve absorption of foam solution into fuels.

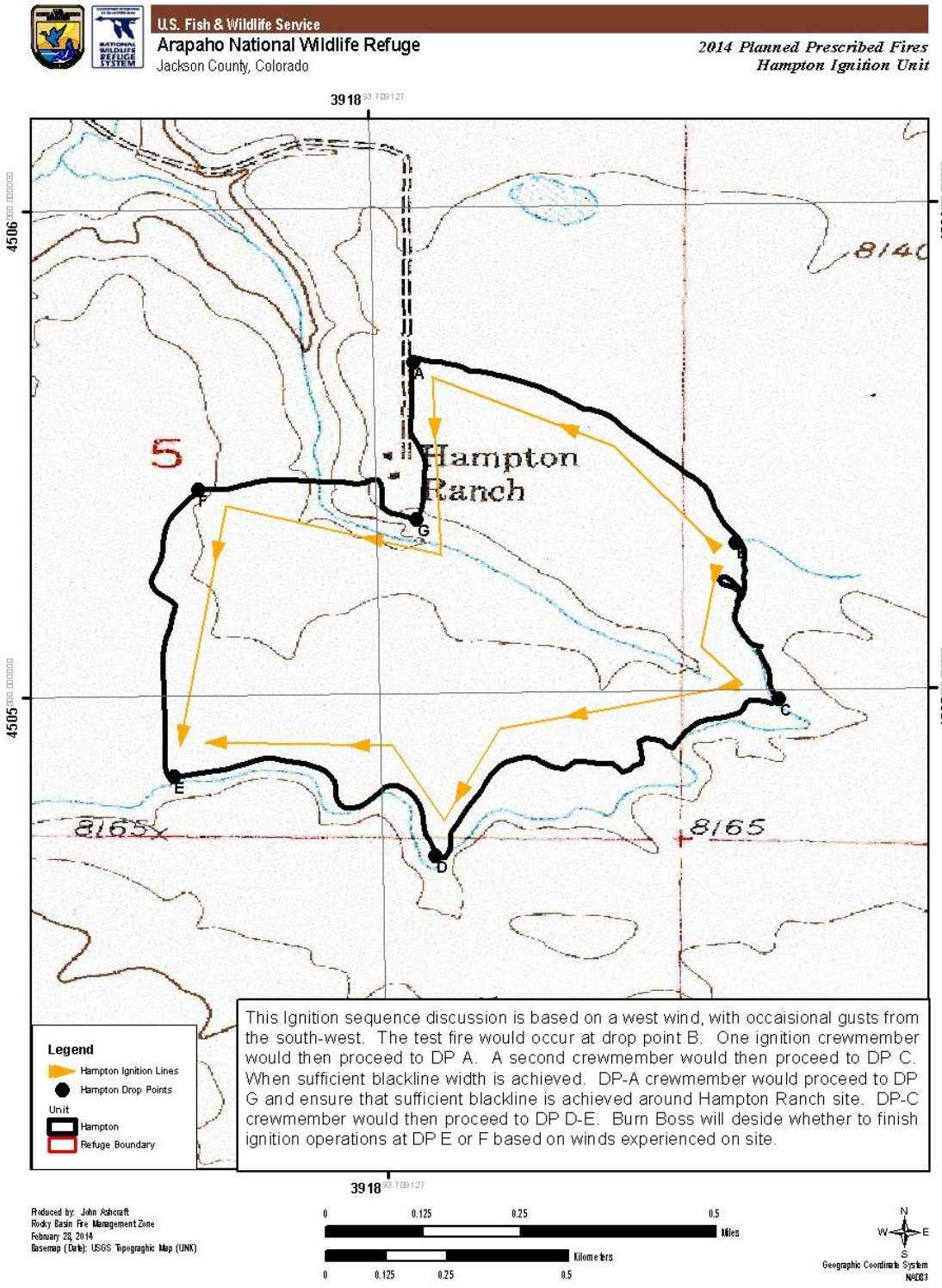
Element 19: Smoke Management and Air Quality

C. Smoke-Sensitive Receptors:

Receptor	Distance	Direction
Jackson County School Complex	2.9 miles	North
Walden, CO	2.9 miles	North
Walden/Jackson County Airport	4.2 miles	North

Maps:


U.S. Fish & Wildlife Service
Arapaho National Wildlife Refuge
Jackson County, Colorado
2014 Planned Prescribed Fires
Hampton Ignition Unit
3908
3918
3928
4507
4506
4505
4504
4503
Legend
Unit
Hampton
Refuge Boundary
Rail Line
Highways
0
0.25
0.5
1
Miles
Kilometers
N
W
E
S


U.S. Fish & Wildlife Service
Arapaho National Wildlife Refuge
Jackson County, Colorado
2014 Planned Prescribed Fires
Hampton Ignition Unit
3918
4506
4505
8140
8165
8165
5
Hampton Ranch
A
B
C
D
E
F
G
This Ignition sequence discussion is based on a west wind, with occaisional gusts from the south-west. The test fire would occur at drop point B. One ignition crewmember would then proceed to DP A. A second crewmember would then proceed to DP C. When sufficient blackline width is achieved. DP-A crewmember would proceed to DP G and ensure that sufficient blackline is achieved around Hampton Ranch site. DP-C crewmember would then proceed to DP D-E. Burn Boss will deside whether to finish ignition operations at DP E or F based on winds experienced on site.
Legend
Hampton Ignition Lines
Hampton Drop Points
Unit
Hampton
Refuge Boundary
Produced by: John Ashcraft
Rocky Basin Fire Management Zone
February 20, 2014
Basemap (Date): USGS Topographic Map (UNK)
0 0.125 0.25 0.5
Miles
Kilometers
0 0.125 0.25 0.5
N
W E
S
Geographic Coordinate System
NAD83

Ignition Unit		Home - Northwest			**Acreage**			61			
Latitude		40.71162° (40° 42' 41.84")N			**Longitude**			106.28125° (106° 16' 52.52")W			
Elevation	**Top**	8,082ft	**Bottom**		8,055ft	**Aspect**		River Bottom - Flat			
7.5' Quad Name		Walden			**Drainage**			Illinois River			
Percentage of Fuels		**GR2 - WW**	39.16%		**GR2 - HERB**	28.66%		**GR8**	22.71%	**GS2**	9.47%

Element 5: Objectives

B. Prescribed fire objectives:

- No additional objectives

Element 13: Public and Personnel Safety, Medical

A. Safety Hazards:

- Illinois River
- Unstable river banks
- Railroad Grade Bridge

Element 16: Holding Plan

B. Critical Holding Points and Actions:

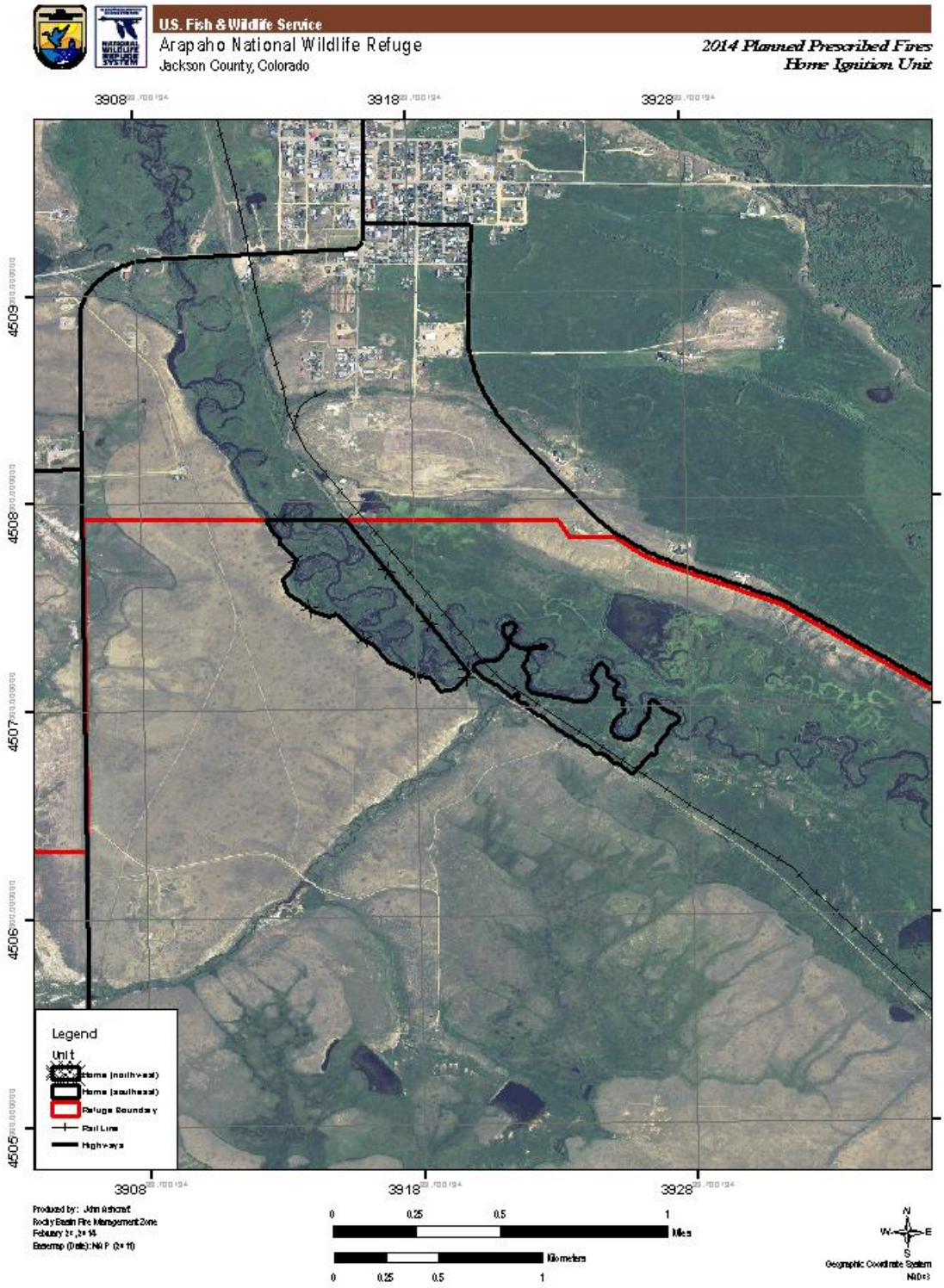
- Mowed Lines – Ensure that lines are mowed to width standard in Element 9. Use of low concentration foam solution during wet line operation is very effective especially if applied in front of vehicle wheel so has to improve absorption of foam solution into fuels.
- Rail Road Grade – Bridge needs to be evaluated for safe crossing of UTV's to hold fire along the rail road grade.
- North Fence Line – Keep fire south of fence line

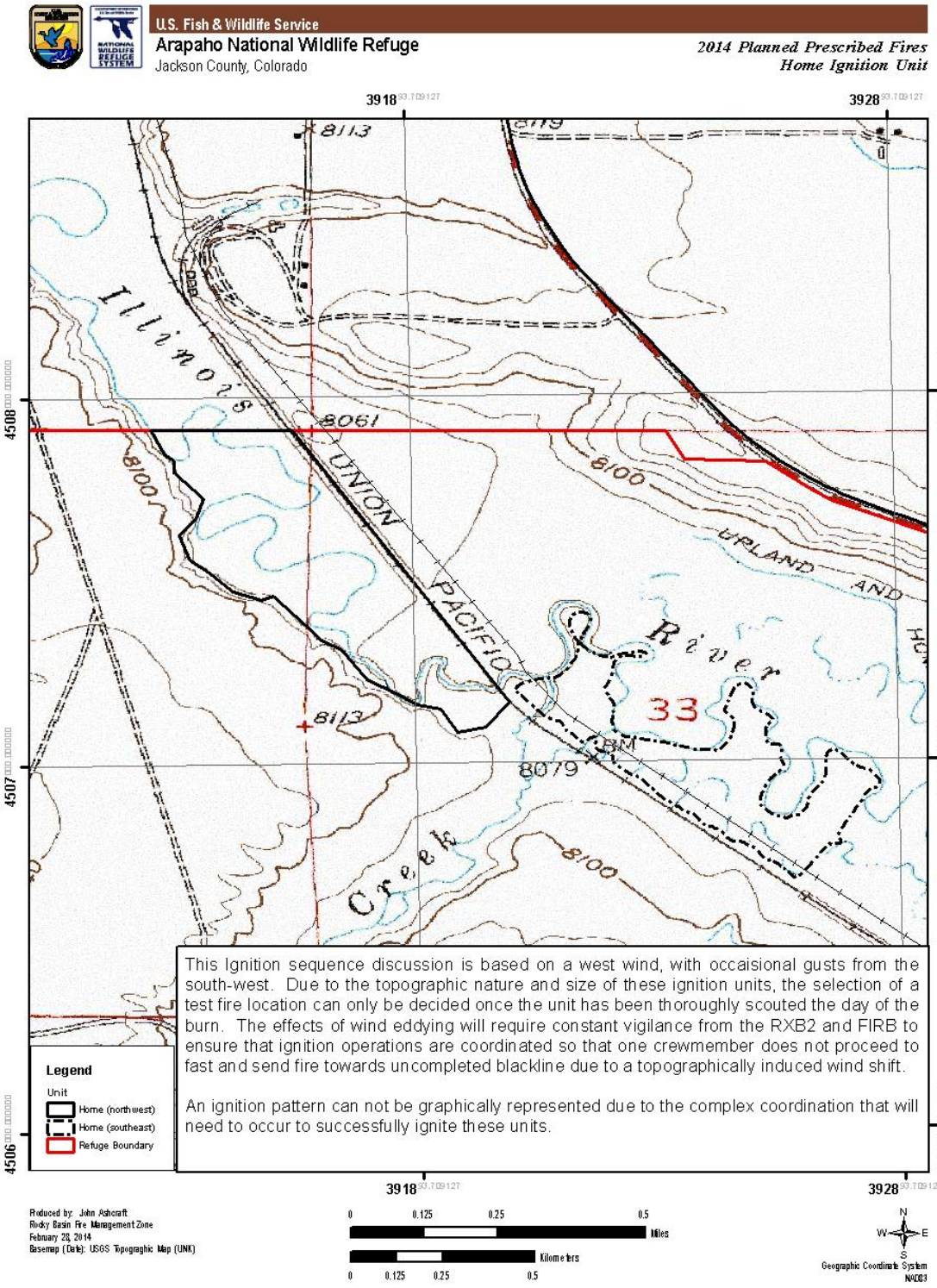
Element 19: Smoke Management and Air Quality

C. Smoke-Sensitive Receptors:

Receptor	Distance	Direction
Jackson County School Complex	1.4 miles	North
Walden, CO	1.4 miles	North
Walden/Jackson County Airport	2.7 miles	North

Maps:


U.S. Fish & Wildlife Service
Arapaho National Wildlife Refuge
Jackson County, Colorado
2014 Planned Prescribed Fires
Home Ignition Unit
3908
3918
3928
4509
4508
4507
4506
4505
Legend
Unit
Home (northwest)
Home (southeast)
Refuge Boundary
Rail Line
Highways
Produced by: John Ashcraft
Rocky Basin Fire Management Zone
Feburary 1st, 2014
Basemap (Date): NAIP (2010)
0 0.25 0.5 1
Miles
Kilometers
0 0.25 0.5 1
N
W
E
S
Geographic Coordinate System
NAD83


U.S. Fish & Wildlife Service
Arapaho National Wildlife Refuge
Jackson County, Colorado
2014 Planned Prescribed Fires
Home Ignition Unit
3918
3928
4508
4507
4506
8113
8061
8100
8079
UNION PACIFIC
UPLAND AND
33
This Ignition sequence discussion is based on a west wind, with occaisional gusts from the south-west. Due to the topographic nature and size of these ignition units, the selection of a test fire location can only be decided once the unit has been thoroughly scouted the day of the burn. The effects of wind eddying will require constant vigilance from the RXB2 and FIRB to ensure that ignition operations are coordinated so that one crewmember does not proceed to fast and send fire towards uncompleted blackline due to a topographically induced wind shift.
An ignition pattern can not be graphically represented due to the complex coordination that will need to occur to successfully ignite these units.
Legend
Unit
Home (northwest)
Home (southeast)
Refuge Boundary
Produced by: John Ashcraft
Rocky Basin Fire Management Zone
February 28, 2014
Basemap (Data): USGS Topographic Map (UNK)
0 0.125 0.25 0.5
Miles
Kilometers
Geographic Coordinate System
NAD83

Ignition Unit		Home - Southeast			**Acreage**			61	
Latitude		40.70644° (40° 42’ 23.18”)N			**Longitude**			106.2718° (106° 16’ 18.47”)W	
Elevation	**Top**	8,082ft	**Bottom**		8,055ft		**Aspect**	River Bottom - Flat	
7.5’ Quad Name		Walden			**Drainage**			Illinois River	
Percentage of Fuels	**GR2 - HERB**	89.18%	**GR8**	6.23%	**GR2 - WW**	2.94%	**GS2**	1.65%	

Element 5: Objectives

B. Prescribed fire objectives:

- No additional objectives

Element 13: Public and Personnel Safety, Medical

A. Safety Hazards:

- Illinois River
- Unstable river banks

Element 16: Holding Plan

B. Critical Holding Points and Actions:

- Hampton Ranch Site – Ensure that buildings and other culturally relevant sites have been prepared before project implementation. Use wet lines and water applied to structures to prevent fire damage to exposed wooden structures / fence posts.
- Mowed Lines – Ensure that lines are mowed to width standard in Element 9. Use of low concentration foam solution during wet line operation is very effective especially if applied in front of vehicle wheel so has to improve absorption of foam solution into fuels.

Element 19: Smoke Management and Air Quality

C. Smoke-Sensitive Receptors:

Receptor	Distance	Direction
Jackson County School Complex	1.8 miles	North
Walden, CO	1.8 miles	North
Walden/Jackson County Airport	3.0 miles	North

Maps:

Please refer to Home – Northwest Ignition Unit for maps associated with this ignition unit.