AN EXAMINATION OF FIRE EFFECTS ON PREHISTORIC PERIOD CULTURAL RESOURCES IN NEVADA

Prepared For

Nevada State Office
Bureau of Land Management
1340 Financial Boulevard
Reno, Nevada 89520

Prepared by

Vickie Clay, Michael P. Drews, Eric Ingbar, and Charles Zeier

MACTEC Engineering and Consulting
1572 East College Parkway, Suite 162
Carson City, Nevada 89706

Gnomon, Inc.
1601 Fairview Drive, Suite F
Carson City, Nevada 89701

Prepared in accordance with provisions of Order FAQ 030047
As issued under GSA Contract GS10F0157K

March 2004

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1. INTRODUCTION

Agency officials and land managers have expressed an increased interest in the effects of fire on cultural resources. The interrelation of fire and cultural resource management has become more pronounced as the occurrence and intensity of unusually large wildfires has increased, especially in National Parks and Monuments dedicated to preserving such resources (e.g., Bandelier, Mesa Verde, and Yellowstone). These management concerns have also affected large public land management agencies such as the BLM and USFS.

Fire effects on cultural resources have become a prominent topic of professional papers, articles, bibliographic compilations, and publications (Deal 2001, 2002; Fawcett 2003; Halford 2001; Jones and Ryan, in press; Loyd et al. 2002; Rude and Jones 2001). Some studies are materials science studies, asking "if one burns a particular artifact or material at a particular temperature and for a specific duration what happens?" Both laboratory (usually involving controlled furnace tests) and field studies (during prescribed burns) have addressed this kind of question.

A second focus of fire effects studies has been the immediate effect of fire on archaeological sites, including their depositional and structural contexts. Most often, such studies focus on the period immediately after a fire. Studied effects include physical alteration of material (changes in color, texture, luster, structure, archaeomagnetic signature) or its disintegration (crackling, crazing, and potlidding, fracturing into smaller and smaller fragments, melting). Chemical alterations also have been studied with regard to obsidian hydration rinds, obsidian sourcing, chemical weathering, and calcined bone. Fewer studies have looked at post-fire depositional and structural context alterations.

The emphasis of the present study is focused more on fire's effects to those essential qualities that make some cultural resources eligible for listing on the National Register of Historic Places. Deal (2001), Jackson (2001), and others have pointed out that the destruction and alteration of artifacts, features, and even structures or buildings are only the proximate effect of fire and heat. In some cases, fire may destroy elements that make a cultural resource significant. In other cases, those

attributes may not be affected. When viewed in this light, the dimension of measurement of fire effect becomes the intellectual, legal, or administrative elements that make a cultural resource important and whether or not those elements would be affected by fire.

Focusing on effects to site eligibility is important for several reasons. First, if it can be determined that fire does affect elements that routinely make a class of resources eligible, then it may be possible to single them out for special treatment in action planning processes. Conversely, if it can be determined that fire does not effect elements that routinely make a class of resources eligible, then it may be possible to reduce or eliminate constraints on fire management practices in those site areas. Also, threat assessments could be mapped for planning and response situations if resource types are predictable geographically (such as flammable ethnohistoric features in old growth pinyon-juniper woodlands). Finally, it may be possible to address whether fire-related changes are ameliorated with the passage of time. Are fire-effected, eligibility-related elements impacted only over the short term, or are those impacts irreversible?

1.1 Overview of Project

The theme of the present study is to develop a concise selection and recording strategy that assesses the effect of fire on previously recorded prehistoric cultural resources in northeast Nevada. The study isolated key eligibility related elements that could be affected by fire and that would be discernable using standard archaeological field recording methods. From a wide range of elements, four were selected for detailed review. The second phase of this study will be a program of field research at previously recorded prehistoric sites with different, known, fire histories (based on BLM fire regime mapping). The goal of the study is to test specific hypotheses regarding the effects of fire on eligibility related site elements, and the ability to discern those effects over time.

This study will, we hope, be the start of a more extensive, long-term, collection of observations. The field protocol developed for this study is intended to be straightforward. Consistent, widespread, use of a protocol of this type for several years throughout the western states could provide excellent data on which to base definitive statements about fire effects on cultural resources.

2. RESEARCH DESIGN

A fairly extensive body of published and "gray" literature exists on the interrelationship between cultural resources and fire. Much of that literature was written by agency personnel and archaeological researchers over the past four decades, as cultural resource management became part of stewardship actions implemented by land-managing agencies coping with fire in the West. Review of this literature suggests that there is a gap with regard to the relationship of fire effects to the broad question of National Register eligibility. Rather, studies have focused on the physics and effects of fire on individual artifact types such as flaked stone (e.g., chert, obsidian, and quartz), ground stone (e.g., limestone, sandstone, and granite), historic artifacts (e.g., plastics, glass, metal), perishables, and flammable structures and features, among many others. These studies provide excellent baseline data for use in the present study.

The research design for this project creates a systematic framework for the observation of fire effects on those elements typically considered when determining the eligibility of prehistoric archaeological sites under National Register Criterion D. More specifically, the study focuses on the effects of fire on eligibility-related elements at the general category of prehistoric archaeological site commonly referred to as "lithic scatters and features." Such sites comprise over 75 percent of known cultural resources in Nevada, and in most other western states as well. The study does not address elements associated with other National Register criteria (A, B, and C). This is because so few prehistoric sites in the West have been evaluated based, in part or in whole, on these criteria. Also, historic period archaeological sites are not considered in detail.

2.1 Study Hypotheses

To focus the study, several explicit hypotheses have been defined. The hypotheses are stated below, accompanied by a brief discussion.

2.1.1 Hypothesis One: It is possible to discern the effects of fire at prehistoric archaeological sites.

The concept of "known fire history" deserves discussion. For this study, known fire history means that the past 10 to 20 years of a site's exposure to fire is documented. In principle, there are four possible combinations of "exposure to fire" and "evidence of exposure to fire." Those combinations are shown in the table below.

Table 1. Hypothesis One Structure and Expectations

	Evidence of Exposure	
Exposed to Fire	**Yes**	**No**
Yes	**	
No		**

Cells in the table with asterisks are the "expected" combinations. Although it would be ideal to know if sites were ever exposed to fire (see Livingston et al. 2003), in practice (and in this study), we will rely on available BLM fire records as controls on exposure. Most prehistoric sites are hundreds to thousands of years old. It is only reasonable to assume that most sites in the study area (northeast Nevada) have been exposed to fire at some time in the past. As a result, it will be important to look for archaeological evidence of exposure even in places where we are not able to discern evidence of fire itself.

Evidence of exposure will be collected through the examination of previously recorded sites. Site examination will include the visual review of archaeological materials and features, and the collection of artifact for selected analysis (obsidian sourcing and hydration). Examination of sites will seek to answer the following questions:

- Is there direct or indirect evidence of exposure to fire?
- Have artifacts been altered by exposure to heat?
- Has fire altered microphysical or chemical characteristics of selected artifact classes (obsidian)?

Because the questions require expert judgment, field examinations will be performed by two highly experienced individuals with experience in archaeology and geo-archaeology. The field team will not be provided information on the fire history status of the sites chosen for evaluation. Sites will be chosen for evaluation by a team of archaeologists and fire specialists through study of maps, records, and fire histories.

Fire, fire suppression and management, and fire prevention encompass a wide variety of natural occurrences and human actions that can directly affect cultural resources. Six categories of fire-related natural and human processes are identified. Each category contains a subset of occurrences or actions.

- Direct Heat Exposure – varying heat intensity;
- Fire Suppression – mechanical construction of fire lines and roads, hand construction of fire lines, fire camps and staging areas, water and chemical retardant drop areas;
- Post-fire Reclamation – air seeding, drill seeding, mulched seeding, hand planting, erosion control features;
- Accelerated Natural Effects – wind erosion, water erosion, deposition, and weathering;
- Effects of People – increased access, unauthorized artifact collection, vandalism;
- Fuel Management Practices – controlled or prescribed burns, chipping or muching of forest products, green strip planting, woodland thinning or removal, herbicide application, and hand clearing.

The present study will focus primarily on effects of direct heat exposure, either from wildfire or by planned burning. To the extent possible, we will also make observations regarding accelerated natural effects.

Cultural resources alteration by heat exposure has been studied by fire and cultural resource specialists for some time. Siefkin (2002) indicates temperature and duration of exposure are the most important factors. Logically, one can consider the combination of temperature and time (duration) as *heat intensity*. Heat intensity may be determined through careful post-fire examinations of artifacts and soil characteristics, and the depth of charring in live and dead fuels.

Heat intensity has been assessed in many ways, but most researchers and fire managers seem content to use three qualitative intensity levels of high, medium, and low. In this study we rely upon

proxy definitions that use sagebrush and other woody shrubs as our frame of reference for measuring heat intensity.

- *High Intensity* exposure will be reported if most sagebrush was burned off flush with ground level, with some visible soil color alteration around the trunk and root zone, and few unburned patches are present;
- *Medium Intensity* exposure will be reported if most sagebrush is burned to within several inches of the ground surface, no ground color alteration is visible, and a moderate amount of unburned patches are present throughout the burned area; and
- *Low Intensity* exposure will be reported if most of the brush remains with burned branches and scorched leaves; brush may or may not be alive.

It should be noted that these characteristics are most observable immediately after the fire, and that one's ability to perceive evidence of heat intensity diminishes with time.

The three levels of heat intensity have implications for both temperature and duration of the effects of heat to artifacts and features. The higher the intensity, presumably the higher the effect, however, many plot studies have shown that all exposure may have an effect. For example, Benson (2002) discusses what she presumed would be low intensity exposure in a prescribed burn in sagebrush that had a marked effect on obsidian hydration and newly manufactured chert flakes.

2.1.2 Hypothesis Two: The effects of fire on archaeological sites are long lasting.

It is important to recognize that fire only affects that portion of a site that is on or near the surface at the time of the fire. If site deposits are thin or limited to the surface, then evidence of exposure to fire (especially on artifacts) should remain through time. If site deposits are present that were not affected, and if turbation or some other mechanism subsequently results in the mixing of burned and unburned materials, then surface evidence of exposure to fire may diminish with time. This hypothesis has implications to fire's effects on site eligibility and on the advisability of fire management prescriptions.

We intend to examine the question of whether prehistoric sites in our project area (northeast Nevada) recover from the effects of fire over a relatively short time span (the span of readily

available fire regime data). Variables to be examined are "age of the burn" and "evidence of exposure to fire." Possible combinations are shown in the table below.

Table 2. Hypothesis Two Structure and Expectations

	Evidence of Exposure to Fire	
Age of the Burn	**Yes**	**No**
Within 1 Year	**	
2 to 5 Years	**	
6 to 10 Years	**	
11 to 15 Years	**	
16 to 20 Years	**	

Cells in the table with asterisks are the "expected" combinations. As noted, the age of the burn will be determined based on existing BLM fire data. Evidence of exposure to fire will be assessed as discussed under Hypothesis One.

The ability to determine whether a site has been "burned over" may diminish through time. For instance, if one walks across a site immediately after a fire, one may see exploded artifacts, exposed features, the potential for surface erosion, and so forth. Five years later, the same site may appear quite stable and in good condition because the obvious effects of fire have been masked by vegetation, upward migration of "undamaged" artifacts, and so on. Ultimately, one may not even know that a site has been exposed to a fire. The lingering question is, however, are impacts to eligibility related elements still evident after evidence of the fire itself has been removed?

2.1.3 Hypothesis Three: The effects of fire diminish elements that make a prehistoric site National Register eligible.

Cultural resources management places a heavy emphasis on segregating sites based on their eligibility to the National Register of Historic Places. The question central to Hypothesis Three is whether fire affects those characteristics that make a particular site National Register eligible. In principle, there are four possible combinations of "exposure to fire" and "changes eligibility."

Those combinations are shown in the table below. Cells in the table with asterisks are the "expected" combinations.

Table 3. Hypothesis Three Structure and Expectations

	Changes Eligibility	
Exposed to Fire	**Yes**	**No**
Yes	**	
No		**

Eligibility determinations are based on site specific elements and the relationship of those site elements to an established historic context. Where possible, we rely on the Nevada State Comprehensive Preservation Plan (Lyneis 1982, White et al.1989) as our historic context. Necessarily, we consider State Plan elements in a more "evidential" way than the State Plan itself presents, because the field study cannot observe State Plan *themes*, only *data elements* relevant to such themes. Themes identified in the State Plan that relate directly to prehistoric archaeological sites include settlement, subsistence, chronology, technology, paleo-environment, trade and exchange, beliefs and ideology, and demography. These prehistoric research themes have remained essentially the same for some time.

Regardless of how one approaches any given theme, the archaeologist must discern whether a site contains elements that speak to one or more themes. Given that the present study is interested in effects to qualities that make a site eligible under Criterion D, our interest is in the presence of data elements that can inform on some aspect of prehistory. Data elements central to the determination of site eligibility under Criterion D have been categorized variously. For purposes of the present study, the following elements are recognized:

- Activity areas: items, deposits, and/or surfaces that provide inferences about specific, relevant past activities.
- Chronological indicators: items or deposits that can place the site or individual components in time.
- Structural indicators: spatial relationships among items, deposits, and/or surfaces that can be reconstructed (i.e., site structure) and that provide information on specific, relevant past

activities.

- Economic indicators: floral, pollen, faunal, or other botanical and zoological data relevant to understanding past subsistence practices.
- Source indicators: items whose potential source area(s) can be identified and are relevant to understanding past trade or exchange, mobility, and/or settlement patterns.
- Human remains: evidence of a preserved burial or cremation relevant to understanding beliefs, ideology, or demography.
- Belief indicators: items or deposits that can provide inferences about past beliefs.
- Paleo-environmental indicators: items or deposits or surfaces (natural or cultural) that allow for the paleo-environmental reconstruction of the site, locality, or region.
- Flammable items: containing flammable wooden resources.

The relationship between themes and data elements is shown in the following table. This type of matrix is often used to evaluate the significance of prehistoric resources with regard to Criterion D.

Table 4. Prehistoric Research Themes and Data Elements

	Data Element								
Theme	**Activity**	**Chronology**	**Structure**	**Economic**	**Source**	**Human Remains**	**Beliefs**	**Paleo-environment**	**Flammable**
Settlement	X	X	X	X	X			**X**	**X**
Subsistence	X	X	X	X				**X**	**X**
Paleo-environment		X		**X**				X	
Trade/Exchange	**X**	X			X				
Beliefs/Ideology	**X**	X	X				X		
Technology	X	X							**X**
Chronology	X	X	X						**X**
Demography	X	X	X			**X**	X		

X indicates that site information is necessary to contribute to a research theme.
X indicates that site information is desirable but not always necessary to contribute to a research theme.

Note: A depositional context or primary physical context is assumed for all value-bearing elements.

The current study places an emphasis on the re-assessment of site eligibility based on surface indications. As a result, four of the nine data elements are likely to be measurable in the field. These are activity areas, chronology, structure, and flammability. The first three of those data elements correspond well with guidelines provided in the State Protocol Agreement between Nevada BLM

and SHPO (1999: Appendix G). The protocol places an emphasis on three physical contexts (depositional, temporal, and structural) when determining eligibility. To some degree, all three data elements must be present if a site is to address most themes.

ACTIVITY INDICATORS. Sites supporting items, deposits, and/or surfaces can provide inferences about relevant past activities. Many sites contain discernable activity indicators such as material or task specific stone tool assemblages, stone tool production debris, hearth or cooking feature traces such as fire-cracked rock or charcoal stains, and their distribution across the site. On some sites, these tools, features, and inferred activity areas are spatially discrete. Sites that inform on many research themes (settlement, subsistence, paleo-environment, trade/exchange, ideology, technology, chronology, and demography) most often contain substantial data regarding inferred activities. Single component base and field camps rich in artifacts (ground and flaked stone tools, debitage) and discernable features (hearths, wickiups, rock rings, storage facilities) are considered prime locations for assessing fire effects on activity data elements.

Recording how fire affects activity indicators and surface features is crucial to determining whether this element has been altered measurably. The effects of fire on each previously recorded activity area, concentration, locus, or feature will be reviewed. A tri-partite system of observation will be employed:

- no visible effects;
- limited visible effects (< 50% of the assemblage shows changes, somewhat diminishing its analytical potential); and,
- strong visible effects (> 50% of the assemblage is altered, substantially diminishing its analytic potential).

The following questions will be considered when determining the effect of fire on a site's activity areas.

- Are tools and flakes still present and recognizable as to type, heat-treatment, or have they been cracked, crazed, potlidded, exploded, vitrified, or weathered into unidentifiable fragments?
- Are surface features still identifiable or are they no longer discernable?
- Has fire-cracked rock changed in size and number?

- Has ground stone been noticeably altered by cracking, breaking, exfoliation, disintegration, or charring?
- Has erosion or deposition disturbed evidence of inferred activities?
- Is new information regarding activity areas or features present, through increased site visibility or erosional activity?

The ultimate question is, has fire compromised or destroyed activity areas causing a sufficient loss of integrity such that the site is no longer significant with regard to Criterion D.

CHRONOLOGICAL INDICATORS. This data element is represented at sites that contain datable items, assemblages, or stratigraphic deposits (including charcoal, volcanic ashes). Most research themes are predicated on the knowledge of the time period or range of periods during which a site was occupied. Common temporal indicators include specific projectile point types (Thomas 1981), ceramic types, obsidian hydration rinds, charcoal for radiocarbon dating, trees with non-complacent tree rings for dendrochronology, and, more rarely, archaeomagnetic or other chemical or geomagnetic dating techniques. Most site types recommended eligible under Criterion D contain chronologically diagnostic artifacts or assemblages.

This study proposes to look at effects on chronological indicators in several ways. One will be to collect, source by XRF (if it is not possible to ascribe visibly), and hydrate a sample of diagnostic obsidian tools and debitage collected from revisited sites. As obsidian appears to be highly sensitive to ground fires (Loyd et al. 2002), we will target sites with pre-fire hydration values. Sampling and analysis of obsidian can yield evidence of fire intensity, fire history, and assessments of whether chronological indicators have been adversely affected by fire. Other chronologically diagnostic tool types (projectile points, crescents, ceramics) will be assessed (but not collected) for specific fire damage. A list of temporally diagnostic items will be maintained at each site, with condition recorded, and a collection record will be used when obsidian tools and debitage are collected. We do not propose to collect artifacts other than time-diagnostic obsidian artifacts and obsidian pieces suitable for hydration (whether morphologically time diagnostic or not). The following questions will be addressed at each revisited site.

- Are previously recorded chronological indicators present and in recognizable condition?
- Have existing chronological indicators changed, and in what way(s)?

- Are new chronological indicators present, and what are the possible reasons for this?
- Has the obsidian hydration rind been altered, such that all bands are diffuse or non-existent?

Assessing whether fire actions have or have not altered a site's chronological information potential will be the ultimate goal. The extent of these alterations, if visible or related to obsidian, will also be assessed.

SPATIAL PATTERNING OR SITE STRUCTURE. Effects to site structure will be manifested in physical removal, damage, destruction, movement, selective movement, or burial of site elements (usually activity areas or features) originally mapped and used to recommend significance with regard to site patterning. Effects on the spatial inter-relationship between activity indicators will be assessed. Original site maps will be used in an attempt to relocate and assess relationships. Major geomorphic processes and/or events such as dune movement, rilling, headward erosion of arroyos, sheet wash, and flood deposits will be described for the entire site and for each area where task specific activities are represented. Basic areas of inquiry will include.

- Has the site structure or spatial patterning of tools or deposits changed?
- How is change evident, and does this change effect site integrity?
- Has the site environment changed catastrophically?
- Is there an increase in site structure or site elements related to fire actions?

The location of original features (preferably GPS based) will be compared with revisited GPS locations. Additionally, the site size as noted originally and during the revisit will be compared to assess fundamental change(s) in overall size and site layout.

FLAMMABLE RESOURCES. Flammable prehistoric and ethnohistoric resources such as pinyon gathering poles and hooks, wickiups, drive lines, surrounds, traps, wooden stump mortars, and pinyon caches offer specific at-risk resource types that are usually significant under Criterion D. Measuring effects to these types of features is warranted during this study. Depth of charring (also a way to indicate fire intensity and duration) on pinyon and juniper elements and complete destruction by burning will be noted for these types of resources. However, these resources are quite rare: we will likely revisit them with BLM staff in a targeted fashion.

Assumptions regarding the effects of fire on the four key data elements are provided in the table below. For each intersection of element and effect, a qualitative scale of low (L), medium (M), and high (H) is provided. These represent assumptions about the effect of fire to the particular data element. Each cell can be thought of as an independent hypothesis, though in practice the cells are not likely to be independent of each other.

Table 5. Predicted Fire Effects to Key Data Elements

	Key Data Elements			
Effects of Direct Heat Exposure	**Activity Areas**	**Chronology**	**Structure**	**Flammability**
High intensity	L-H	L-H	L	H
Medium intensity	L-M	L-M	L	H
Low intensity	L	L	L	H

Heat exposure and fuel levels have a variable effect on essential data elements. Generally, high intensity burns are expected to have the greatest effects to:

- certain artifacts and their inferential potential;
- chronological indicators such as obsidian;
- site structure by adding false (root burn) features, new features, or by increasing site size; and
- to flammable features and structures such as drive lines, traps, bow stave trees, wickiups, lean-tos, among others.

Medium intensity fires have slightly less and possibly more variable effects on these same data elements, while low intensity fires (presumably including prescribed burns) are suggested to have the least effect. In all cases, flammable resources are at risk, and in most cases are considered highly valuable data elements.

2.2 Site Selection Process

To obtain a sufficient sample, we will select a sample of sites using the current NVCRIS site

distributions, fire polygons obtained from the BLM Nevada State Office, and assistance from the staff of the Elko and Ely Field Offices. In general, our goal is to select about 100 sites for consideration and then to revisit about 45 to 50 of those sites. Selection criteria include a polythetic set consisting of:

- Use BLM NVSO fire polygons that show fires within the past 20 years (current maps show fire polygons from 1981 through 2002);
- Overlay large area cultural resource inventories on these fire polygons;
- Select inventoried ground within the spectrum of known-age fires;
- Select sites in and near inventoried, burned, areas;
- Sites will be mapped (electronically) and examined for clusters. Clusters are convenient because they save travel time, thus increasing the number of sites it is feasible to record.
- The highest ranked sites will be screened for site record adequacy, to further winnow the possible target sites.
- Examine records and select sites considered eligible under Criterion D, and sites with multiple kinds of archaeological evidence (features, time-diagnostic artifacts, etc.);
- Some criterion D eligible sites located outside burn areas should be selected as control units (the field crew will not be told that these sites are outside of known burn areas);
- Consult with agency staff on the list of prospective sites;
- Add to the list of high priority sites based on recommendations by agency staff;
- Gather records for the target sites;
- The field team will familiarize themselves with the target sites (but not their fire histories) and create a fieldwork agenda.

Prehistoric property types in the Great Basin may be described using Binford's (1980, 1983) classification for observed hunter-gatherer site types. Locations, field camps, and base camps are the three major site types, which can be described quantitatively by looking at the number of tool types, thus inferring the number of activities and the complexity of the site assemblage (Delacorte 1990, Leach 1992). In this study, emphasis will be placed on selecting a sample of base camps or field camps (more likely to be data element rich) that are medium to small size sites. The preferred site size would be about 5 acres (2.7 hectares). A perfectly circular five acre site would have a radius of about 100 m – large enough to be diverse, but small enough to address easily. Sites larger than 5 acres are often so large and complex that they could not be addressed effectively.

A key element to this selection strategy is reviewing the preliminary list with agency staff in the Ely and Elko Field Offices. The field staff will have a good sense of "interesting" sites to visit, and burn areas where fire effects can best be seen. Once the preliminary list has been updated based on its

review by field office staff, it will be reduced to a final list containing approximately 100 sites. This number is more than we can revisit, but it provides a large number of "alternates" in case access to some sites is impossible, sites cannot be re-located, or sites turn out to be inappropriately recorded.

Once selected, sites will be targeted for revisits by the field team. Targeting must also consider the feasibility of traveling to the site, finding it, and making field observations in a timely fashion. Sites that are remote or that are difficult to access will be passed over in favor of other sites, all other things being equal.

We had initially considered selecting sites with known fire exposure histories. This would have included sites exposed to high, moderate, and low fire intensities. Our intent is to keep this information from the field team, creating something of a blind test situation. However, specific fire intensity data is lacking for sites themselves – only general fire intensity is available for particular burn areas. So, there was no way to be precise about degree of heat exposure. Also, micro-topography, vegetation cover, thickness of duff, climate, and other factors create variation in heat intensity across a site. So, characterizing a site as having been exposed to a single heat intensity is probably not appropriate.

The field teams will not be given site fire histories prior to the site visit. We have, however, dropped a strict double-blind methodology. The field crews will invoke the prescribed field protocols. Later, in the office, we will examine whether data element impairment is associated with overall fire regime.

In the long run, assuming that the results of this study are interesting and useful, we recommend the creation of a double-blind methodology and a control study. A control study methodology could be deployed in prescribed burn situations. Sites would be recorded prior to the burn, heat sensing monitors would be installed, the burn would take place, the intensity of the fire would be "measured," and the archaeology would be observed for changes. A series of such studies using the same methodology but in many different settings across the West would be extraordinarily useful. A double-blind method could then be used to test the results of such a study, examining the question of whether one can tell if a site has been exposed to fire and fire management, and whether

or not this alters site significance.

2.3 Field Protocol

Researchers have proposed that fire intensity (heat and length of heat exposure) are the main correlates of damage to archaeological materials themselves. In this study, we examine how damage to archaeological materials and contexts impairs the values that make a site significant. To do this, we will revisit sites that were already recorded but have since been subjected to fire. As a control, we will also revisit nearby sites that have not been subjected to fire.

Field methods will follow a consistent routine at each site chosen. This protocol is outlined in flow chart form below (Figure 1). At each site, the field team will assess whether they have sufficient information to meaningfully review the targeted key data elements. If they do not, then the site will be abandoned for the purposes of this study. Because the study contrasts prior recording to current observations, the first field task after locating the site will be to evaluate the validity of such a comparison. If the prior record does not allow study questions to be addressed, then no valid contrast can be made. If a site is adequately recorded, then the field team will relocate features and other attributes of the site, decide upon a representative location and direction for a 100 m sample transect, and create an observation plan that will estimate the range of variation and dominant effects of fire and fire management.

At each site included in the study, the team will place a 100 m transect. Observations will be made every 5 m along the 100 m line. The observation points will encompass approximately a 1 m radius around the appropriate meter and record whether fire effects are evident, and if so, in what way or ways. Figure 2 shows an observation recording sheet. The 100 m transect samples (21 per transect) create comparable information across all visited sites.

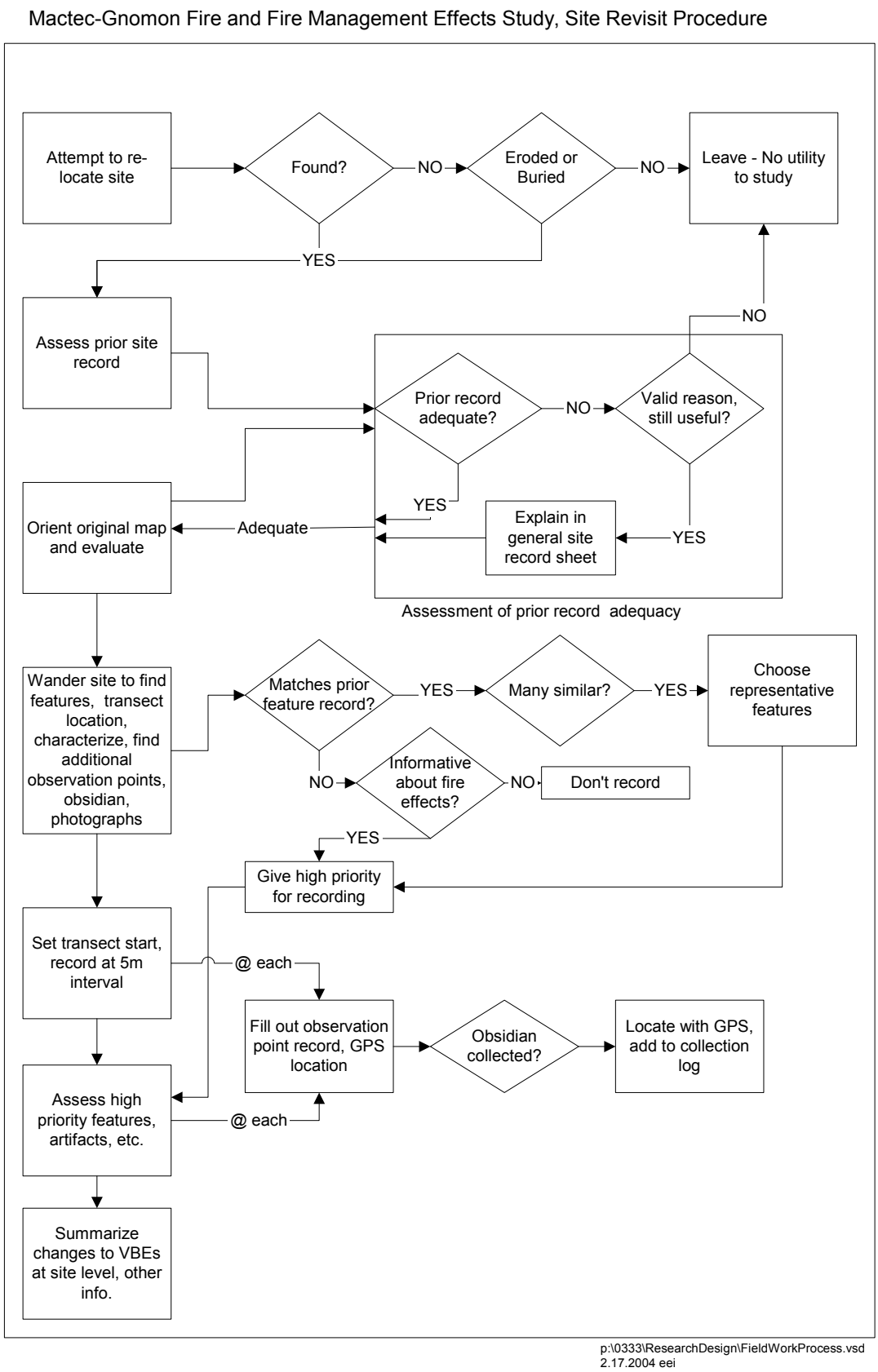

Figure 1. Fieldwork process.

Features, concentrations, and other site attributes are also of interest. These will be relocated from the field maps and assessed. As Figure 1 shows, sites with many features of the same type will not have each feature revisited and recorded – a representative selection will be made by the field team. The same observations noted at transect points will be made at features, and activity areas.

Because obsidian hydration is such an important technique for dating sites, and it is known to be affected by heat exposure, the team will collect samples of obsidian when encountered. We are especially interested in collecting obsidian from sites that burned after obsidian artifacts were already collected. Apparently, several sites in the Elko District will be useful for this (W. Fawcett, personal communication). All collected artifacts will be listed in a log, and their location will be recorded with resource grade GPS.

At each observation point, an analysis sheet will be completed. Artifacts will be collected for obsidian hydration as appropriate. Observation points and collected artifacts will be recorded with resource grade GPS measurements, with each measurement keyed to the observation records (or individual artifact). The location of all observation points will be taken with resource grade GPS units. Other recording that will be done at the site will be to take representative photographs, assess whether the site needs to be re-recorded, and determine whether the NRHP status ascribed to it might be inappropriate.

A general site summary will be made in addition to each observation point. Figure 3 shows the site summary sheet. We are especially interested in the data element summary at the bottom of the recording form, where the field team will assess whether data elements once recorded at the site have changed in some way. These will become part of the analytical process, a brief glimpse of which can be seen in Table 6.

Revisited sites will not be fully rerecord. However, we will note whether the site records need to be completely redone, updated, or a new map made. The study records will be attached to the site records already in electronic form in NVCRIS, and hard copies will be sent to the appropriate repository to append to the paper file.

Table 6. Example Assessment of Pre and Post-visit Presence of Key Data Elements

	Key Data Elements Pre-visit (P), Re-visit (R)							
	Activity Area		Chronology		Structure		Flammable	
Theme	P	**R**	P	**R**	P	**R**	P	**R**
Settlement	X	**X**	X		X	**X**	X	
Subsistence		**X**				**X**		
Paleo-environment								
Trade/Exchange	X		X					
Beliefs/Ideology								
Technology	X	**X**	X	**X**	X	**X**		
Chronology	X		X					
Demography							X	

X indicates information originally recorded and documented on IMACS and in report.
X indicates information now present, or if blank, not present.

2.4 Limitations of the Current Study

There are several important limitations to this study. First, the field study concentrates on prehistoric archaeological sites and materials. These are the majority of archaeological sites known in the Great Basin and they are the sites most frequently evaluated with respect to Criterion D of the National Register.

Second, some data elements will not be studied systematically. We propose to study only those that can be assessed based on the surface archaeology. Other data elements could only be evaluated through detailed excavation. A second reason for eliminating some data elements is that we will have no baseline on which to base a comparison. For instance, a site might have contained floral remains prior to a fire, but because the site was never excavated we have no knowledge of its presence or its relationship to site eligibility. We think it wiser to focus on the few, key data elements that are most often cited in arguments about the National Register eligibility of surface archaeological sites.

This leads to a third limitation; the prior record of each visited site. We will rely on prior recordings to tell us about data elements present at each site. Sometimes these records are spotty or poor; in other records, no good consideration of the data elements can be found, although the record may be exemplary otherwise. Evidence of burning and impairment of data elements will necessarily be informed conjecture. The best records for study would be those that have already been through the formal National Register nomination process at the state and federal level; these sites are likely to have had the most thorough field investigation.

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Figure 2. Fire Effects Assessment Study – Field Observation Record
Attached as separate file "recordingsheetnewest"

Figure 3. Fire Effects Assessment Study – Site Summary Record
Attached as separate file "recordingsitesheetnewest"