

DEFINING A VISUAL AREA OF POTENTIAL
EFFECTS TO HISTORIC PROPERTIES
ON BLM LANDS IN NEVADA

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ADMINISTRATIVE SUMMARY

When assessing visual effects to Historic Properties, the Bureau of Land Management, Nevada (BLM Nevada) analyzes the potential of a proposed project to visually effect the characteristics of a property that make it eligible for the National Register of Historic Places. Defining the Visual Area of Potential Effect (V-APE) from the point of new construction to a defined distance away from the constructed features in which visual effects are considered acute enough to adversely affect the setting and/or feeling of an historic property can be highly subjective and arbitrarily set due to a lack of information on the distance in which adverse visual effects are not likely to occur. BLM Nevada has developed this guide to assist in defining a V-APE for large-scale projects including 500kV and 230 kV transmission lines, Photo Voltaic (PV) or parabolic solar projects, wind turbine projects, and mining Plans of Operations that is based in science to attempt to remove as much as possible the subjective and arbitrary nature of the current individual process in place to define V-APEs. The process described below combines the methods used to analyze visual contrast with the process for assessing adverse effects to historic properties. Data used in the final template V-APE recommendations are based on the previous research sponsored by Argonne National Laboratory, BLM Nevada's own in-field research on built-facilities in southern Nevada, and on the mathematical principle known as the intercept theorem, or basic proportionality theorem. This process allows cultural resources specialists to consistently define reasonable V-APEs for these large-scale project types. BLM Nevada finds that adverse visual effects are not likely to occur in most instances beyond 3 miles from the centerline (6 miles total width) of either lattice or monopole 500kV transmission lines, 1.5 miles (3 miles total width) of either lattice or monopole 230kV transmission lines, and 0.5 miles (1 mile total width) for wooden monopole transmission lines. We also find that PV-parabolic solar projects without a power tower have a low potential to cause adverse visual effects beyond 5 miles from the edge of the Direct Effects boundary. Wind turbines with blade tips up to 300-400 feet in height are not likely to cause adverse visual effects beyond 12 miles. Geothermal facilities, including wells and pipelines, are not likely to cause adverse visual effects beyond 2 miles. For hard rock

mining facilities, a general guide based on maximum height of the waste rock pile is 6 miles for 750' tall piles, 4 miles for 500' tall piles, and 2 miles for 250' tall piles. These recommendations are summarized in the table below.

Undertaking Type	Recommended NTE Visual APE Distance
230kV transmission lines	1.5-mile radius (3-mile total width)
345kV and 500kV transmission lines	3-mile radius (6-mile total width)
50-70' wooden monopole transmission lines	0.5-mile radius (1-mile total width)
Solar Energy Fields (PV or Parabolic Trough)	5 miles
Wind Turbine Energy Fields up to 400 feet	12 miles
Geothermal Power Plants, Wells, and Pipelines	2-mile radius around plant or 0.5 mile around individual plant / well / pipeline – BPT = .40 inch
Mining Plans of Operation 750' High Waste Rock Pile	6 miles – BPT = .71 inch
Mining Plans of Operation 500' High Waste Rock Pile	4 miles – BPT = .71 inch
Mining Plans of Operation 250' High Waste Rock Pile	2 miles – BPT = .71 inch
Mining Exploration – Temporary with Immediate Reclamation	Same as physical disturbance APE

BPT: Apparent size of facility based on Basic Proportionality Theorem

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PURPOSE OF THE VISUAL EFFECT APE ANALYSIS

Over the past few years, the BLM's Nevada State Office has noticed that the V-APEs being defined for individual undertakings are highly variable and inconsistent, despite the fact that many Nevada landscapes are similar in character and project designs are nearly identical. Other issues that have been noted include the disagreement between the BLM and various consulting parties on the distances to reasonably address adverse visual effects. This leads to highly uncertain costs and time frames necessary for completion of the Section 106 process.

For example, prior to federal agencies consulting with their State Historic Preservation Office (SHPO) on eligibility and effect, the 36 CFR § 800 regulations are designed to allow Authorized Officers, following appropriate consultation, to determine three steps required under 36 CFR § 800.4: (1) define the APEs; (2) review previous work within the APEs; and (3) make a reasonable effort to record and report on the cultural resources that might be adversely affected within the APEs using the appropriate property types (site, structure, building, object, district) determined by the Authorized Officer.

Importantly, federal agencies are not required to design these identification efforts to ensure that all potential historic properties are identified, evaluated for the National Register, and assessed for adverse effects within the APEs, nor to identify, evaluate, and assess effects to cultural resources located outside of the APEs. Rather, the regulations call for Authorized Officers to make a reasonable and good faith effort to identify, evaluate, and assess effects to historic properties within APEs based on a holistic, multitude of factors that include, but are not limited to, size and scope of the undertaking, level of federal involvement and control over the lands involved, and potential to actually cause adverse effects within the delineated APEs (see the Advisory Council on Historic Preservation's (ACHP) *Meeting the "Reasonable and Good Faith" Identification Standard in Section 106 Review*).

Authorized Officer agreement with a SHPO, tribes, other consulting parties, and the public are not required to move the Section 106 process forward on the initial three steps noted above, and there is not a formal dispute resolution process if disagreements occur among the parties, although any agency, individual, or

organization may request an advisory opinion from the ACHP on BLM's determinations under 36 CFR § 800.9. As a result, following appropriate consultation, once an Authorized Officer makes his/her determinations on these three initial steps, then the required pedestrian surveys, collection of additional information, production of reports, preliminary acceptance of the report recommendations from the cultural contractor/permittee on eligibility and effect, and finally submission of the reports to a SHPO seeking concurrence on eligibility and effect ensues.

The 36 CFR § 800.4-5 regulations then provide opportunities for a SHPO to dispute an Authorized Officer's findings of eligibility and effect. Disputes involving eligibility of the property types (site, structure, building, object, or district) determined by the Authorized Officer during initial steps 1-3 can be sent to the Keeper, who makes a final determination of eligibility rather than the Authorized Officer. Disputes involving an agency determination of 'no historic properties affected' or a 'finding of no adverse effect' can be disputed to the ACHP for advisory comment, after which the agency makes final determinations of effect. 36 CFR § 800.6 then provides an opportunity for a SHPO to dispute the terms of a memorandum of agreement to resolve any identified adverse effects to the ACHP. All of these disagreements and disputes can, and have, resulted in substantial delays and costs to project approvals, especially large-scale infrastructure projects critical to the health and well-being of the citizens of the United States, as well as projects such as hard rock mining Plans of Operations that are the backbone of Nevada's rural economies.

The purpose of this study, therefore, is to establish written guidance and justification for BLM Nevada's Authorized Officers to establish reasonable V-APEs for specific undertaking types in the hope of minimizing delays in project permitting while also providing reasonable preservation and management strategies for cultural resources within BLM's overall multiple-use mandate.

BACKGROUND – THE SECTION 106 PROCESS

In accordance with Section 106 of the National Historic Preservation Act of 1966 (Public Law 89-665 as amended) (NHPA) codified at 54 U.S.C. 306108 “The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, shall take into account the effect of the undertaking on any historic property...”

The appropriate Authorized Officer, the agency’s line manager who will be making the decision for the undertaking, determines whether the undertaking has the potential to effect Historic Properties. If the Authorized Officer determines that there is no potential to effect Historic Properties, then the agency has no further obligations under the NHPA.

If the Authorized Officer determines that an undertaking does have the potential to effect Historic Properties, then the process outlined in the regulations found in 36 CFR § 800 are implemented in order to take into account potential adverse effects of the undertaking on Historic Properties.

Section 106 Process

1. Identify Historic Properties (36 CFR § 800.4)
 - a. Determine the Scope of Identification
 - i. Define the Area of Potential Effect
 - ii. Review Existing Information within the APE
 - iii. Seek Information from Consulting Parties
 - b. Identify Historic Properties
 - c. Evaluate Historic Significance
2. Apply Criteria of Adverse Effect (36 CFR § 800.5)
3. Resolve Adverse Effects (36 CFR § 800.6)

IDENTIFY HISTORIC PROPERTIES (36 CFR § 800.4)

Agencies are required to make a "reasonable and good faith effort" to identify Historic Properties that may be directly or indirectly affected by the undertaking, evaluate identified property types to the National Register, and take into account adverse effects to Historic Properties in their decision-making process. This reasonable and good faith effort does not require federal agencies to identify and evaluate all historic properties that may exist within the APEs.

DETERMINE THE SCOPE OF IDENTIFICATION

In accordance with 36 CFR § 800.4, the Authorized Officer determines the scope of the identification efforts, in consultation with the SHPO, and takes the action(s) necessary to review and seek information from others that may have knowledge regarding Historic Properties within the APEs. As organized within the regulations, this process includes three steps, although during implementation of Step 3 below two "sub-steps" are carried out in practice: (1) define the APEs; (2) review previous work within the APEs, and reach out to consulting parties, tribes, and the public that are likely to have knowledge of, or concerns with, potential Historic Properties within the APEs; and (3) using the information gathered in step 2, make a reasonable and good faith effort to Identify Historic Properties.

STEP 1: DEFINE THE AREAS OF POTENTIAL EFFECT

The Authorized Officer determines the undertaking's APEs, in consultation with the SHPO, tribes, and as appropriate, other consulting parties and the public. The APEs are influenced by the scale and nature of an undertaking, as well as factors such as topography and vegetation that, for example, might obscure the visibility of an

Historic Property

Historic Property is any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records and remains that are related to and located within such properties.

36 CFR § 800.16(l)

undertaking, thereby impacting the potential for visual effects from specific vantage points. APEs may be different because of differences in the kinds of effects potentially caused by the undertaking (e.g. physical versus visual effects). BLM Nevada's Protocol (December, 2014) defines visual, atmospheric, auditory, and some types of physical effects as "Indirect". Thus, when working under Nevada's Statewide Protocol rather than the 36 CFR § 800 regulations, these effects are considered "Indirect". However, many agencies, SHPOs, and the ACHP are moving toward defining visual, atmospheric, and auditory effects as "Direct" effects along with all physical effects (e.g., earth disturbance, blasting impacts etc.). Thus, when working under the 36 CFR § 800 regulations, it may be prudent to define these types of effects as "Direct". The remainder of this document simply refers to "Visual Effects" and does not define them further as either "Indirect" or "Direct" for this reason.

Once the APEs have been defined, if there is a revision to the project plans there may also need to be a revision of the APE boundaries. APEs are generally not influenced by presence and absence of resources, either during their initial delineation nor following results of pedestrian surveys, although under certain circumstances they can be at the discretion of the Authorized Officer.

The agency is required to document its determination of the APEs. The general standard for documentation is that the Authorized Officer shall

Areas of Potential Effect

The Areas of Potential Effect are the geographic areas within which an undertaking may directly or indirectly cause alterations in the character or use of Historic Properties, if any such properties exist.

36 CFR § 800.16(d)

The APEs should take into account:

- all locations where the undertaking may result in disturbance of the ground;
- all locations from which elements of the undertaking may indirectly affect Historic Properties;
- all locations where the activity may result in changes in traffic patterns, land use, public access, etc.; and

At a minimum, projects may have different APEs for direct and indirect effects. There may be others depending on other types of effects anticipated for an undertaking.

ensure that a determination, finding or agreement is supported by sufficient documentation to enable any reviewing parties to understand its basis.

Determination of an APE does not mean that Historic Properties are located within that area and that those properties will *de facto* be adversely affected. The APEs are simply the area that if Historic Properties are located, then they may be affected by the undertaking.

STEP 2: REVIEW EXISTING INFORMATION WITHIN THE APES

Once any necessary APEs have been established, the next step is to determine what is already known about the area. This process should include reviewing existing records and conferring with consulting parties who might have knowledge of resources in the APEs and concerns regarding the undertakings potential to affect Historic Properties.

Some helpful questions to ask to determine the nature and type of identification effort that is going to be necessary for the undertaking include:

Have the APEs been inventoried before?

Are there documented Historic Properties Present within the APEs?

What do we know about Historic Properties in the APEs?

Who should we talk to learn more about Historic Properties in the APEs?

Recording and Reporting Identification Efforts

On BLM-managed lands in Nevada, the recording and reporting standards are codified in two separate documents: *Guidelines and Standards for Archaeological Inventory* and *Guidelines for Recording and Reporting Architectural Resources in Nevada*. These standards are required by all archaeologists (private sector and federal) and are a required stipulation in Survey and Recordation Permits issued by the BLM Nevada State Office under the authority of the Federal Land Policy and Management Act. As such, they are the required standards for recording and reporting archaeological and architectural resources whether an undertaking is being handled under the Statewide Protocol Agreement or the 36CFR800 regulations.

What further actions will we need to take to fill in gaps in our knowledge?

Have Historic Properties within the APEs undergone mitigation during previous undertakings?

STEP 3: IDENTIFY HISTORIC PROPERTIES

Sub-step 1: Based on the information gathered during the process to this point the Authorized Officer, in consultation with the SHPO, tribes, and as appropriate other consulting parties and the public, defines the effort to identify, record, and report potential Historic Properties within the APEs. When determining what the identification effort is going to look like the Authorized Officer shall take into account: (1) past planning, research and studies; (2) the magnitude and nature of the undertaking; (3) the degree of Federal involvement; (4) the nature and extent of potential effects on historic properties; and (5) the likely nature and location of historic properties within the APEs. The Authorized Officer should also consider other applicable professional, State, tribal and local laws, standards and guidelines. No single factor listed above 'overrides' all others, and thus the Authorized Officer takes a holistic approach to determining what constitutes a reasonable and good faith effort to Identify Historic Properties on a case-by-case basis. As noted earlier, there is no requirement to ensure that ALL potential historic properties (sites,

Integrity of Cultural Resources

Location is the place where the historic property was constructed or the place where the historic event occurred.

Design is the combination of elements that create the form, plan, space, structure, and style of a property.

Setting is the physical environment of a historic property.

Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.

Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.

Feeling is a property's expression of the aesthetic or historic sense of a particular period of time.

Association is the direct link between an important historic event or person and a historic property.

National Register Bulletin 15:
(U.S. NPS, 1997)

buildings, structures, objects, or districts = known as Property Types) nor ALL potential effects are included in the determination of what will constitute the “reasonable and good faith standard” to identify and assess effects to historic properties.

The Authorized Officer shall also take into account any confidentiality concerns raised by Indian tribes. This effort must represent a reasonable and good faith effort and may include background research, consultation, oral history interviews, sample field investigation and/or field survey.

Sub-Step 2: The evaluation of historic significance is to determine which cultural resources (or which Property Types determined by the federal agency to record and report through Sub-step 1) within the APEs are Historic Properties and thus subject to further Section 106 review. The agency official is responsible for evaluating the historic significance of identified properties against the National Register criteria. This evaluation is guided by the *Secretary of the Interior's Standards and Guidelines for Evaluation* and carried out in consultation with the SHPO and any Indian tribe that attaches religious and cultural significance to the property. In order for a cultural resource to be defined as a Historic Property it must meet at least one of the National Register criteria for evaluation as defined in 36 CFR § 60.3: (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (d) that have yielded, or may be likely to yield, information important in prehistory or history. A district, site, building, structure or object is considered significant if it meets one of the four criteria and the property maintains integrity of Location, Design, Setting, Material, Workmanship, Feeling and Association.

A Historic Property must have the ability to convey its significance. If a property cannot convey its significance, then it does not retain integrity and is not eligible for the NRHP

under any criteria. If a cultural resource is not included in or eligible for inclusion in the National Register, it is not a Historic Property and effects to that resource do not need further consideration under the NHPA.

APPLY CRITERIA OF ADVERSE EFFECT (36 CFR § 800.5)

The purpose of this step is to determine the nature of the impacts of an undertaking to Historic Properties. Agencies do this by applying criteria of adverse effect prior to making a formal finding of “no adverse effect” or “adverse effect.”

When assessing visual effects to a Historic Property it is critical to understand how integrity is assessed to determine a property’s significance. Integrity is based on significance: why, where, and when a property is important. Ultimately, the question of integrity is answered by whether the property retains the identity for which it is significant.

An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property.

Authorized Officers should take the necessary steps to Avoid or Minimize effects to Historic Properties to the extent practicable to come to a No Adverse Effect determination. To reach this conclusion, it is helpful to ask the following questions:

Does the proposed project comply with BLM’s multiple use mandate?

Is the proposed project required by law, regulation, or policy?

Effect vs Adverse Effect

Effect means alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register.

36 CFR § 800.16(i)

An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association. . . .

36 CFR § 800.5(a)(1)

Can the project be moved to a different area to avoid affecting the Historic Properties?

Can the project be altered to minimize impacts to the Historic Properties?

RESOLVE ADVERSE EFFECTS (36 CFR § 800.6)

Historic Properties within the APEs for the undertaking do not necessarily need to be preserved, however, any adverse effects need to be taken into account prior to authorization of the undertaking.

If a determination of Adverse Effect is made for an undertaking, the agency works with the consulting parties to seek a solution that takes into account the adverse effect. The result of this effort is a Memorandum of Agreement (MOA) that details the measures agreed upon by the agency and the consulting parties, identifies who is responsible for carrying them out and provides documentary evidence that the agency has met the requirements of Section 106. The Authorized Officer shall ensure that the terms identified in the MOA are carried out.

ASSESSING VISUAL EFFECTS

One of the difficulties in defining a V-APE comes from disagreements between consulting parties regarding the distance from a Historic Property at which structural additions to the landscape begin to diminish the visual integrity of a property's significant features. Most of the time these arguments are based on differences of experience in working with different types of projects, as well as the subjectivity and opinions of what constitutes an adverse visual addition to the landscape between individuals. These disagreements can therefore lead to "erring on the side of caution" and developing unreasonably large APEs for assessing visual effects.

The simple fact that an addition may be seen does not mean that it has the potential to cause adverse visual effects to Historic Properties. An adverse visual effect to a Historic Property would need to be acute to the point that a visual element introduced into the viewshed of the property diminishes the property's ability to convey its significance. In other words, if a property is eligible because the viewshed is a major contribution to its significance and an introduced element obstructed the view in such a way that the view's integrity was acutely compromised, that likely constitutes an adverse visual effect to a Historic Property.

VISIBILITY DOES NOT EQUAL ADVERSE EFFECT

What characteristics of a Historic Property are sensitive enough that a visual addition into the viewshed can diminish a property's ability to convey its significance? To answer this question BLM Nevada reviewed each of the 7 Aspects (or Qualities) of Integrity, and then evaluated the potential effects of a visual element introduced into the viewshed of a Historic Property. Table 1 reflects the results of this assessment.

Table 1. The 7 Aspects of Integrity and the Effects of Visual Additions to the Landscape

Aspect/Quality	Effects of Visual Additions to the Landscape
Location	It is impossible for visual elements introduced into the viewshed of a Historic Property to affect the location of the property.
Design	Visual elements introduced into the viewshed of a Historic Property would not affect the integrity of design unless the design of the property incorporated the view from the property. In the circumstance where the landscape has been incorporated into the design of the Historic Property then the Adverse Effect Criteria should be applied.
Setting	Visual elements introduced into the viewshed of a Historic Property may affect the setting of a property and the Adverse Effect Criteria should be applied to Historic Properties for which setting is a quality that contributes to its National Register Eligibility.
Materials	It is impossible for Visual elements introduced into the viewshed of a Historic Property to affect the materials of the property.
Workmanship	Visual elements introduced into the viewshed of a Historic Property cannot affect the workmanship of the property.
Feeling	Visual elements introduced into the viewshed of a Historic Property may affect the feeling of a property and the Adverse Effect Criteria should be applied to Historic Properties for which feeling is a quality that contributes to its National Register Eligibility.
Association	Visual elements introduced into the viewshed of a Historic Property would not affect the integrity of association if the intrusion would not alter the property's link with its associated significant event or person. This scenario is unlikely to occur unless the association is between the property and another property for which an unobstructed view is necessary.

With this understanding, the assessment of visual effects to Historic Properties only needs to be carried out when the property maintains integrity of Setting and Feeling, and possibly Association (when the view is required to maintain that association) and/or Design (when the view is integral to integrity of the design of the property). If the integrity of these aspects is missing or the property is only eligible for the location and materials of the site, then adverse visual effects are highly unlikely. If the integrity of one or more of these aspects is present, then visual effects to that property need to be addressed.

HOW DO YOU MEASURE A VISUAL EFFECT?

BLM Handbook 8431 contains the Visual Resource Contrast Rating System, which is one way to rate visual impacts. This rating system looks at the Form, Line, Color and Texture of Landscape then assesses the degree of contrast between the landscape that is present, and those elements introduced by the project. Handbook 8431 provides the following guidance on assessing this contrast:

Form. Contrast in Form results from changes in the shape and mass of landforms or structures. The degree of change depends on how dissimilar the introduced forms are to those continuing to exist in the landscape.

Line. Contrast in Line results from changes in edge types and interruption or introduction of edges, bands, and silhouette lines. New lines may differ in their sub elements (boldness, complexity, and orientation) from existing lines.

Color. Changes in value and hue tend to create the greatest contrast in Color. Other factors such as chroma, reflectivity, and color temperature also increase the contrast.

Texture. Noticeable contrast in Texture usually stems from differences in the grain, density, and internal contrast. Other factors such as irregularity and directional patterns of Texture may affect the rating.

The rating is completed by determining the degree of contrast for each element of the proposed action. Table 2 shows the general criteria and factors used when rating the degree of contrast.

Table 2. The Degree of Contrast and their criteria in BLM's Visual Resource Contrast Rating System

Degree of Contrast	Criteria
None	The element contrast is not visible or perceived.
Weak	The element contrast can be seen but does not attract attention.
Moderate	The element contrast begins to attract attention and begins to dominate the characteristic landscape.
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

This process is generally adequate at defining the level of contrast anticipated between the existing environment and the new anticipated additions to the landscape. However, it is complicated and lacks the consistency between observers necessary to adequately address visual effects to Historic Properties.

The rating system developed by Argonne National Laboratory for their Visual Contrast Threshold studies is based on the BLM's Visual Contrast Rating system outlined above, but it provides a six (6) level rating system (Table 3) and definitions that allow for a more robust discussion in its potential application to assessing visual effects under Section 106. In short, it takes the Weak, Moderate and Strong contrast ratings of the BLM system, divides them in half and provides sound definitions of what each rating means. This system provides for more consistency between observers, thus reducing the amount of subjectivity introduced by the evaluator (Sullivan et al. 2013; Sullivan et al. 2014a; Sullivan et al. 2014b). That said, the recommendations made in these studies are meant to address the BLM's assessment of Visual Resources, and not to address adverse effects to Historic Properties under NHPA *per se*, so there remains a substantial difference between the objectives of the two programs. Nevertheless, BLM

Nevada has concluded that the visibility levels developed by Argonne for these studies provides a reasonable standard that can assist in defining 'template' V-APE distances under the NHPA based on Argonne's and our in-field studies that are discussed in detail below.

Table 3. The definitions of the six levels of contrast developed by Argonne National Laboratory. These six definitions and levels (1-6) are used below in the development of BLM Nevada's final template visual APEs under Section 106 based on Argonne's and our in-field studies, as well as the basic proportionality theorem described in more detail below.

VISIBILITY RATINGS PER ARGONNE NATIONAL LABORATORY

Visibility Level	Definition	Instructions
1	Visible only after extended, close viewing; otherwise invisible.	An object/phenomenon is near the extreme limit of visibility. It could not be seen by a person who was not aware of it in advance and looking for it. Even under those circumstances, the object can only be seen after looking at it closely for an extended period of time.
2	Visible when scanning in general direction of study subject; otherwise likely to be missed by casual observer.	An object/phenomenon is very small and/or faint, but when the observer is scanning the horizon or looking more closely at an area, it can be detected without extended viewing. It could sometimes be noticed by a casual observer; however, most people would not notice it without some active looking.
3	Visible after brief glance in general direction of study subject and unlikely to be missed by casual observer.	An object/phenomenon can be easily detected after a brief look and would be visible to most casual observers, but without sufficient size or contrast to compete with major landscape elements.
4	Plainly visible, could not be missed by casual observer, but does not strongly attract visual attention, or dominate view because of apparent size, for views in general direction of study subject.	An object/phenomenon is obvious and with sufficient size or contrast to compete with other landscape elements, but with insufficient visual contrast and insufficient size to strongly attract visual attention.

5	Strongly attracts visual attention of views in general direction of study subject, but not the most prominent or dominant feature in the view. Attention may be drawn by strong contrast in form, line, color, texture, or luminance.	An object/phenomenon contrasts with the surrounding landscape elements so strongly that it is a major focus of visual attention, draws viewer attention immediately and tends to hold viewer attention, but is not prominent enough to dominate the view. In addition to strong contrasts in form, line, color, texture, and luminance (such as reflections) associated with the study subject, it may contribute substantially to drawing viewer attention. The visual prominence of the study subject interferes noticeably with views of nearby landscape elements.
6	Dominates view because of structure or facility size (for views in its general direction) and strong contrasts in form, line, color, texture, or luminance.	An object/phenomenon with strong visual contrasts that is of such large size that it is the major focus of visual attention and dominates the view. The large apparent size is a major factor in its view dominance. In addition to size, contrasts in form, line, color, and texture, bright light sources associated with the study subject may contribute substantially to drawing viewer attention. The visual prominence of the study subject detracts noticeably from views of other landscape elements.

WHEN IS A VISUAL INTRUSION A POTENTIAL ADVERSE EFFECT UNDER NHPA?

Earlier in the paper we established that for a visual intrusion to become an adverse effect to a Historic Property it must diminish the property’s ability to convey its significance. We also established that just because you can see a new infrastructure project recently added to a landscape does not mean that it is causing adverse effects.

Generally, according to the evidence presented herein, when the degree of contrast of a visual addition to the landscape is non-existent or weak (1 or 2 on the Argonne Scale; see Table 3 above) then the addition is likely to cause **no effect** to Historic Properties because the project is likely to be missed by the casual observer. When the degree of contrast is visible but does not strongly attract the viewer’s attention (3 or 4 on the Argonne Scale; Table 3 above) then the addition is likely to cause **no adverse effect** to Historic Properties because the effects have insufficient visual contrast and size to strongly attract the attention of the viewer. When a visual addition begins to dominate the view (5 or 6 on the Argonne Scale; Table 3 above) then those visual effects are

likely to cause **adverse effects** to Historic Properties, provided that the effects are to elements of the property that contribute to its eligibility.

BLM Nevada's goal is to define a Section 106-relatable rating scale and correlate distances that do not simply 'catch the eye' of a casual observer, but either dominates or acutely impacts the view of that observer. BLM Nevada's position is that simply 'catching the eye' of a casual observer should not be used to define reasonable V-APE boundaries nor assume an adverse effect under the NHPA. Argonne's description of their Visibility Level 3 (Table 3) is: "An object/phenomenon can be easily detected after a brief look and would be visible to most casual observers, but without sufficient size or contrast to compete with major landscape elements". Distances that correlate with Visibility Level 3, then, are visible to the casual observer but do not compete with major elements of the landscape. This is not a reasonable definition of adverse visual effects under Section 106 in the mindset of BLM Nevada, and, as a result, distances that correlate with Visibility Level 3 will generally not cause adverse effects and would therefore constitute an unreasonably large V-APE.

Argonne's Visibility Levels 5 or 6, on the other hand, are those that dominate the viewshed, and therefore distances associated with these ratings are most likely to cause adverse visual effects under the NHPA. The true "middle of the road" is Argonne's Visibility Level 4, in which additions are 'plainly visible and could not be missed by a casual observer, but they do not strongly attract visual attention or dominate a view because of apparent size'. BLM Nevada's position is that distances associated with Visibility Level 4 would generally not cause effects of an acute nature to be considered adverse, but that possibility may exist in some cases. However, our in-field studies indicate that "getting into the weeds" with Visibility Level 4 is largely moot because, for example, and as will be shown below, the potential for adverse visual effects caused by 500kV transmission lines drops off dramatically after 3 miles. Thus, 3 miles from a 500kV transmission line will generally display a Visibility Level of 5 with clear potential to cause adverse visual effects, while 4 miles distant generally results in a Level of 2 or 3 with improbable potential to cause adverse effects. Therefore, from one mile marker to the next, the degree of visual impact is not necessarily slow and

gradual, from a 6, then a 5, then a 4, then a 3, and so forth, rather degree of impact drops off dramatically at some point distant from the project.

It was noted above that Argonne's six Visibility Levels are partly based on apparent size of the project from the casual observer at various distances from the project. A person standing directly below a 120 foot tall transmission tower will sense a 100+ foot tall object. As the observer moves away from the tower, it appears progressively smaller in size. All things being equal, the apparent size of an object at points distant from it can be predicted by applying the 2,500-year old intercept theorem, or basic proportionality theorem (BPT), developed in ancient Greece. BPT's basic formula as applied to our analysis is:

$$\text{size of } x = (\text{distance to } x)(\text{size of } y) / \text{distance to } y$$

where distance to x = arm's length (standard = 30 inches); size of y = height of infrastructure; and distance to y = distance from infrastructure. All inputs must be in the same unit e.g. inches.

In this scenario, if an observer holds a dime in the hand of their outstretched arm, then the dime would cover the object of an apparent size of .75 inches or less, a nickel would cover an object of .87 inches or less, and a quarter 1.0 inch or less. While this method does not account for multiple objects in a line such as a transmission line, it is another tool in the arsenal that adds a degree of predictability and science to the process of determining reasonable V-APEs. This method has been used successfully for several years in BLM Nevada's Winnemucca District Office (WDO) during consultations on V-APEs. In the experience of WDO archaeologists, apparent size of .75 inches or less (the size of a dime in an outstretched arm) are not likely to cause adverse visual effects, and it is this value that is the target when incorporating data using the BPT below in conjunction with Visibility Ratings and standard photographs of existing visual landscapes at various distances from already-built projects.

SUMMARY OF ARGONNE AND BLM NEVADA SECTION 106-RELATED OBSERVATIONS AND BPT CALCULATIONS

At what distance would the visibility level of an undertaking reach a Level 5 or 6 and/or have a .75 or less value based on the BPT? As noted above, BLM Nevada has determined that this distance should be used in most undertakings involving large-scale transmission lines, PV-parabolic solar projects, wind farms, hydrothermal plants, and mining Plans of Operation, as well as smaller-scale transmission lines such as single wooden poles, as the Not-To-Exceed (NTE) distance to define the V-APE for that undertaking. Beyond that distance, the visibility effects are not likely to cause adverse visual effects. These NTE distances may be reduced along all or part of an undertaking to the “visible horizon” if that horizon is a shorter distance than the NTE distance. For example, it would be unreasonable to maintain a 3-mile from the centerline V-APE for a 500kV transmission line of 150 feet in height travelling through a box canyon that is 500 feet in height and which the visible horizon is located 0.5 miles from the centerline. In that case, the V-APE along that section of the transmission line would be reduced from 3 miles to 0.5 miles.

Argonne’s Correlate Distances With Visibility Ratings

Electrical Transmission Lines – 500kV & 230kV

The Average Visibility Rating (AVR) documented for 500kV lattice tower electrical transmission facilities reached Level 5 (major attractant of visual attention) at distances up to 3 miles and reached Level 3 (visible after a brief glance) at distances of up to 10 miles. 500-kV lattice tower facilities were visible up to 17 miles, however beyond 11 miles facilities were judged to be too small and faint to even be noticed by most casual observers (Sullivan et al. 2014a).

The AVR documented for 500kV monopole electrical transmission facilities reached Level 5 at distances up to 2.5 miles, which is only slightly less than the values for 500kV lattice tower facilities at that distance, but reached Level 3 at distances of

approximately 5 miles, which is considerably less than that for lattice tower facilities. The 500kV monopole facilities maximum visibility distance for this study was 11 miles (Sullivan et al. 2014a).

The AVR documented for 230kV H-frame tower electrical transmission facilities reached Level 5 at distances up to 1.5 miles. The AVR reached Level 3 at distances up to 3.5 miles. Beyond 3.5 miles, the facilities were judged unlikely to be noticed by casual observers, and, even when skylined, were nearing the limit of visibility at distances beyond 6.5 miles. The maximum visibility distance for these types of facilities was observed at 8 miles (Sullivan et al. 2014a).

The AVR documented for 230kV monopole electrical transmission facilities reached Level 5 at a distance of 1 mile. The AVR reached Level 3 at distances of about 2.5 miles. However, the study here had few data points, and the view was cut off beyond 3.5 miles because of topography and access restrictions (Sullivan et al. 2014a).

Wind Turbines

Sullivan et al. (2013) analyzed 5 wind farm facilities that contained between 34 – 274 individual turbines. Blade tip height of the turbines analyzed ranged between 300 - 400 feet in height. The overall AVR documented for wind turbine electrical generation facilities reached Level 5 at a maximum distance of 12 miles. The AVR reached Level 3 at a maximum distance of about 23 miles. Facilities were judged to be too small and faint to be noticed by most casual observers at distances greater than 30 miles. The maximum visibility distance for these types of facilities was observed at 36.2 miles.

Solar Facilities

Sullivan et al. (2012) studied visual impacts from a variety of relatively low-lying 'parabolic trough' PV solar facilities and power tower facilities. Among these study sites were two parabolic trough solar facilities (Nevada Solar One and Solar Energy Generating Stations) that ranged from 400 – 970 acres in size, and one power tower (Ivanpah) facility consisting of a 459 foot tower and 3,400 acres of supporting structures

in Nevada. Based on Sullivan et al.'s (2012) descriptions of visual impacts, acute visual impacts (Levels 5 or 6) sometimes occurred at distances greater than 4 miles.

Elevation played a factor in visibility, with parabolic solar facilities sometimes causing acute visual impacts at 5 miles from higher elevations. Some facilities were visible between 14 – 20 miles, but at these distances they were often not recognizable as solar facilities (Sullivan et al. 2012:25, Figure 11). At these distances the facilities often appear as natural mirages on the desert landscape, particularly from low elevation viewpoints.

Apparent Size Based on BPT

Using the BPT, a 345kV transmission line of 145' in height would result in an apparent size of each tower of only .27 inches at 3 miles distance. A 230kV transmission line of 113' in height would result in an apparent size of each tower of only .43 inches at 1.5 miles distance. These representative figures are well below the .75 inch target discussed above. For smaller transmission lines, for example, a 50-70' tall wooden monopole would result in an apparent size of .80 inches at 0.5 miles distance, or about the size of a dime.

For illustrative purposes for other types of infrastructure projects:

- A 400' tall wind turbine would result in an apparent size of each tower of only .19 inches at 12 miles distance;
- A 35' tall binary type geothermal power plant would result in an apparent size of .40 inches at 2 miles distance;
- A 750' tall hard rock mining waste rock pile would result in an apparent size of .86 inches at 5 miles distance;
- A 500' tall hard rock mining waste rock pile would result in an apparent size of .71 inches at 4 miles distance; and
- A 250' tall hard rock mining waste rock pile would result in an apparent size of .71 inches at 2 miles distance.

While BPT calculations are helpful in determining V-APEs, the horizontal spread relative to vertical height as well as the design and materials of the undertaking should also be given due consideration. For example, a PV solar facility may have a height of <10' which would have a small apparent size at a short distance; however, such facilities may have a large horizontal spread or elevation differences may allow for a large surface area to be visible necessitating larger V-APEs. These considerations are reflected in the final recommendations in this document. Similarly, power tower solar facilities such as Ivanpah and Crescent Dunes exhibit light-concentrating designs that cause increased visibility such that reasonable V-APEs may be significantly larger than the 5 miles recommended for parabolic facilities. In these latter cases visual simulations or observations of similar existing facilities may be informative.

BLM Nevada Field Observations

On April 18, 2018, Nicholas Pay visited various locations in Southern Nevada to observe the visual effects of various existing facilities associated with Solar Energy Generation Facilities that have been built in Eldorado and Ivanpah Valleys. Because BLM's field investigations specifically targeted visual analysis from the standpoint of potential adverse effects under NHPA, our results both differ from and complement those of Sullivan et al. (2012, 2013, 2014a).

Field observations were made from points selected to represent various distances from the facilities in the region. No pre-work was done so that the initial observations could be made to relate to those experiences of the Casual Observer. During the initial observation a number of other facilities were noted that we could include into this study so special care was taken to ensure that there were good photographs at the various observation points to capture any potential visual effects of all of the facilities in the area.

All photographs were taken using a Nikon COOLPIX B700 Camera mounted on a tripod at a height of about 6 feet. Images were captured using the camera's Landscape Shooting Mode using the Noise Reduction Burst to reduce the amount of noise in the background. Images were taken at the widest angle available on the camera with a

focal length of 5mm. This results in a field of view of about 46 degrees. Images were stored using the camera's Fine Image Quality as JPG files with the default file names on the camera. The dimensions of the original files are 5184 x 3888 pixels with 300 dpi resolution. Photographs were imported and the originals were archived to ensure that they are available for future use.

At each photo point, a compass was used to ensure that photos were taken facing generally West, Northwest, North, Northeast, East, Southeast, South and Southwest. Each point was marked with a spatial point using a Garmin Montana 680t which is accurate to within +/- 12 feet or 3.65 meters. The spatial data was downloaded from the GPS and put into ArcMap.

To identify facilities located in the areas under study the following data were used:

- U.S. Power Plants shapefile obtained from the U.S. Energy Information Administration (https://www.eia.gov/maps/layer_info-m.php). This is a point dataset representing operable electric generating plants in the United States by energy source. This includes plants that are operating, on standby, or short- or long-term out of service. The surveys collect data on all plants with a combined nameplate capacity of 1 MW or more. Source: EIA-860, Annual Electric Generator Report, EIA-860M, Monthly Update to the Annual Electric Generator Report, and EIA-923, Power Plant Operations Report. Data period: January 2018.

- U.S. Petroleum Product Pipelines shapefile obtained from the U.S. Energy Information Administration (https://www.eia.gov/maps/layer_info-m.php). This includes major petroleum product pipelines in the United States. Layer includes interstate trunk lines and selected intrastate lines. Based on publicly available data from a variety of sources with varying scales and levels of accuracy. Updated January 2018.

- U.S. Natural Gas Pipelines shapefile obtained from the U.S. Energy Information Administration (https://www.eia.gov/maps/layer_info-m.php). This is a polyline dataset representing the major natural gas transmission pipelines in the U.S. including interstate, intrastate, and gathering pipelines. These data were obtained by the U.S. Energy Information Administration from various sources including FERC Form 567—Annual Report of System Flow Diagrams and Capacity, and other external sources such as company web pages and industry press. Updated April 2018.

- Electric Power Transmission Lines shapefile obtained from the Department of Homeland Security’s Homeland Infrastructure Foundation – Level Data webpage (<https://hifld-geoplatform.opendata.arcgis.com/datasets/electric-power-transmission-lines>). This includes lines operated at relatively high voltages varying from 69 kV up to 765 kV which are capable of transmitting large quantities of electricity over long distances. Underground transmission lines are included where sources were available.

- ROW Lines shapefile obtained from the Bureau of Land Management Southern Nevada District Office GIS Data.

Given the complexity of the various resources located in these areas, individual projects were chosen to ensure that a sample of each type of facility was obtained. A visual analysis was completed from multiple observation points from which the structures associated with the project could be seen. These observations were documented in an excel file to facilitate data analysis.

An Observer’s Position is considered superior or inferior if it is approximately 50 meters from the elevation used for the facility. The range generally accounts for the elevation range of the facility.

One observation that was made that is difficult to photograph concerns the point where a solar field loses the texture associated with the individual panels. At this point it is difficult to distinguish between the field and the mirage, as Sullivan et al. (2012) noted. A mirage is an optical effect that is often observed in the desert or over a hot pavement, that has the appearance of a pool of water and that is caused by the bending or reflection of rays of light by a layer of heated air of varying density (Merriam-Webster, 2018).

Another un-photographed observation is that glow from the top of the solar tower associated with the Crescent Dunes 110 MW Solar Energy Facility, located outside of Tonopah Nevada, was observed from the top of Goldfield Summit while traveling north on US95. This is 40 miles from the facility. The 653' tower appears as a glowing orb rising over the mountains. This effect draws the attention of those traveling north on US95 as people were observed parked along the road and taking pictures of the facility.

Results

Figure 1 summarize the results of this exercise for all the facilities analyzed, and Figure 2 for solar facilities. Figure 1 graphs all of the large-scale facilities (transmission lines, solar facilities, and geothermal facilities) on a biplot showing the relationship between distance and Visibility Rating Level. Overall, there is a consistent relationship between 3 miles and potential for adverse visual effect: in other words, our data suggest that, for most of these facilities, adverse visual effects (Level 5 or 6) is not likely to occur beyond 3 miles. This relationship also holds true for Level 4. Figure 2 displays how adverse visibility drops dramatically beyond 3 miles for solar facilities, with no rating greater than a 2 beyond 6 miles.

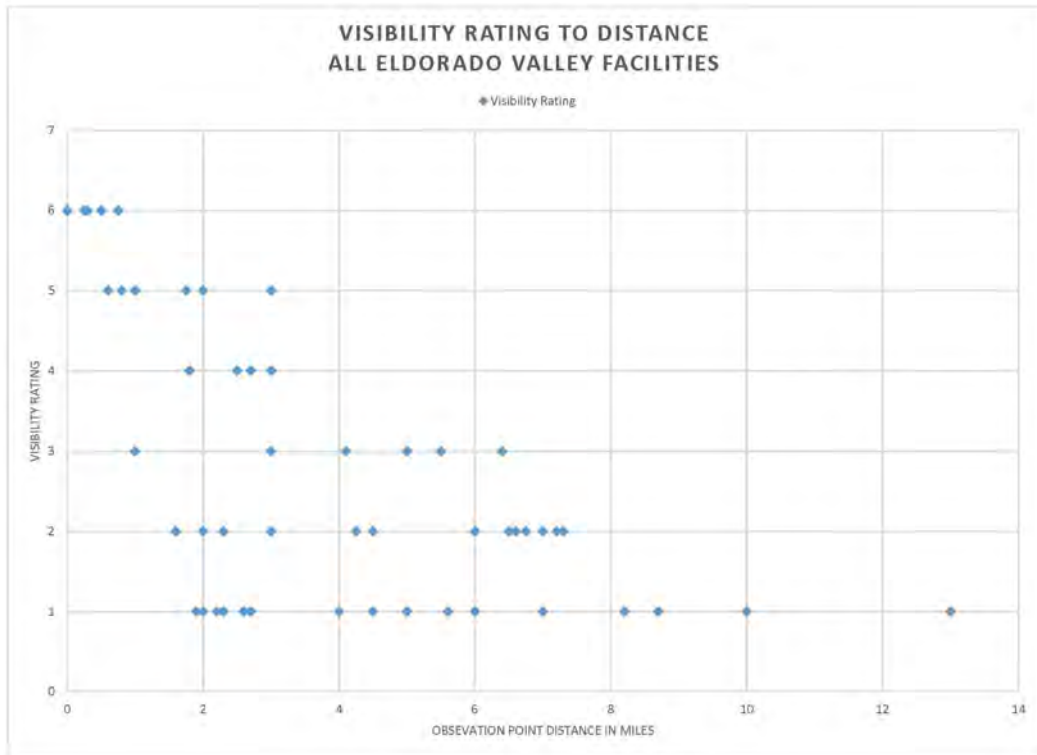


Figure 1. Combined graph of BLM Nevada’s Visibility Rating Levels associated with fixed distances from large-scale 500kV transmission lines, PV-parabolic solar plants, and geothermal plants in southern Nevada. Note that none of the large-scale projects analyzed here resulted in a Visibility Contrast Rating Level equal to or greater than 4 beyond 3 miles, suggesting that 3-mile V-APEs from the centerline (6 miles total width) are reasonable and justifiable for 500kV transmission lines, as well as most solar and geothermal projects of this size in Nevada.

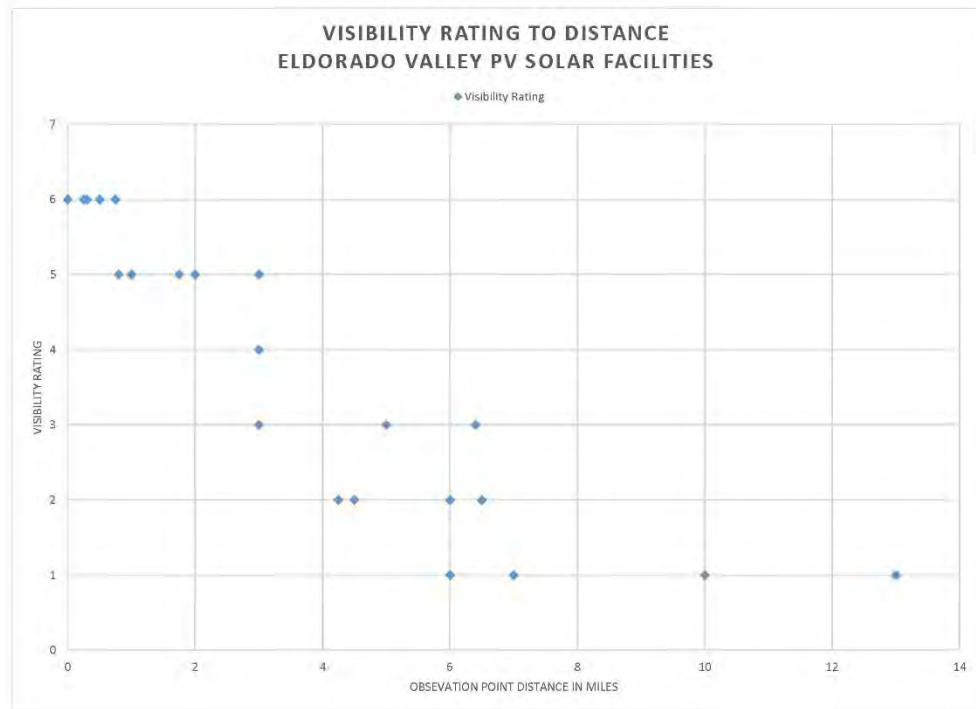


Figure 2. BLM Nevada’s Visibility Rating Levels associated with fixed distances from large-scale PV-parabolic solar projects in southern Nevada. Note that the adverse visibility drops dramatically beyond 3 miles from the project, with no rating greater than a 2 beyond 6 miles. However, 86% of the ratings between 3-6 fall within the first 3 miles. Of the four ratings taken between 3-5 miles, two scored a Level 2 and two scored a Level 3. However, because Sullivan et al. (2012) documented acute visual impacts up to 5 miles from these projects from higher elevation, a 5-mile V-APE from these projects is reasonable and justifiable.

Figures 3-43 illustrate these results through photographs. Figures 3-14 illustrate visual impacts from the Boulder City to Primm South Utility Corridor. This corridor contains several 500kV transmission lines. Even with several lines existing within the corridor, Level 5-6 visual impacts are reduced to Levels 1-3 beyond 3 miles. Figures 15-17 illustrate visual impacts from the Boulder City to Searchlight 500kV utility corridor, corroborating the data from Boulder City to Primm.

Figures 18-32 illustrate visual impacts from the Copper Mountain PV-Parabolic Solar Plant #2. At 3 miles distant, only one Level 4 rating was given, and none greater than Level 3 beyond 3 miles. As noted above, however, Sullivan et al. (2012) noted that higher elevation may cause Level 5 impacts up to 5 miles distant. Figures 33-43 illustrate corroborative evidence for the Copper Mountain PV-Parabolic Solar Plant #3.

BOULDER CITY TO PRIMM UTILITY CORRIDOR



Figure 3. Boulder City to Primm South Utility Corridor @ 0 miles distance.

BLM Visibility Rating: 6 {Photo DSCN 0062}



Figure 4. Boulder City to Primm South Utility Corridor @ 0.6 miles distance.

BLM Visibility Rating: 5 **{Photo DSCN 0009}**



Figure 5. Boulder City to Primm South Utility Corridor @ 1.0 miles distance.

BLM Visibility Rating: 3 {Photo DSCN 0011}



Figure 6. Boulder City to Primm South Utility Corridor @ 1.6 miles distance.

BLM Visibility Rating: 2 {Photo DSCN 0056}



Figure 7. Boulder City to Primm South Utility Corridor @ 1.9 miles distance.

BLM Visibility Rating: 1 {Photo DSCN 0088}



Figure 8. Boulder City to Primm South Utility Corridor @ 2.0 miles distance.

BLM Visibility Rating: 2 **{Photo DSCN 0018}**



Figure 9. Boulder City to Primm South Utility Corridor @ 2.2 miles distance.

BLM Visibility Rating: 1 {Photo DSCN 0038}



Figure 10. Boulder City to Primm South Utility Corridor @ 2.3 miles distance.

BLM Visibility Rating: 2 **{Photo DSCN 0046}**



Figure 11. Boulder City to Primm South Utility Corridor @ 2.3 miles distance.

BLM Visibility Rating: 1 {Photo DSCN 0080}



Figure 12. Boulder City to Primm South Utility Corridor @ 2.6 miles distance.

BLM Visibility Rating: 1 {Photo DSCN 0028}



Figure 13. Boulder City to Primm South Utility Corridor @ 3.0 miles distance.

BLM Visibility Rating: 2 {Photo DSCN 0072}



Figure 14. Boulder City to Primm South Utility Corridor @ 5.0 miles distance.

BLM Visibility Rating: 1 **{Photo DSCN 0118}**

BOULDER CITY TO SEARCHLIGHT UTILITY CORRIDOR



Figure 15. Boulder City to Searchlight Utility Corridor @ 1.0 miles distance.

BLM Visibility Rating: 3 {Photo DSCN 0144}



Figure 16. Boulder City to Searchlight Utility Corridor @ 2.0 miles distance.

BLM Visibility Rating: 1 {Photo DSCN 0128}



Figure 17. Boulder City to Searchlight Utility Corridor @ 2.7 miles distance.

BLM Visibility Rating: 1 {Photo DSCN 0120}

COPPER MOUNTAIN PV SOLAR #2



Figure 18. Copper Mountain PV Solar Plant #2 @ 0.0 miles distance.

BLM Visibility Rating: 6 {Photo DSCN 0093}



Figure 19. Copper Mountain PV Solar Plant #2 @ 0.0 miles distance.

BLM Visibility Rating: 6 {Photo DSCN 0088}



Figure 20. Copper Mountain PV Solar Plant #2 @ 0.25 miles distance.

BLM Visibility Rating: 6 {Photo DSCN 0086}



Figure 21. Copper Mountain PV Solar Plant #2 @ 0.30 miles distance.

BLM Visibility Rating: 6 {Photo DSCN 0116}



Figure 22. Copper Mountain PV Solar Plant #2 @ 0.75 miles distance.

BLM Visibility Rating: 6 {Photo DSCN 0079}



Figure 23. Copper Mountain PV Solar Plant #2 @ 1.0 miles distance.

BLM Visibility Rating: 5 {Photo DSCN 0070}



Figure 24. Copper Mountain PV Solar Plant #2 @ 3.0 miles distance.

BLM Visibility Rating: 3 {Photo DSCN 0066}



Figure 25. Copper Mountain PV Solar Plant #2 @ 3.0 miles distance.

BLM Visibility Rating: 4 {Photo DSCN 0125}



Figure 26. Copper Mountain PV Solar Plant #2 @ 4.25 miles distance.

BLM Visibility Rating: 2 {Photo DSCN 0011}



Figure 27. Copper Mountain PV Solar Plant #2 @ 4.5 miles distance.

BLM Visibility Rating: 2 {Photo DSCN 0020}



Figure 28. Copper Mountain PV Solar Plant #2 @ 5.0 miles distance.

BLM Visibility Rating: 3 {Photo DSCN 0030}



Figure 29. Copper Mountain PV Solar Plant #2 @ 5.0 miles distance.

BLM Visibility Rating: 3 **{Photo DSCN 0039}**



Figure 30. Copper Mountain PV Solar Plant #2 @ 6.0 miles distance.

BLM Visibility Rating: 2 {Photo DSCN 0048}



Figure 31. Copper Mountain PV Solar Plant #2 @ 6.4 miles distance.

BLM Visibility Rating: 3 {Photo DSCN 0142}



Figure 32. Copper Mountain PV Solar Plant #2 @ 6.5 miles distance.

BLM Visibility Rating: 2 {Photo DSCN 0057}

COPPER MOUNTAIN PV SOLAR #3



Figure 33. Copper Mountain PV Solar Plant #3 @ 0.25 miles distance.

BLM Visibility Rating: 6 {Photo DSCN 0033}



Figure 34. Copper Mountain PV Solar Plant #3 @ 0.5 miles distance.

BLM Visibility Rating: 6 {Photo DSCN 0024}



Figure 35. Copper Mountain PV Solar Plant #3 @ 0.8 miles distance.

BLM Visibility Rating: 5 {Photo DSCN 0014}



Figure 36. Copper Mountain PV Solar Plant #3 @ 1.0 miles distance.

BLM Visibility Rating: 5 **{Photo DSCN 0049}**



Figure 37. Copper Mountain PV Solar Plant #3 @ 1.75 miles distance.

BLM Visibility Rating: 5 {Photo DSCN 0006}



Figure 38. Copper Mountain PV Solar Plant #3 @ 2.0 miles distance.

BLM Visibility Rating: 5 {Photo DSCN 0058}



Figure 39. Copper Mountain PV Solar Plant #3 @ 3.0 miles distance.

BLM Visibility Rating: 5 {Photo DSCN 0061}



Figure 40. Copper Mountain PV Solar Plant #3 @ 5.0 miles distance.

BLM Visibility Rating: 3 {Photo DSCN 0072}



Figure 41. Copper Mountain PV Solar Plant #3 @ 6.0 miles distance.

BLM Visibility Rating: 1 {Photo DSCN 0081}



Figure 42. Copper Mountain PV Solar Plant #3 @ 7.0 miles distance.

BLM Visibility Rating: 1 {Photo DSCN 0118}



Figure 43. Copper Mountain PV Solar Plant #3 @ 10.0 miles distance.

BLM Visibility Rating: 1 {Photo DSCN 0126}

SUMMARY AND CONCLUSION

In accordance with 36 CFR § 800.5(a)(1) an adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property. The Bureau of Land Management, Nevada has determined that the only aspects of integrity that can be visually adversely affected by elements introduced into the viewshed of a Historic Property are Setting and Feeling, and possibly Design (if the landscape is incorporated as part of the design) and Association (if the association is between two or more properties for which an unobstructed view is necessary to retain that association). Therefore, if Historic Properties do not retain integrity of Setting, Feeling, Design or Association, or these aspects do not contribute to the property's eligibility then there is no need to address visual effects to those properties.

A visual addition into the viewshed of a historic property has a significant potential to adversely affect the integrity of a historic property when that addition strongly attracts the visual attention of a viewer looking in the general direction of the addition. In the case of the rating scale developed by Argonne National Laboratory and used for this study this equates to a Visibility Rating Level of 5 or 6. These studies, taken together with mathematical principles based on the BPT and BLM Nevada's in-field studies suggest that distances beyond those Visibility Ratings are unlikely to be of an adverse nature under the NHPA. BLM Nevada has determined that it is reasonable to define 'template' V-APEs based on this research, especially given the fact that the difference in the distance between where an intrusion is visible and where it strongly attracts attention can be 3 times as great.

The Visibility Rating Level documented for 500kV lattice towers reached Level 5 (major attractant of visual attention) at distances of up to 1 mile and occasionally at distances up to 3 miles. In most cases, the background of the analyzed powerlines consisted of desert landscapes that are riddled with relatively small mountain ranges that help to

conceal these transmission lines as one moves away from the infrastructure. It also is well documented that when the sky and other light backgrounds are present these powerlines may be visible at much further distances. Thus, a 3-mile radius from the centerline (6-mile total width) is adequate to define a visual APE boundary for 500kV transmission lines in Nevada in most cases. For 230kV transmission lines, a 1.5-mile radius from the centerline (3-mile total width) is adequate. BPT corroborates these findings.

One interesting aspect of studying the visual impacts of transmission lines is that greater capacity of the powerline does not necessarily equate to greater height of the facility. Figure 44 illustrates the average height based on industry standards for construction of these types of facilities. The red line is 100' from the ground. These data suggest that the 3-mile radius (6-mile total width) recommendation for 500kV transmission lines would likely be reasonable for 345kV lines as well. The industry standard shorter 230kV lines result in a reduction of Level 5 visual impacts by one-half those of the typical 345kV and 500kV lines.

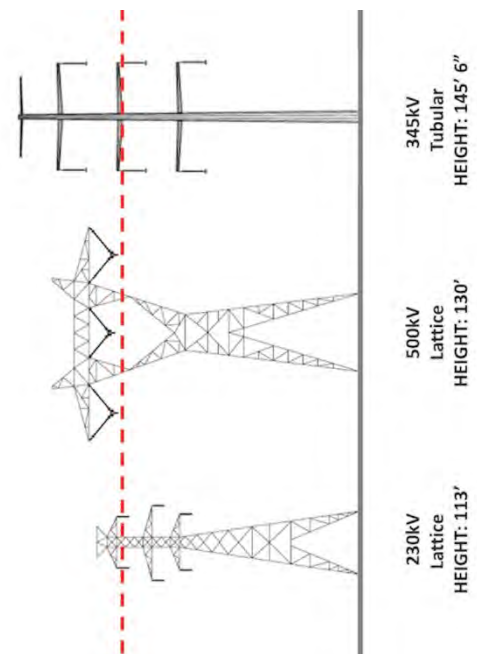


Figure 44. Industry standard heights of 230kV, 345kV and 500kV transmission lines.

The Visibility Rating for Solar Power Generation Facilities located in Eldorado Valley reaches a Level 5 at distances of up to 3 miles. Elevation extends this NTE adequate definition to 5 miles from the solar plant. BPT calculations indicate that smaller V-APEs may be reasonable for PV solar facilities depending on their horizontal size and terrain.

The Visibility Rating of wind turbine facilities up to 400 feet in height can be considered a Level 5 within 12 miles, and thus this distance would be a reasonable V-APE. BPT calculations indicate that smaller V-APEs may be reasonable depending on the number of turbines, their horizontal spread, and the terrain.

While not discussed in detail here, one Natural Gas Facility in Eldorado Valley, Nevada, did not reach a rating of Level 5 at any of the observation locations for this study. However, there were no observation locations closer than 1.8 miles. Thus, 2 miles appears to be a reasonable and adequate V-APE for geothermal facilities. These observations are similar to those that Argonne National Laboratory has made in their various studies of visual effects (Sullivan et al. 2012; Sullivan et al. 2013; Sullivan et al. 2014a; Sullivan et al. 2014b). BPT calculations indicate that individual geothermal facilities would have a small apparent size with a 0.5 mile V-APE around each plant, well, and pipeline; however, because of their interconnectedness and horizontal spread a 2-mile V-APE around the power plant would be a reasonable alternative to account for visual effects from the entire facility.

Mining Plans of Operation are highly variable but V-APEs can be determined by utilizing BPT calculations for taller facilities such as waste rock piles and heap leach pads. Additional consideration may be given to the horizontal spread and the coloration of facilities prior to reclamation. Exploration drill rigs are relatively short and generally the recommended V-APE for wooden monopole transmission lines could be applied. Additionally, exploration mining may be of a temporary and short duration that is followed by immediate reclamation; in these cases, the V-APE may be reasonably argued to equal the physical disturbance APE.

Table 4 summarizes the results of our analysis and recommendations for adequate and justifiable visual APEs on BLM-managed lands in Nevada. BLM Nevada Districts should begin with these NTE limits and then use a GIS based visual analysis to refine the V-

APE to reflect topographic parameters that affect the actual area from which the undertaking would be visible. In addition, Districts should use field-based observations for potential vegetation parameters that affect the actual area from which the undertaking is visible.

Be aware that the visual integrity of all or a portion of the V-APE may be such that property types that may otherwise be potentially adversely effected by visual additions are not likely to be adversely effected by the addition of new infrastructure projects because the viewshed has been severely compromised by existing already-built projects. This is especially the case for “energy corridors” or “transmission corridors” that already contain several transmission lines, as well as key solar field areas that may have several solar facilities and other additions to the landscape such as highways.

Table 4. Summary and recommendations.

Undertaking Type	Recommended NTE Visual APE Distance
230kV transmission lines	1.5-mile radius (3-mile total width)
345kV and 500kV transmission lines	3-mile radius (6-mile total width)
50-70’ wooden monopole transmission lines	0.5-mile radius (1-mile total width)
Solar Energy Fields (PV or Parabolic Trough)	5 miles
Wind Turbine Energy Fields up to 400 feet	12 miles
Geothermal Power Plants, Wells, and Pipelines	2-mile radius around plant or 0.5 mile around individual plant / well / pipeline – BPT = .40 inch
Mining Plans of Operation 750’ High Waste Rock Pile	6 miles – BPT = .71 inch
Mining Plans of Operation 500’ High Waste Rock Pile	4 miles – BPT = .71 inch

Mining Plans of Operation 250' High Waste Rock Pile	2 miles – BPT = .71 inch
Mining Exploration – Temporary with Immediate Reclamation	Same as physical disturbance APE

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