Appendix L: Aesthetics/Visual Quality Technical Resource Report

For Programmatic Environmental Impact Statement on Utility-Scale Onshore Wind Energy Facilities in Washington State

By

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For the

Shorelands and Environmental Assistance Program

Washington State Department of Ecology

Olympia, Washington

June 2025, Publication 25-06-003

DEPARTMENT OF ECOLOGY
State of Washington

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Acronyms and Abbreviations List

ADLS	aircraft detection lighting system
BESS	battery energy storage system
FAA	Federal Aviation Administration
GMA	Growth Management Act
KOP	key observation point
PEIS	Programmatic Environmental Impact Statement
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
UGP EIS	*Upper Great Plains Wind Energy Final Programmatic Environmental Impact Statement*
USFS	U.S. Forest Service

Summary

This technical resource report describes the conditions of visual resources in the study area. It also describes the regulatory context, potential impacts, and measures that could avoid or reduce impacts.

This report analyzes the following key features:

- Long-term change or reduction in visual quality
- Creation of a new source of light or glare that would adversely affect day or nighttime views in the area

Findings for aesthetics and visual quality impacts described in this technical resource report are summarized as follows:

- Depending on the location and size of project sites and visual characteristics of the activities, visual quality impacts from construction, operation, decommissioning, and repowering of all types of facilities considered could range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. In general, larger projects and projects located in high-value scenic landscapes would have a greater potential to impact visual quality.
- Construction, operation, and decommissioning for all facilities would result in **less than significant impacts** attributable to light or glare.

Impacts may be avoided and reduced through project size, location, and design considerations. However, mitigation may not be possible for all impacts, and some utility-scale onshore wind energy facilities may result in **potentially significant and unavoidable adverse impacts** on visual quality, depending on location and design. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

Crosswalk with Aesthetics/Visual Quality Technical Resource Report for Utility-Scale Solar Energy

Two Programmatic Environmental Impact Statements (PEISs) are being released at the same time, one for utility-scale solar energy facilities and one for utility-scale onshore wind energy facilities. This crosswalk identifies the areas with substantial differences between the aesthetics/visual quality technical resource reports for each PEIS.

Utility-Scale Solar Energy PEIS	Utility-Scale Onshore Wind Energy PEIS (this document)
• Different specific visual quality, light, and glare conditions associated with facilities and resulting different ranges of potential impacts • Some differences in measures to avoid and reduce impacts	• Different specific visual quality, light, and glare conditions associated with facilities and resulting different ranges of potential impacts • Some differences in measures to avoid and reduce impacts

1 Introduction

This technical resource report describes aesthetics and visual quality within the study area and assesses probable impacts associated with the types of facilities (alternatives), and a No Action Alternative. Chapter 2 of the State Environmental Policy Act (SEPA) Programmatic Environmental Impact Statement (PEIS) provides a description of the types of facilities evaluated.

This section provides an overview of the aspects of aesthetics and visual quality evaluated and lists relevant regulations that contribute to the evaluation of potential impacts.

1.1 Resource description

Visual resources refer to all objects (built and natural, moving, and stationary) and features (e.g., landforms and waterbodies) that are visible on a landscape. These resources add to or detract from the aesthetic or scenic quality (or visual appeal) of the landscape. A visual impact is the creation of an intrusion or perceptible contrast that affects the scenic quality of a landscape. A visual impact can be perceived by an individual or group as either positive or negative, depending on a variety of factors or conditions (e.g., personal experience, time of day, and weather/season).

Visual resources considered in this analysis include the following:

- Designated scenic vistas
- Designated scenic corridors, including roadways, trails, rivers, and streams (including federally designated Wild and Scenic Rivers)
- Designated viewsheds
- Designated ridgelines and other elevated (i.e., visually prominent) natural features
- Areas with comprehensive plan, zoning, or other land controls that define an area as scenic or as designated/protected rural character
- Publicly accessible vantage points having moderate to high visual or rural character and quality and that are well traveled and populated
- Recreational resources
- Areas sensitive to light and/or glare, including designated night sky areas, as well as areas potentially affecting military and commercial aircraft

The following resources may have potentially overlapping impacts, or the impact analysis for these resources may be informed by the analysis of aesthetics and visual quality. Impacts on these resources are reported in their respective technical resource reports:

- **Tribal rights, interests, and resources:** Tribal resources may be affected by visual changes in some areas, and sensitive viewers could include members of local Tribes. Information regarding potential visual changes informs the Tribal impact analysis in the *Tribal Rights, Interests, and Resources Technical Report* (Appendix B).

- **Biological resources:** Potential effects of light/glare on terrestrial and aquatic species and habitats are analyzed in the *Biological Resources Technical Report* (Appendix G).
- **Land use:** Potential effects to rural character are analyzed in the *Land Use Technical Resource Report* (Appendix K).
- **Recreation:** Recreation impacts are informed by the analysis of visual effects on the recreational experience. Recreational resource impacts are presented in the *Recreation Resources Technical Report* (Appendix M).
- **Historic and cultural resources:** Cultural resources may be affected by visual changes in some areas. Information regarding potential visual changes informs the cultural impact analysis in the *Historic and Cultural Resources Technical Report* (Appendix N).

1.2 Regulatory context

Table 1 provides an inventory of applicable laws, regulations, policies, and plans that contribute to the evaluation of aesthetics and visual quality. For local regulations and plans, it would be dependent on the specific location of a project. The developer would consult with the appropriate county or other local officials to determine local regulatory guidance that would be applied to project-level SEPA reviews.

Table 1. Applicable laws, plans, and policies

Regulation, statute, guideline	Description
Federal	
U.S. Department of Transportation Federal Highway Administration National Scenic Byways and All-American Roads Program	This program designates National Scenic Roads that meet the criteria for at least one of six “intrinsic qualities”: archeological, cultural, historic, natural, recreational, and scenic. The features contributing to the distinctive characteristics of the corridor’s intrinsic quality are recognized throughout the region and are considered regionally significant. Designated All-American Roads meet two of these “intrinsic qualities.” They are both considered in this analysis as designated scenic resources.
Federal Aviation Administration (FAA) Advisory Circular 70/7460-1M, Obstruction Marking and Lighting	The advisory circular describes FAA’s standards for marking and lighting structures to promote aviation safety. These standards are considered in this analysis relative to impacts attributable to light.
U.S. Forest Service (USFS) Forest Service Manual 2800 – Chapter 2380: Landscape Management and USFS Handbook 279 Landscape Aesthetics: A Handbook for Scenery Management	Chapter 2380 states that it is USFS policy to: 1. Inventory, evaluate, manage, and, where necessary, restore scenery as a fully integrated part of the ecosystems of National Forest System lands and of the land and resource management and planning process. 2. Employ a systematic, interdisciplinary approach to scenery management to ensure the integrated use of the natural and social sciences and environmental design. 3. Ensure scenery is treated equally with other resources.

Regulation, statute, guideline	Description
	4. Apply scenery management principles routinely in all National Forest System activities. USFS's Scenery Management System provides an overall framework for inventory, analysis, and management of scenery on National Forest lands.
Bureau of Land Management Manual 8400 – Visual Resource Management and associated handbooks and technical standards	The Visual Resource Management program provides a system for inventory of scenic values, protection of present and future values through land use planning, and management of visual impacts from proposed projects through project planning and visual design principles.
State	
Chapter 47.39 Revised Code of Washington (RCW), Scenic and Recreational Highway Act of 1967	This legislation establishes the State's Scenic Byway program and standards for eligibility and maintenance of scenic roadways and corridors. These roadways are considered in this analysis as designated scenic resources.
Chapter 70A.550 RCW, Aircraft Detection Lighting System	This legislation, effective in 2023, requires developers, owners, or operators of new utility-scale wind energy facilities of five or more turbines to comply with FAA lighting requirements and mitigations. This includes an aircraft detection lighting system. These standards are considered in this analysis relative to impacts attributable to light.
Local	
County and city comprehensive plans, zoning ordinances, municipal codes, including night sky ordinances	Many counties and cities in Washington have codes, plans, and ordinances that are relevant to an understanding of visual quality and potential impacts of facilities.

2 Methodology

This section provides an overview of the process for evaluating potential impacts and the criteria for determining the occurrence and degree of impact.

2.1 Study area

The study area for aesthetic and visual resources includes the overall onshore wind geographic scope of study area (Figure 1), as well as surrounding viewsheds. The study area for the evaluation of aesthetic and visual resources associated with the construction and operation of the onshore wind energy facilities would be determined by the presence (or absence) of aesthetic and visual resources during project-specific reviews. Parameters could include sensitive visual resources such as visually sensitive vantage points, designated scenic resources (as listed previously), and receptors and facilities sensitive to light/glare (such as airports or residential neighborhoods).

The PEIS geographic scope of study includes various federal, state, and locally managed lands; however, Tribal reservation lands; national parks, wilderness areas, and wildlife refuges; state parks; and areas within cities and urban growth areas were excluded from the geographic scope of study for facilities considered in the PEIS. Some of these areas adjacent to the PEIS geographic scope of study are considered in the study area if they contain visual resources that may be impacted by facilities.

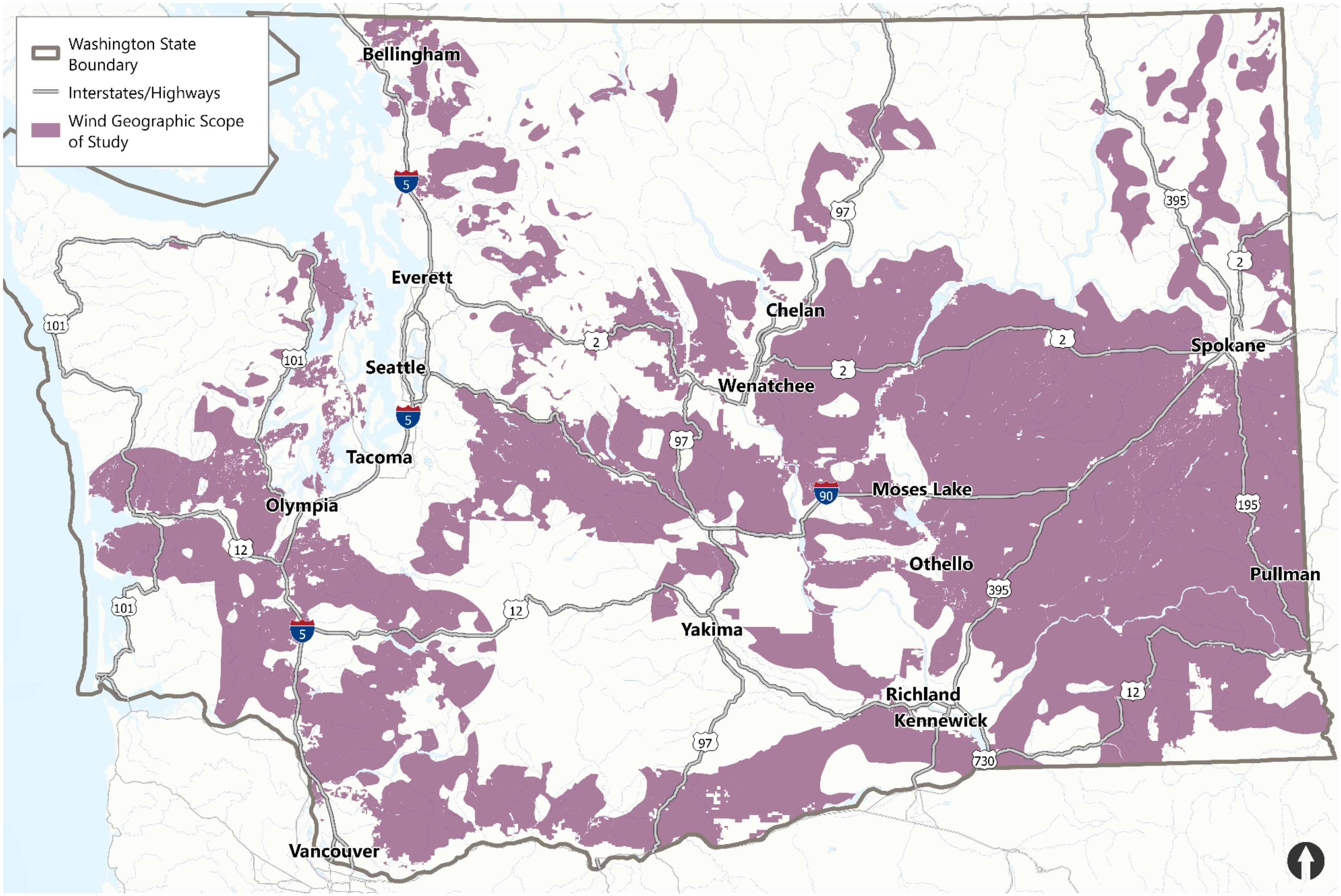

Figure 1. Onshore Wind Energy Facilities PEIS – geographic scope of study

2.2 Technical approach

The general technical approach for the following qualitative assessment of aesthetic and visual quality impacts in the study area included the following:

- Existing visual or rural character, land uses that may be sensitive to strong visual contrast (including light and glare), and sensitive viewer groups
- Potential impacts of facilities on existing visual or rural character and sensitive viewer groups or land uses
- Effects of lighting and glare on sensitive receptors

2.3 Impact assessment approach

The PEIS analyzes a timeframe of up to 20 years of potential facility construction and up to 30 years of potential facility operations (totaling up to 50 years into the future). The magnitude of the aesthetics and visual quality impacts associated with a given onshore wind energy project would depend on site- and project-specific factors, including the following:

- Distance of the project from publicly accessible vantage points and their placement within the context of foreground, middleground, and background views[1]
- Size of the project (number and spacing of turbines and other infrastructure)
- Size of the wind turbines (including height and rotor span), towers, substations, and gen-tie lines
- Surface treatment of wind turbines, the buildings, and other structures (primarily color)
- The presence and arrangement of lights on the turbines and other structures
- The presence of workers and vehicles for construction, maintenance, or decommissioning activities
- Viewer characteristics, such as the number and type of viewers (e.g., landowners in the vicinity of onshore wind energy facilities, residents, tourists, motorists, and workers) and their attitudes toward renewable energy and wind power
- The visual characteristics of natural and built elements in the existing landscape
- The visual quality and sensitivity of the landscape, including the presence of sensitive visual, Tribal, and cultural resources including historic properties
- The existing level of development and activities in the onshore wind energy facility area and nearby areas, and the landscape's capacity to withstand human alteration without loss of landscape character (i.e., scenic integrity and visual absorption capability)
- Weather and lighting conditions

[1] The foreground, middleground, and background refer to areas in space. The foreground refers to the nearest area. The background refers to the area of space in the distance. The middleground occupies the space in between.

These factors would be evaluated in detail during site-specific environmental analysis; a general discussion is provided in this technical resource report.

In 2015, the Western Area Power Administration and U.S. Fish and Wildlife Service published the *Upper Great Plains Wind Energy Final Programmatic Environmental Impact Statement* (UGP EIS; USDOE and USFWS 2015). The UGP EIS considered the impacts of utility-scale onshore wind energy facilities. The geographic area addressed in the UGP EIS included all or portions of Iowa, Minnesota, Montana, Nebraska, North Dakota, and South Dakota. The variety of landscapes in this large region is similar to those found within the study area. These include large expanses of undeveloped or agricultural and rural lands dissected by waterways, small- to moderately sized population centers, foothills and mountains, and recreational areas. The analysis of visual resources in the UGP EIS relied on a large number of studies to provide a basis for determining impacts and their severity. Many of the mitigation measures presented in the UGP EIS are applicable to utility-scale onshore wind energy facilities considered in the PEIS. This aesthetics and visual quality analysis incorporates much of the UGP EIS visual analysis methodology.

The UGP EIS consulted a number of studies that addressed the visibility of a wind turbine over distance, the visual effect of wind turbine movement, atmospheric haze and back- or frontlighting (i.e., whether illumination is from the back or front), color/finish of the apparatus, and public attitudes toward utility-scale wind energy facilities. These are incorporated by reference.

For the purposes of this assessment, a potentially significant impact would occur if a facility resulted in the following:

- Long-term changes in visual quality that would substantially contrast with the existing visual or rural character or with designated scenic resources, including:
    - Large-scale permanent clearing of vegetation
    - Construction of a large structure (i.e., wind turbines) in a previously undeveloped area
    - Construction of a structure that would block views
- Creation of a new source of light or glare that would adversely affect views in the area continuously or for most day or night hours and be visible to a substantial number of people

3 Technical Analysis and Results

3.1 Overview

This section provides an analysis of potential impacts on aesthetics and visual quality that might occur for utility-scale onshore wind energy facilities analyzed in the PEIS. The temporal scope of this analysis assumes that utility-scale onshore wind energy developments would be constructed between approximately June 2025 and January 2045, with construction of individual facilities taking 6 to 18 months. An approximate 50-year scope of analysis is assumed to encompass the period in which utility-scale onshore wind energy developments are likely to be constructed and operational. This section also evaluates measures that could avoid, minimize, or reduce the identified impacts and potential unavoidable significant adverse impacts.

3.2 Affected environment

The affected environment represents existing conditions at the time this study was prepared. The study area analyzed in this technical resource report encompasses a variety of landscape types determined by geology, topography, climate, soil type, hydrology, and land use. Included in this study area are diverse landscapes such as the Columbia River basin, the Cascade Range, the Palouse, the coastal ranges, the southern Olympic Peninsula, and the Puget Sound islands. Overall, the study area is relatively evenly divided between level terrain with long viewing distances and hilly/mountainous topography consisting of valleys and ridgelines. The study area does not include major urban and built-up areas, such as Seattle, Tacoma, Olympia, Spokane, Yakima, Kennewick, Pasco, Richland, Vancouver, or Bellingham. Therefore, the extent of built-up and other developed land in the study area is limited.

Although much of the region is sparsely populated, human influences have altered much of the visual landscape, especially with respect to land use and land cover; in some places, intensive human activities, particularly agriculture, have seriously altered visual qualities. There are very few urban areas with populations of more than 50,000, and overall the region has a rural character, with many widely scattered small towns. Within these smaller urban areas, the built environment consists primarily of commercial, public service, and residential development, with industrial development serving the local economy. Outside of these small urban areas, other built features could include energy infrastructure, including hydroelectric dams, power-generating facilities, substations, transmission lines, and towers; highway services; and facilities supporting the various agricultural activities throughout the study area.

The term “rural character” has different definitions including a definition under the Washington State Growth Management Act (GMA). The GMA identifies rural character as patterns of land use and development that, among other things, allow open space, the natural landscape, and vegetation to predominate over the built environment, and provide visual landscapes that are traditionally found in rural areas and communities

(Washington Administrative Code 365-196-425(2)(b)). For more information on rural character, refer to the *Land Use Technical Resource Report*.

The undeveloped areas in the hilly and mountainous terrain are primarily forested up to the tree line elevation. In more level undeveloped areas, the non-agricultural landscape is dominated by sparsely vegetated plains and plateaus. In the central areas of the state, these give way to the Columbia River and its tributaries, which dissect an otherwise continuous landscape expanse. Large Tribal reservations and federal and state government holdings contribute to the undeveloped landscape, with the exception of clusters of structures within those holdings.

The air quality in many of these less developed areas is good, and the humidity is often low. Given this, and the general lack of vertical relief and the absence of trees and buildings, it is possible to see for great distances in many parts of the study area. In general, the undeveloped areas of the study area have dark night skies, with relatively few sources of light pollution.

The western portion of the onshore wind study area is higher in elevation and includes mountains such as the Cascade Range and the Olympic Mountains. Resource extraction activities (e.g., logging and mining) and recreation are land uses that may impact visual characteristics of the landscape. Because of the greater topographic relief and diversity of vegetation and the presence of mountains, buttes, rock outcroppings, and mountain streams, the visual diversity of the landscape is generally higher than in the central and eastern portion of the study area, and visual quality generally is also higher. In some areas within or near the study area, particularly in areas with national/state parks, waterbodies, forests, and other outdoor recreational opportunities, visual quality is very high, making these sites extremely attractive to tourists and other recreational users.

There are extensive scenic resources that occur within or near the study area, such as national and state parks, monuments, and recreation areas; historic sites, parks, memorials, and landmarks; National Wild and Scenic Rivers, national historic trails, scenic highways, and national wildlife refuges; and other designated scenic resources. In addition, many other scenic resources exist within or near the study area on federal, state, and other non-federal lands, including traditional cultural properties important to Tribes and state or locally designated scenic resources, such as state-designated scenic highways, state parks, and county parks. Many of these designated scenic resources provide views of broad scenic vistas.

The various scenic attractions within the study area draw tourists to the study area and surrounding lands each year and contribute to making tourism a component of many regional and local economies. For many individuals, however, their experience of the visual character of the study area is limited to the views from their vehicles from the interstate, U.S., and state highways that cross the region—for instance, I-5, I-82, I-90, US 12, US 97, and US 395—lending particular importance to the viewsheds of these roadways. There are five National Scenic Byways that traverse or are in close proximity to portions of the study area (USDOT 2024). These byways, designated by the Federal Highway Administration, are White Pass, Chinook, Mountains to Sound, Stevens Pass, and Coulee Corridor. There are also more than 100 state-designated Scenic Byways distributed across every region of the state, including the study area. Parts of the six waterways in the state designated as National Wild and Scenic Rivers also traverse portions of the study area (National Wild and Scenic Rivers System 2024). These include Illabot Creek, the Klickitat River, the Middle Fork Snoqualmie River, the Pratt River, the Skagit River, and the White Salmon River. They are all located in the Cascades portion of the study area.

Sensitive viewer groups are varied throughout the study area. These groups range from people in residential areas in less developed and agricultural areas to motorists and recreationalists/tourists. The viewing experience for each group would vary, depending on the length of time and distance the viewer would be exposed to an onshore wind project and the physical conditions of the vantage point and viewshed. For instance, passengers in a vehicle traveling at highway speeds, pedestrian/bike path users, and visitors to scenic lookouts located approximately the same distance from a facility would view that facility for different lengths of time and, as a result, would experience the effect of visual change resulting from the project siting differently.

3.3 Potentially required permits and approvals

None of the federal or state laws, plans, and policies presented in Table 1 require permits related to aesthetics and visual quality. However, local land use development ordinances may require some form of design approval (i.e., in designated scenic corridors) or night sky exemption related to safety or obstruction lighting. Local land use permits may also require that projects demonstrate conformance with zoning and comp plan designations, which may include areas of rural character. Federally managed lands also have planning requirements for the protection of visual resources and would evaluate visual effects from proposed projects during right-of-way or leasing processes.

3.4 Utility-scale onshore wind facilities

This section describes potential impacts on aesthetics and visual quality due to the site characterization, construction, operation, decommissioning, or repowering of utility-scale onshore wind energy facilities.

3.4.1 Impacts from construction and decommissioning

3.4.1.1 Change or reduction in visual quality

Construction and decommissioning would involve a range of activities associated with potential visual impacts. Construction and decommissioning activities, including site characterization activities, are dependent on the site conditions and facility design details; however, they could include activities that result in contrasts in form, line, color, and texture; worker presence and activity; dust; and emissions. Construction of an onshore wind energy facility would typically involve the following major actions with potential visual impacts:

- Erecting temporary meteorological towers
- Building/upgrading roads
- Grading certain parts of the site
- Constructing and using temporary staging and laydown areas
- Removing vegetation from construction and laydown areas
- Transporting towers, turbines, nacelles (housing), and other materials and equipment to the onshore wind energy facility site
- Assembling and erecting the wind turbine generators
- Installing temporary meteorological towers for site characterization
- Installing permanent meteorological towers (as necessary)
- Constructing ancillary structures (e.g., control buildings, fences)
- Constructing electrical power conditioning facilities and substations
- Installing power-conducting cables and signal cables (typically buried)

Additional site characterization and construction activities may also be necessary at very remote locations or for the bigger range of onshore wind energy project sizes; they may include constructing temporary offices or sanitary facilities.

Construction visual impacts would vary in frequency and duration throughout the course of construction. There may be periods of intense activity followed by periods with less activity. Visual impacts would, to some degree, vary in accordance with construction activity levels. Construction schedules are also specific to each project site and design. While construction of many projects might be completed within 1 year, other facilities may take longer to construct and could involve phased development, with construction-related visual impacts therefore lasting longer.

Vegetative clearing, roads, and staging areas

Construction would require clearing of vegetation, large rocks, and other objects for roads. The nature and extent of clearing are affected by the requirements of the project, the types of vegetation, and other objects to be cleared. Vegetation clearing and topographic grading may be required for the construction of access roads, maintenance roads, and roads to support facilities (e.g., electric substations). Typically, vegetation-clearing activities would create visual impacts on existing landscape features primarily by changing the color and texture of the cleared areas, with additional impacts occurring if refuse materials are not disposed of off site, mulched, or otherwise concealed.

Constructing new temporary and permanent access roads and/or upgrading existing roads would typically be required to support project construction and maintenance activities. Roads are expected to be topped with aggregate. Road development may introduce strong visual contrasts to the existing landscape and landscape features (e.g., hills, waterways, elevated viewing opportunities), depending on the elevation compared to the surrounding area, the relationship of the routes to surface contours, and the widths, lengths, and surface treatments of the roads. Construction of access roads would have some associated residual impacts (e.g., vegetation disturbance) that could be evident for some years afterward, with a gradual diminishing of impacts over time as vegetation is re-established. The length of time required for vegetation to reestablish varies greatly depending on location, weather patterns, soil fertility, surrounding land use, and the type of vegetation planted or recruited (e.g., grasses, forbs, shrubs, trees). Refer to the *Biological Resources Technical Report* for more discussion of vegetation. These impacts could be lessened by application of mitigation measures, which are presented in Section 3.4.3.

The nature and extent of visual impacts associated with construction laydown areas and crane staging areas would depend in part on the size of the area and the nature of required clearing and grading, and on the types and amounts of materials stored at the laydown areas. The presence of materials and equipment in these areas would introduce temporary changes in the existing visible landscape, and additional visual contrasts could be introduced by any vegetation clearing or grading. Most of these areas would be restored to pre-construction conditions immediately after completion of construction. However, as noted previously, some associated residual impacts (e.g., vegetation disturbance) could be evident for some years afterward, with a gradual diminishing of impacts over time. These impacts could be reduced by application of mitigation measures, which are presented in Section 3.4.3.

Constructing wind turbines and associated facilities

Because of the very large size of wind turbine towers, blades, and other components, the transport and installation of wind turbines on site are visually conspicuous activities. Large (and in some cases very unusual) vehicles are required to transport some components. Construction activities would also introduce increased human (construction worker) and vehicular activities into the existing landscape.

The installation of turbines at each facility typically involves excavating the tower foundation, pouring concrete, and performing a variety of other standard construction activities, but because of the height and size of the turbines and the cranes involved, tower erection and placement of the nacelle and rotor on the tower could be visible for long distances. For a large project, installation of turbines and associated visual impacts could last for months, but at a given turbine location there would be brief periods of activity between periods of little or no activity.

The relative scale of typical onshore wind facility components and other buildings and potential elements of onshore wind facilities are compared in Figures 2 and 3. The various construction activities described previously require work crews, vehicles, and equipment that would add to the temporary visual impacts of construction.

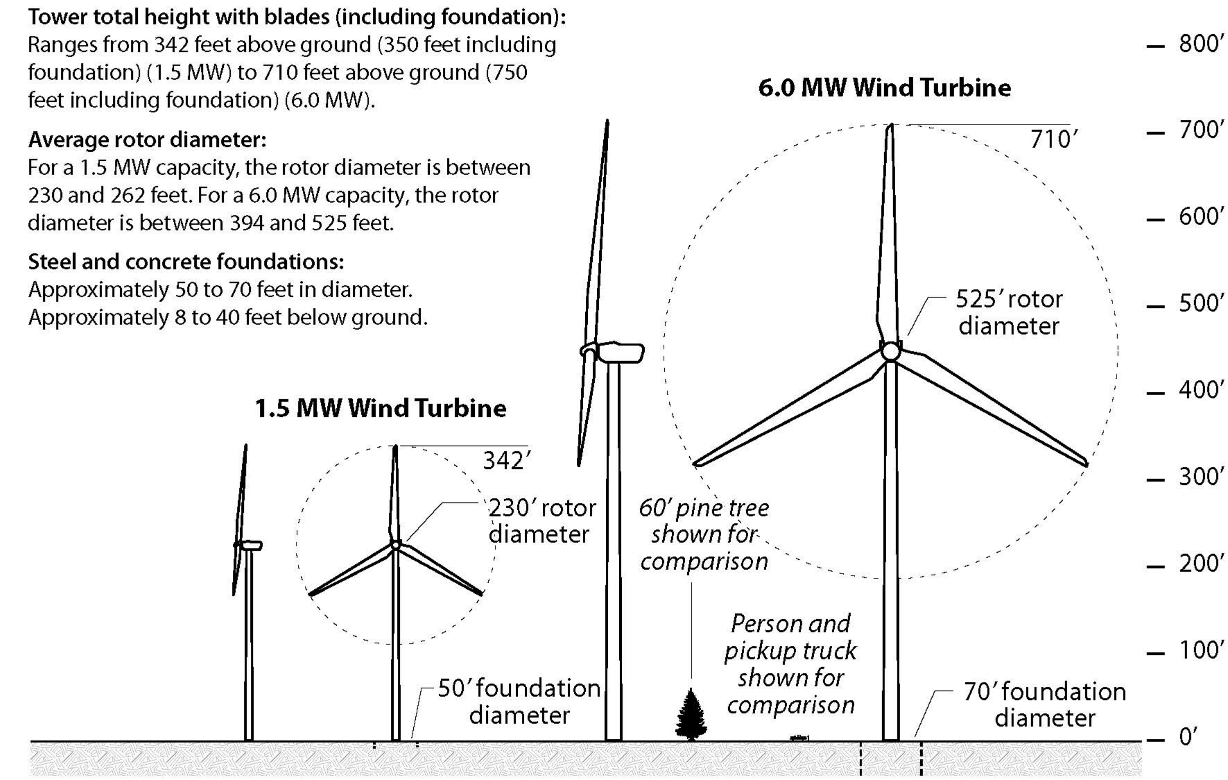

Figure 2. Relative scale of typical wind turbines

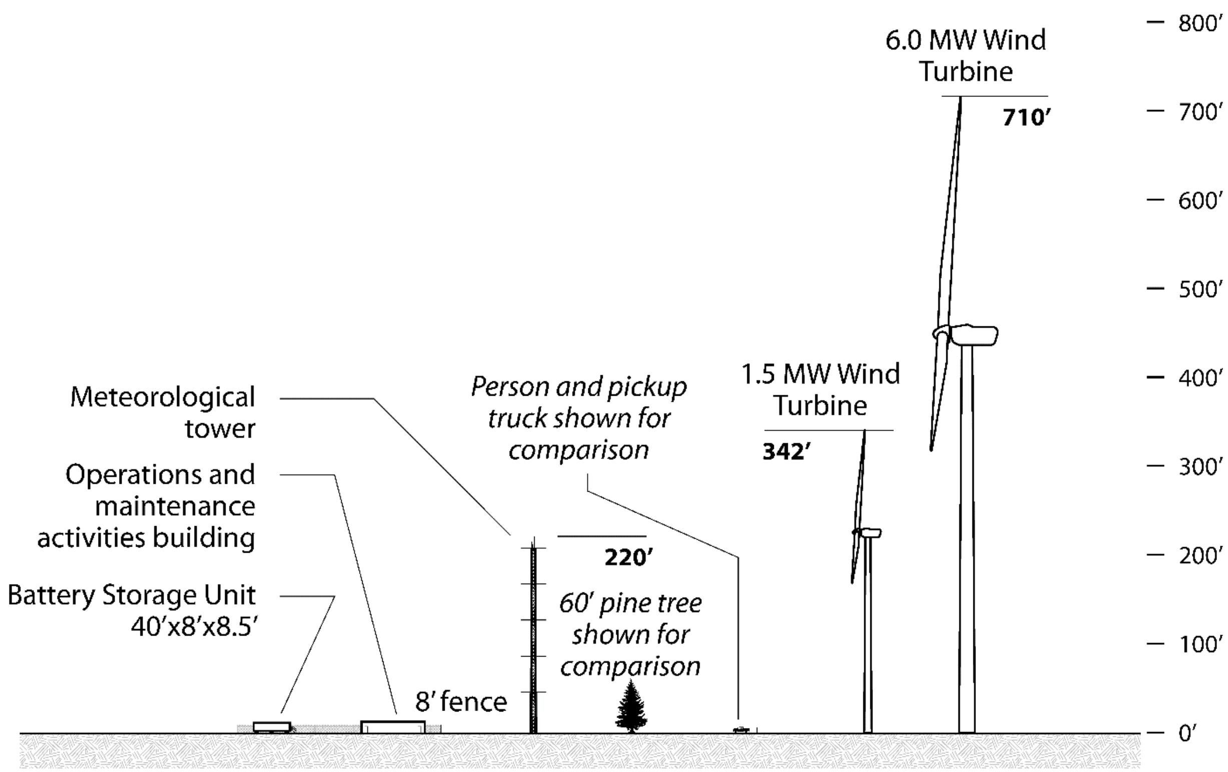

Figure 3. Relative scale of typical wind turbines with ancillary facilities

Dust and excavation

Traffic would produce visible activity and dust in dry soils. Suspension and visibility of dust would be influenced by vehicle speeds, road surface materials, and weather conditions. Temporary parking for vehicles would be needed at or near work locations. Unplanned and unmonitored parking could likely expand these areas, producing visual contrast due to suspended dust and loss of vegetation. Construction activities would proceed in phases, with several crews moving through a given area in succession, giving rise to brief periods of intense construction activity (and associated visual impacts) followed by periods of inactivity. Cranes and other construction equipment would produce emissions while in operation and may thus create visible exhaust plumes.

Excavation would damage or remove vegetation, expose bare soil, and suspend dust. Soil stockpiles (if not removed) could be visible for the duration of construction. Soil scars, exposed slope faces, eroded areas, and areas of compacted soil could result from excavation, leveling, and equipment/vehicle movement. Invasive species may colonize disturbed and stockpiled soils and compacted areas. These species may be introduced naturally in seeds, plants, or soils introduced for intermediate restoration or by vehicles. In some situations, the presence of invasive species may introduce contrasts with naturally occurring vegetation, primarily in color and texture. The presence of workers and construction activities could also result in litter and debris that could create negative visual impacts within and around work sites. Site monitoring, adherence to standard construction practices, and restoration activities discussed in Section 3.4.3 would reduce many of these impacts.

Other construction activities that could introduce visual contrast with existing landscape conditions include bracing and cutting existing fences; constructing new fences, gates, or cattle guards to contain livestock; and providing temporary walks, passageways, fences, or other structures to prevent interference with traffic. If a mobile or on-site concrete batch plant were required, it might temporarily create a visible steam plume under certain atmospheric conditions.

Decommissioning activities

Decommissioning of an onshore wind energy facility would involve the dismantling and removal of infrastructure associated with each wind turbine, the removal of aboveground and buried ancillary structures, road redevelopment, temporary fencing, and restoration of the decommissioned site to pre-facility conditions. Expected visual impacts of decommissioning activities would be similar to construction activities.

Similar to construction, the various decommissioning activities would require work crews, vehicles, and equipment that would have visual impacts during decommissioning. Decommissioning impacts would last until restoration of the site is complete.

Restoration activities would typically include recontouring, grading, scarifying, seeding and planting, and stabilizing disturbed surfaces. Newly disturbed soils would create a visual contrast that could persist for several seasons before revegetation would begin to mature and restore the pre-facility visual landscape. Complete restoration of vegetation to pre-facility conditions may take much longer. As noted for construction, the time for vegetation to reestablish varies greatly depending on location, weather patterns, soil fertility, surrounding land use, and the type of vegetation planted or recruited. Invasive species may colonize newly and recently reclaimed areas. These species may be introduced naturally or in seeds, plants, or soils introduced for intermediate restoration, or by vehicles. Non-native plants that are not locally adapted would likely produce visual contrasts with existing conditions. Refer to the *Biological Resources Technical Report* for more discussion of vegetation.

According to the U.S. Energy Administration, repowering older wind turbines—replacing aging turbines or components—is becoming more common. Fully repowering wind turbines involves decommissioning and removing existing turbines and replacing them with newer turbines at the same facility site. If a facility were repowered instead of decommissioned, repowering activities would require work crews, vehicles, and equipment similar to construction, but reduced in scope and duration.

Summary of construction and decommissioning visual quality impacts

Depending on the project location, there could be some situations where work areas would be blocked from view by intervening topography or screened by vegetation. There could also be projects located in unpopulated or sparsely populated areas where there would be a limited number of sensitive viewers or viewer groups, if any. However, some projects would be in proximity to roadways, towns and cities, recreational areas, and other vantage points that would provide views of these developments and affect the existing landscape and landscape features. Larger projects are more likely to be within view. Impacts on residents are generally greater than those on more transient viewers, such as drivers or workers, in part because residents are likely to view the construction and decommissioning of onshore wind energy projects more frequently and for longer durations.

An onshore project constructed and decommissioned in a high-value scenic landscape typically would be more conspicuous and therefore perceived as having greater visual impact than if that same project were constructed and decommissioned in a setting of low scenic value or where similar facilities were already visible. Some landscapes have special meaning to some viewers because of unique scenic, Tribal, cultural, or ecological values and are therefore perceived as being more sensitive to visual disturbances. Depending on visibility factors, onshore wind energy projects constructed and decommissioned within or near sensitive landscapes, such as state and national parks, historic sites, landscapes sacred to Tribes, scenic highways and trails, recreational attractions, and other valued cultural features, may be of particular concern. Depending on the project location, size, and topography, visual impacts could extend to viewers outside the study area.

Depending on the location and size of project sites and visual characteristics of the construction and decommissioning activities, visual quality impacts would range from **less than significant impacts** to **potentially significant adverse impacts**. If a utility-scale onshore wind energy project was repowered, impacts attributable to facility repowering activities could range from

less than significant impacts to **potentially significant adverse impacts** on visual quality, and the long-term changes in visual quality and related impacts would persist.

Section 3.4.3 presents measures that could avoid or reduce construction and decommissioning impacts of utility-scale onshore wind energy facilities on the visual environment.

3.4.1.2 New source of light or glare

Lighting and glare

Most site characterization, construction, and decommissioning activities would be expected to occur during daylight hours. Some nighttime activities may occur, such as electrical connection, inspection, and testing activities. Larger facilities would include a greater area of construction and decommissioning activity and, therefore, a greater potential for night work requiring lighting. It is assumed that such activities would be performed with temporary lighting that would be directed downward to focus illumination on work areas and minimize impacts on neighboring properties in the vicinity of a project. Any lighting used during construction activities would be occasional, temporary, and shielded downward. Decommissioning is not likely to include nighttime activities. Cranes more than 200 feet (61 meters) tall used to install turbines may require Federal Aviation Administration (FAA)-compliant aircraft warning lights. FAA guidelines for marking and lighting facilities could require aircraft warning lights that flash during the day and at night. The presence of aircraft warning lights would greatly increase visibility of the cranes at night and could potentially cause visual impacts in predominantly rural settings within the study area, especially if few similar light sources were present in the area. However, only a limited numbers of turbines would be erected at any given time, and limited portions of the facility site would be actively under construction at a particular time. Obstruction lighting on cranes would not remain in any one fixed location for the entire duration of construction and decommissioning but would be present at different locations depending on the phase of construction and decommissioning activities throughout the site.

Onshore wind facilities would require substantial areas of undeveloped or minimally developed land (up to approximately 21,250 acres), which would likely place much of the construction and decommissioning activities away from receptors sensitive to light. The potential for nighttime lighting during construction to impact nighttime views would be minimal.

Construction and decommissioning would involve increased vehicle traffic and the presence, transport, and use of construction equipment and materials. These activities could temporarily increase glare conditions in and around a project site if activities were associated with an increased presence of reflective materials, potentially including construction equipment, new materials (i.e., not yet subjected to weathering), and vehicle windows. However, an increase in glare that could result from the presence of construction equipment or materials would be minimal and temporary. Only portions of the project site would be actively under construction or decommissioned at a particular time. Such new temporary sources of glare would not remain in any one fixed location for the entire duration of construction or decommissioning but would be present at different locations depending on the phase of construction and decommissioning activities throughout the site. Facility construction and decommissioning would not introduce new, substantial sources of glare that could affect daytime views in the vicinity. If a facility were repowered instead of decommissioned, repowering activities would generate similar light and glare as construction activities.

Through compliance with laws and permits and with the implementation of measures that could avoid and reduce impacts, construction and decommissioning activities would likely result in **less than significant impacts** related to light or glare. If a facility were repowered, activities would not introduce new, substantial sources of light that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people. Repowering would result in a **less than significant impact** attributable to light and glare, and the long-term light, shadow flicker, and glare conditions described in Section 3.4.2.2 would persist.

3.4.2 Impacts from operation

3.4.2.1 Change or reduction in visual quality

Visual impacts associated with the development of onshore wind energy projects in the study area include the presence of wind turbine structures; movement of the rotor blades; shadow flicker and blade glinting; turbine marker lights and other lighting on control buildings and other ancillary structures; roads; vehicles; and occasional on-site workers, such as those conducting maintenance activities. The effects of shadow flicker, blade glinting, and lighting are discussed in Section 3.4.2.2.

Wind turbines and other facility components

The primary visual impacts associated with onshore wind energy facilities would result from the introduction of the numerous vertical lines of wind turbines into the generally strongly horizontal landscapes (e.g., plains, agricultural fields, high desert) found in most of the study area, or the placement of turbines on ridgelines where they would be visible against the skyline. The visible structures would potentially produce visual contrasts by virtue of form, color, and line of their design attributes.

The very large sizes and strong geometric lines of both the individual turbines themselves and the array of turbines could dominate views, and the large sweep of the moving rotors would tend to command visual attention depending on the proximity of the turbines to viewers, especially nearby communities and residences, and the intervening landform. Structural details, such as surface textures, could become apparent, and the control buildings and other structures could be visible, as well as strong reflections from the towers and moving rotor blades (blade glint). For viewers close enough to fall within the cast shadows of the turbines, shadow flicker might be observed. These effects are described in more detail in Section 3.4.2.2.

Based on the empirical studies consulted, the UGP EIS determined that a wind farm with wind turbines approximately 400 feet (122 meters) tall could be visible from approximately 25 miles (40 kilometers) away or farther assuming good visibility, and could potentially cause substantial visual contrasts at distances less than 7 to 8 miles (11 to 13 kilometers), and more moderate impacts up to approximately 15 miles (24 kilometers), with smaller visual impacts beyond approximately 15 miles (24 kilometers). These values are approximate, dependent on facility and turbine size and the number of turbines visible, and would be subject to lighting, atmospheric, and other effects. Further, taller turbines would increase the distances at which they can be seen.

Atmospheric haze could reduce turbine visibility. Backlighting or frontlighting can either decrease or increase contrast depending on the backdrop. Conditions of high contrast could substantially increase the perceived visual impact of turbines (e.g., when front-lit turbines are viewed against a dark sky or when backlit turbines are viewed against a bright sky). In cases in which turbines are viewed against a landform and vegetation (“backclothing”), the light gray or white color can produce strong visual contrasts with the background, but the contrast is reduced when the ground/vegetation is snow-covered. Strong visual contrasts can also occur when wind turbines are prominently placed along ridgelines and viewed against an open sky (“skylining”).

A number of studies referenced in the UGP EIS noted that when the rotor blades on turbines were moving, the movement tends to attract viewers’ attention to a greater extent than when the blades were not moving. A field-based study conducted in 2002 by the University of Newcastle involving wind turbine visibility at eight wind energy facilities in Scotland indicated that blade movement increased visual impact in all cases. The movement was discernible at distances of up to 9.3 miles (15 kilometers) in optimum viewing conditions and would be noticeable to casual viewers at distances of up to approximately 6.2 miles (10 kilometers).

The visibility and associated visual impacts of an onshore wind energy project and of individual wind turbines depend in part on the size of the facility, the arrangement of the turbines, and the size, height, surface treatment, and other characteristics of the turbines.

Greater numbers of wind turbines would have increased visibility, which would be expected to increase perceived visual impact, but the UGP EIS reported that the perceived impact is not necessarily directly proportional to the number of wind turbines in view. Regular spacing (grid layout) versus nonregular spacing (random layout) can strongly affect the appearance of the onshore wind energy facility, with viewers generally finding regular turbine spacing to have less negative visual impact, but the apparent geometry can change substantially as viewer location and distance change.

Wind turbines are generally painted white or light gray to blend in with sky backgrounds, but other colors are sometimes used in particular settings, such as beige or tan in desert settings. When viewed against earth or vegetated backdrops, light-colored wind turbines may create strong color contrasts with these backdrops. Low-reflectance coatings are used for wind turbines and other structures to reduce specular reflections.

Support building structures would normally be constructed of sheet metal, concrete, or cinder blocks and would be of varying sizes. Support buildings may be fenced and may include landscaping plantings, possibly used for visual screening in certain situations. These built structures would also introduce complex rectilinear geometric forms and lines and artificiallooking textures and colors into the landscape that would likely contrast markedly with natural-appearing landscapes.

Operation and maintenance activities and traffic

As during other phases of development, occasional small-vehicle traffic can be expected for testing, commissioning, monitoring, maintenance, and repair, in addition to infrequent large-equipment traffic for turbine replacements and upgrades. Both would produce apparent worker activity and dust in dry soils. Suspension and visibility of dust would be influenced by vehicle speeds and road surface materials. These impacts would be infrequent and of short duration primarily limited to periodic or as-needed maintenance activities.

Summary of operations visual quality impacts

The degree of visual impact for an onshore wind energy project is determined in part by the facility location, the natural and built elements of the existing visual landscape, the number of viewers who experience the impact, the type of activities viewers are engaged in when viewing a visual impact, and the sensitivity to visual impacts. The degree of visual impact is also determined by the distances that projects are sited from communities and residences and at which viewers would experience ongoing visual impacts over the life of the onshore wind energy facility.

In areas of the study area with lower population density, onshore wind energy projects may be visible for long distances, but they would generally be viewed by few people. Impacts on residents are generally greater than those on more transient viewers, such as drivers or workers, in part because residents are likely to view onshore wind energy projects more frequently and for longer durations. Projects located in or near a high-value scenic landscape or in proximity to viewers with unique scenic, Tribal, cultural, or ecological values typically would be more conspicuous and therefore would be perceived as having greater visual impact than if that same facility were present in a setting of low scenic value where similar facilities were already visible. Likewise, projects located in or near rural areas would also be perceived to have more visual impact, which would be incompatible with elements of rural character such as a minimization of built structures in open spaces and natural areas and maintaining visual landscapes traditionally found in rural areas. Project operations that change areas with rural character protections may also result in impacts on land use, which are evaluated in detail in the *Land Use Technical Resource Report*.

Similarly, the level of perceived visual impact may be affected by any type of human alteration of the landscape, including industrial or agricultural. In these areas, the addition of facilities may not be perceived to be as conspicuous as in unaltered landscapes. Depending on the facility location and topography, visual impacts could extend to viewers outside the study area.

Depending on the project size and the nature of its structures, operation of utility-scale onshore wind energy facilities could result in a range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. In general, larger projects and projects located in high-value scenic landscapes would have a greater potential for impacts.

3.4.2.2 New source of light or glare

The primary light and glare impacts associated with onshore wind energy projects would result from the introduction of the numerous vertical lines of wind turbines into the generally strongly horizontal landscapes found in most of the study area, or the placement of turbines on ridgelines where they would be skylined in an area of greater topographic relief. The visible structures would potentially produce visual contrasts in light by virtue of their design attributes, the reflectivity of their surfaces and resulting glare, and their movement. In addition, marker lighting could cause substantial visual impacts at night.

Lighting

FAA guidelines for marking and lighting wind energy facilities require lights that flash white during the day and at twilight and red at night (FAA 2020). The white daytime lights may be omitted if the turbines are painted white or a light shade of off-white, as is frequently the case. White light strobes could be used optionally. All marker lights within a wind facility are also required to flash simultaneously (approximately 24 times/minute); however, only the perimeter turbines of a wind farm need such markings, provided that there is no unlighted gap greater than 0.5 mile (0.81 kilometer). Terrain, weather, and other location factors allow for adjustments to the manner in which FAA requirements are applied.

The presence of aircraft warning lights would greatly increase visibility of the turbines at night, because the synchronized flashing red warning lights or strobes could be visible for long distances. In the dark nighttime sky conditions typical of the predominantly rural setting within the study area, the warning lights could potentially cause significant visual impacts, especially if few similar light sources were present in the area. In nighttime observations in a rural setting in eastern Wyoming, Sullivan et al. (2012) observed plainly visible red aircraft warning lights on a wind farm containing 277 wind turbines at distances exceeding 36 miles (58 kilometers). At this distance, the amount of visible lighting from the wind turbines was small, but the lights were easily seen because of the synchronized flashing of the red lights against a featureless black background. White lights would likely be less obtrusive in daylight.

Revised Code of Washington 70A.550.020 requires developers, owners, or operators of new utility-scale wind energy facilities of five or more turbines to apply to the FAA for the installation of a light-mitigating technology system that complies with FAA lighting requirements and mitigations. This includes installing an aircraft detection lighting system (ADLS) with FAA approval. An ADLS utilizes sensors and radar to track aircraft operating in proximity to the wind facility and activates the obstruction lighting system when aircraft enter the ADLS coverage area, for safety purposes. The lights are turned off when aircraft are no longer present in the coverage area. Because of their intermittent operation, aircraft warning lights would likely not contribute to sky glow from artificial lighting. Security and other lighting on support structures (e.g., the control building) could contribute to skyglow. These impacts could be reduced by downward shielding or other measures and would be expected to have minimal effects in any event because typically only the maintenance facility and possibly the control building in the substation would have lighting capable of producing skyglow.

With regulatory requirements and with the implementation of mitigative measures provided in Section 3.4.3, security and other facility lights would not introduce new, substantial sources of light that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people.

Summary of operations light and glare impacts

Through compliance with laws and permits and with the implementation of measures that could avoid and reduce impacts, operations would likely result in **less than significant impacts** attributable to light and glare.

Shadow flicker

As wind turbine blades spin under sunny conditions, they may cast moving shadows on the ground or nearby objects, resulting in alternating light intensity (flickering) as each blade shadow crosses a given point. If the duration and intensity of shadow flicker is sufficient, it can cause a nuisance to viewers, particularly if they are subjected to it frequently, as at their homes or places of work. Several factors determine the nature and extent of shadow flicker occurrence and the magnitude of potential associated visual impacts at a given onshore wind energy project, including the following:

- Distance and orientation of affected location with respect to turbines
- Rotor size and height of turbines
- Blade orientation, pitch, and speed (dependent on wind speed and direction)
- Geographic location and sun angle
- Local topography
- Presence of screening vegetation
- Weather/cloud cover
- Presence of airborne particles/haze
- Presence of sensitive viewers

Shadow flicker effects are more likely to cause visual impacts when the sun is low in the sky, as at sunrise or sunset, and in winter months when cast shadows are longest; however, at greater distances from the turbines, the loss of shadow intensity and sharpness would reduce the visual impacts associated with shadow flicker. Similarly, cloud cover or haze would reduce shadow intensity and sharpness, thus reducing shadow flicker effects. In general, because shadow flicker effects are dependent on precise geometric relationships between receptors (if any are present), the turbines, and the sun's direction and height above the horizon, with proper siting, shadow flicker effects are typically very limited in duration and area of effect. With the implementation of mitigative measures related to turbine siting and layouts provided in Section 3.4.3, shadow flicker would not introduce new, substantial sources of light or glare that could affect daytime or nighttime views visible to a substantial number of people in the vicinity and would result in a **less than significant impact** attributable to light and glare.

Glare

Blade glinting is the reflection of sunlight from moving wind turbine blades when viewed from certain angles under certain lighting conditions. The UGP EIS referenced an International Finance Corporation report (IFC 2007), which noted that glinting can also occur from wind turbine tower surfaces. The IFC report suggested that blade and tower glinting is a problem primarily for new turbines, that the problem is reduced as turbines become soiled in normal use, and that it can be mitigated through the use of low-reflectivity coatings, which are commonly specified for wind turbines and other structures to reduce specular reflections on blades and towers. With the implementation of typical best management practices and mitigative measures provided in Section 3.4.3, blade glinting would not introduce new, substantial sources of glare that could affect daytime or nighttime views in the vicinity and would result in a less than significant impact attributable to glare.

3.4.3 Measures to avoid, reduce, and mitigate impacts

The PEIS identifies a variety of measures to avoid, reduce, and mitigate impacts. These measures are grouped into five categories:

- **General measures:** The general measures apply to all projects using the PEIS.
- **Recommended measures for siting and design:** These measures are recommended for siting and design in the pre-application phase of a project.
- **Required measures:** These measures must be implemented, as applicable, to use the PEIS. These include permits and approvals, plans, and other required measures.
- **Recommended measures for construction, operation, and decommissioning:** These measures are recommended for the construction, operation, and decommissioning phases of a project.
- **Mitigation measures for potential significant impacts:** These measures are provided only in sections for which potential significant impacts have been identified.

Aesthetic and visual quality impact mitigation measures appropriate for onshore wind energy and interconnector and gen-tie lines would vary on a site-specific basis and would depend on the specific phase of the project. Site-specific mitigation actions would be developed during project-specific reviews and permitting for each project proposed in the future.

3.4.3.1 General measures

- **Laws, regulations, and permits:** Obtain required approvals and permits and ensure that a project adheres to relevant federal, state, and local laws and regulations.

  Rationale: Laws, regulations, and permits provide standards and requirements for the protection of resources. The PEIS impact analysis and significance findings assume that developers would comply with all relevant laws and regulations and obtain required approvals.

- **Coordination with agencies, Tribes, and communities:** Coordinate with agencies, Tribes, and communities prior to submitting an application and throughout the life of the project to discuss project siting and design, construction, operations, and decommissioning impacts, and measures to avoid, reduce, and mitigate impacts. Developers should also seek feedback from agencies, Tribes, and communities when developing and implementing the resource protection plans and mitigation plans identified in the PEIS.

Rationale**:** Early coordination provides the opportunity to discuss potential project impacts and measures to avoid, reduce, and mitigate impacts. Continued coordination provides opportunities for adaptive management throughout the life of the project.

- **Land use:** Consider the following when siting and designing a project:
  - Existing land uses
  - Land ownership/land leases (e.g., grazing, farmland, forestry)
  - Local comprehensive plans and zoning
  - Designated flood zones, shorelines, natural resource lands, conservation lands, priority habitats, and other critical areas and lands prioritized for resource protection
  - Military testing, training, and operation areas

  Rationale**:** Considering these factors early in the siting and design process avoids and minimizes the potential for land use conflicts. Project-specific analysis is needed to determine land use consistency.

- **Choose a project site and a project layout to avoid and minimize disturbance:** Select the project location and design the facility to avoid potential impacts to resources. Examples include the following:
  - Minimizing the need for extensive grading and excavation and reducing soil disturbance, potential erosion, compaction, and waterlogging by considering soil characteristics
  - Minimizing facility footprint and land disturbances, including limiting clearing and alterations to natural topography and landforms and maintaining existing vegetation
  - Minimizing the number of structures required and co-locate to share pads, fences, access roads, lighting, etc.

  Rationale**:** Project sites and layouts may differ substantially in their potential for environmental impacts. Thoughtful selection of a project site and careful design of a facility layout can avoid and reduce environmental impacts.

- **Use existing infrastructure and disturbed lands, and co-locate facilities:** During siting and design, avoid and minimize impacts by:
  - Using existing infrastructure and disturbed lands, including roads, parking areas, staging areas, aggregate resources, and electrical and utility infrastructure
  - Co-locating facilities within existing rights-of-way or easements
  - Considering limitations of existing infrastructure, such as water and energy resources

***Rationale*: **Using existing infrastructure and disturbed lands and co-locating facilities reduces impacts to resources that would otherwise result from new ground disturbance and placement of facilities in previously undisturbed areas.

- **Conduct studies and surveys early:** Conduct studies and surveys early in the process and at the appropriate time of year to gather data to inform siting and design. Examples include the following:
  - Geotechnical study
  - Habitat and vegetation study
  - Cultural resource survey
  - Wetland delineation

  ***Rationale*: **Conducting studies and surveys early in the process and at the appropriate time of year provides data to inform siting and design choices that avoid and reduce impacts. This can reduce the overall timeline as well by providing information to agencies as part of a complete application for environmental reviews and permits.

- **Restoration and decommissioning:** Implement a Site Restoration Plan for interim reclamation following temporary construction and operations disturbance. Implement a Decommissioning Plan for site reclamation at the end of a project. Coordinate with state and local authorities, such as the Washington Department of Fish and Wildlife, county extension services, weed boards, or land management agencies on soil and revegetation measures, including approved seed mixes. Such plans address:
  - Documentation of pre-construction conditions and as-built construction drawings
  - Measures to salvage topsoil and revegetate disturbed areas with native and pollinator-supporting plants
  - Management of hazardous and solid wastes
  - Timelines for restoration and decommissioning actions
  - Monitoring of restoration actions
  - Adaptive management measures

  ***Rationale*: **Restoration and decommissioning actions return disturbed areas to pre-construction conditions, promote soil health and revegetation of native plants, remove project infrastructure from the landscape, and ensure that project components are disposed of or recycled in compliance with all applicable laws and regulations.

- **Cumulative impact assessment:** Assess cumulative impacts on resources based on reasonably foreseeable past, present, and future projects. Identify measures to avoid, reduce, and mitigate cumulative impacts. Consider local studies and plans, such as comprehensive plans.

  ***Rationale*: **Cumulative impacts can result from incremental, but collectively significant, actions that occur over time. The purpose of the cumulative impacts analysis is to make sure that decision-makers consider the full range of consequences under anticipated future conditions.

3.4.3.2 Recommended measures for siting and design

- Site and design facilities to avoid and minimize visual impacts.
- Conduct a detailed visual resource analysis during siting using a qualified visual resource specialist to identify and map landscape characteristics, key observation points (KOPs), and key viewsheds; prominent scenic, Tribal, and cultural landmarks; and other visually sensitive areas near the project location.
- Consult with the appropriate land management agencies, planning entities, Tribes, and the local public early to provide input on the identification of important visual resources near a project site and on the siting and design process.
- Use geographic information systems (GIS) and visual impact simulations for conducting visual analyses (including mapping), analyzing the visual characteristics of landscapes, visualizing the potential impacts of facility siting and design, and fostering communication.
- Conducts a shadow flicker study using appropriate siting software and procedures and site wind turbines to eliminate shadow flicker effects on nearby residences or other highly sensitive viewing locations or reduce them to the lowest achievable levels.
- Avoid siting facilities where the landscape setting observed from national historic sites, national trails, and cultural resources may be a part of the historic context contributing to its historic significance.
- Site projects outside the viewsheds of KOPs, highly sensitive viewing locations, and/or areas with limited visual absorption capability and/or high scenic integrity. If projects must be sited within view of KOPs, site them as far away as possible to reduce the visual impacts.
- Use topography and vegetation as screening devices to restrict views of the project from visually sensitive areas. Where screening topography and vegetation are absent, use natural-looking earthwork berms and vegetative or architectural screening to minimize visual impacts. Vegetative screening can be particularly effective along roadways.
- Minimize visual impacts by:
    - Designing the facility to comply with applicable land use regulations related to light, glare, building height, setbacks, vegetation screening, exterior storage, fencing, and any other requirements related to the visual appearance of the facility.
    - Avoiding siting near prominent landscape features (e.g., peaks and waterfalls).
    - Avoiding siting linear facilities, such as interconnector and gen-tie lines and roads, so that they bisect ridge tops or run down the center of valley bottoms.
    - Avoiding siting facilities on ridgelines, summits, or other locations where they would be silhouetted against the sky (skylining) from important viewing locations.
    - Configuring turbines to be visually compatible with the landscape, such as following local topography in rolling landscapes, or using geometric or linear configurations in flatter agricultural landscapes.
    - Separating long lines of turbines and inserting breaks or open zones to create distinct visual units or groups of turbines, while avoiding visual disruptions and perceived disorder, disarray, or clutter.
    - Using monopole turbine structures.

  - Siting linear features to follow natural land contours rather than straight lines, particularly up slopes. Avoid fall-line cuts. Site facilities to take advantage of natural topographic breaks and avoid siting on steep slopes.
  - Avoiding installation of gravel and pavement where possible to reduce color and texture contrasts with the existing landscape.
  - Using turbine and other ancillary facilities with visual uniformity in shape, color, and size.
  - Choosing low-profile structures to reduce their visibility.
  - Preserving existing rocks, vegetation, and drainage patterns and varying the slope to preserve trees and nonhazardous rock outcroppings.
- In forested areas or shrublands, site linear facilities to follow the edges of clearings rather than pass through their center. Locate openings in vegetation for facilities, structures, and roads to mimic the size, shape, and characteristics of naturally occurring openings. Include the feathering of cleared area edges (i.e., the progressive and selective thinning of trees from the edge of the clearing inward) combined with the mixing of tree heights from the edge in the vegetation-clearing design in forested areas.
- Locate interconnector and gen-tie line right-of-way crossings of roads, trails, streams, and other linear features to avoid KOP viewsheds and other visually sensitive areas and to minimize disturbance to vegetation and landforms. Locate rights-of-way so they cross linear features at right angles whenever possible to minimize the viewing area and duration.
- Minimize use of overhead gen-tie and collector lines, unless underground gen-tie and collector lines are not feasible due to environmental conditions (e.g., topography, soil conductivity) or cultural or Tribal resource concerns.
- Minimize light pollution, including using motion-activated security lights, using full-cutoff designs that minimize upward light scattering and use, and avoiding steady-burn high intensity lights. Use Dark Sky International’s Five Principles for Responsible Outdoor Lighting (Dark Sky International 2025) to design outdoor lighting.

3.4.3.3 Required measures

There are no specific permit requirements that pertain to aesthetics/visual quality. Local land use development ordinances may require some form of design approval (e.g., in designated scenic corridors) or night sky exemption related to safety or obstruction lighting. Local land use permits may also require that projects demonstrate conformance with zoning and comprehensive plan designations, which may include areas of rural character. Federally managed lands also have planning requirements for the protection of visual resources and would evaluate visual effects from proposed projects during right-of-way or leasing processes.

3.4.3.4 Recommended measures for construction, operation, and decommissioning

- Mulch and spread slash from vegetation removal to cover fresh soil disturbances (preferred) or bury it in previously disturbed areas. Segregate topsoil from cut/fill activities and spread on freshly disturbed areas to reduce color contrast and aid rapid revegetation. Do not leave piles in sensitive viewing areas.

- Minimize signage. Paint or coat reverse sides of signs to reduce color contrasts with the existing landscape.
- Paint structures before or immediately after installation. Use materials and surface treatments that repeat and/or blend with the existing landscape.
- In compliance with FAA-requirements, select colors for turbines to reduce visual impact and apply uniformly to tower, nacelle, and rotor, unless gradient or other patterned color schemes are used.
- Use non-reflective materials or non-specular finishes and coatings on facilities to prevent glare.

3.4.3.5 Mitigation measures for potential significant impacts

- Consult with permitting agencies to develop visual mitigation strategies, which may include measures identified above and other actions to align with local plans.

  ***Rationale*:** Visual mitigation is dependent on project- and site-specific impacts. Consulting permitting agencies when developing mitigation strategies would identify the specific actions to address visual impacts.

3.4.4 Unavoidable significant adverse impacts

Utility-scale onshore wind energy facilities may result in **potentially significant and unavoidable adverse impacts** on visual quality, depending on location and design. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

3.5 Onshore wind facilities with battery energy storage systems

This section describes potential impacts on aesthetic and visual quality due to the construction, operation, and decommissioning/repowering of utility-scale onshore wind energy facilities with battery energy storage systems (BESSs).

3.5.1 Impacts from construction and decommissioning

The construction and decommissioning activities occurring with a co-located BESS would be the same as those for facilities without a BESS. Installation of the BESS would be similar to the construction of other support facilities and structures included in the project construction. BESSs are usually installed in a graveled area where vegetation clearing and gravel surfacing or a concrete pad would be required. Decommissioning of an onshore wind energy facility with a BESS would generally involve the same activities as described in Section 3.4. The addition of decommissioning the BESS would involve similar activities to those of removing other support facilities and infrastructure.

For this analysis, it is assumed the BESS would be located within the project site and would require a small additional area of development.

3.5.1.1 Change or reduction in visual quality

BESSs are similar to other support facilities for a utility-scale onshore wind energy facility and would not contribute to visual impacts from construction and decommissioning more than what was described for utility-scale facilities.

Depending on the project size and the nature of the structures, construction and decommissioning of utility-scale onshore wind energy facilities could result in a range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Section 3.4.3 presents measures that could avoid or reduce impacts of utility-scale onshore wind energy facility on the visual environment.

If a facility with a BESS was repowered instead of decommissioned, repowering activities would require work crews, vehicles, and equipment similar to construction, but reduced in scope and duration. Impacts attributable to facility repowering activities could range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality, and the long-term changes in visual quality and impacts described in Section 3.5.2.1 would persist.

3.5.1.2 New source of light or glare

Sources of light and glare during construction and decommissioning would be largely the same as those for projects without a BESS. The additional BESS construction may require night work lighting; however, these activities would be occasional, temporary, and shielded downward as described for facilities without BESSs and would not otherwise change the visual nature of the construction of the onshore wind energy facility. Construction and decommissioning of a facility with a co-located BESS would not introduce new, substantial sources of glare that could affect daytime views in the vicinity.

Through compliance with laws and permits and with the implementation of measures that could avoid and reduce impacts, construction and decommissioning activities would likely result in **less than significant impacts** related to light or glare.

If a facility with a BESS were repowered instead of decommissioned, repowering activities would generate similar light and glare as construction activities. If a facility were repowered, activities would not introduce new, substantial sources of light that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people. Repowering would result in a **less than significant impact** attributable to light and glare, and the long-term light, shadow flicker, and glare conditions described in Section 3.5.2.2 would persist.

3.5.2 Impacts from operation

3.5.2.1 Change or reduction in visual quality

The addition of a BESS would not change or reduce the nature of visual quality impacts associated with the operation of facilities without a BESS. The BESS would not create a higher level of visual contrast when viewed together with other ancillary structures that would also be a part of the larger onshore wind project and share an industrial appearance.

Depending on the location and size of project sites and visual characteristics of the operations activities, impacts from operations would range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Section 3.4.3 presents measures that could avoid or reduce impacts of a utility-scale onshore wind energy facility on the visual environment.

3.5.2.2 New source of light or glare

The addition of a BESS would not change the sources of light and glare of an onshore wind energy project. For the most part, similar to facilities without a BESS, the lighting and glare impacts, including shadow flicker and blade glinting, would be limited by design considerations, limited operational use, distance from receptors, and other measures. However, for larger facilities with a BESS, similar to larger facilities without a BESS, the regulatorily required obstruction lighting would be visually distributed over a much broader area and seen at greater distances. However, developers of facilities would be required to apply to FAA for the installation of a light-mitigating technology system that complies with FAA lighting requirements and mitigations, including the installation of an ADLS that would result in obstruction lighting being activated only when aircraft come into the ADLS coverage area and deactivated at all other times. With the implementation of this regulatory requirement and other mitigative measures provided in Section 3.4.3, facilities would not introduce new substantial sources of light and glare that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people. Through compliance with laws and permits and with the implementation of measures that could avoid and reduce impacts, operation of facilities would likely result in **less than significant impacts** related to light or glare.

3.5.3 Measures to avoid, reduce, and mitigate impacts

The measures to avoid, reduce, and mitigate aesthetic and visual quality impacts would be the same as those in Section 3.4.3.

3.5.4 Unavoidable significant adverse impacts

Some utility-scale onshore wind energy facilities with co-located BESSs may result in **potentially significant and unavoidable adverse impacts** on visual quality, depending on location and design. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

3.6 Onshore wind facilities that include agricultural uses

This section describes potential impacts on aesthetics and visual quality due to the construction, operation, and decommissioning of utility-scale onshore wind energy facilities with agricultural use.

3.6.1 Impacts from construction and decommissioning

The construction and decommissioning activities for onshore wind facilities with co-located agricultural uses would be largely the same as those for facilities without agriculture. A facility may be located on lands where there is already existing agricultural activity, with or without changing the type of agricultural activity, or a facility could add a new agricultural use to a site.

3.6.1.1 Change or reduction in visual quality

Construction and decommissioning of facilities with co-located agriculture on existing agricultural land would be similar to the construction and decommissioning of onshore wind energy facilities without co-located agriculture. Some construction and decommissioning activities, such as earthmoving, may appear similar to certain cultivating or other farming activities that also require use of large mechanical equipment. Construction and decommissioning of facilities with co-located agriculture in other areas would generally be the same as for facilities without agriculture. If decommissioning activities would only apply to the onshore wind facility components but agricultural activities would continue, extant agricultural activities would need to halt temporarily to allow the decommissioning work to commence. The presence of ongoing agricultural activities following decommissioning of energy facilities may reduce the visual contrast prior to maturation of revegetated areas as compared to facilities without agricultural uses.

Considering the size of project sites and the visual characteristics of the construction and decommissioning activities, impacts attributable to construction and decommissioning of facilities with co-located agriculture could range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Section 3.4.3 presents measures that could avoid or reduce impacts of utility-scale onshore wind energy facility on the visual environment.

If a facility with co-located agricultural use were repowered instead of decommissioned, repowering activities would require work crews, vehicles, and equipment similar to construction, but reduced in scope and duration. Impacts attributable to facility repowering activities could range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality, and the long-term changes in visual quality and impacts described in Section 3.5.2.1 would persist.

3.6.1.2 New source of light or glare

Sources of light and glare during construction and decommissioning would be largely the same as those for facilities without co-located agriculture. Development of agricultural areas are anticipated not to involve nighttime lighting, except for emergency or other episodic use.

Because construction and decommissioning activities would be largely the same as those for facilities without co-located agriculture, additional sources of glare are not anticipated. Agricultural activities that occur currently on a project site could create sources of glare, much like construction and decommissioning activities; however, these sources would not remain in any one fixed location for the entire duration of construction and decommissioning but would be present at different locations depending on the phase of construction.

Through compliance with laws and permits and with the implementation of measures that could avoid and reduce impacts, construction and decommissioning activities would likely result in **less than significant impacts** related to light or glare.

If a facility with co-located agricultural uses were repowered instead of decommissioned, repowering activities would generate similar light and glare as construction activities. If a facility were repowered, activities would not introduce new, substantial sources of light that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people. Repowering would result in a **less than significant impact** attributable to light and glare, and the long-term light, shadow flicker, and glare conditions described in Section 3.6.2.2 would persist.

3.6.2 Impacts from operation

3.6.2.1 Change or reduction in visual quality

The co-location of an onshore wind energy facility with agricultural land uses would still change or reduce the visual nature of a site to an onshore wind energy facility. For sites that are already in agricultural use, the presence of an onshore wind project where none existed would change the visual character of the site. For sites not already in agricultural use, the conversion to agricultural use, in addition to the presence of an onshore wind facility, would also change the visual character of the site.

Depending on the location and size of facility sites and visual characteristics of the operations activities, impacts from project operations would range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Section 3.4.3 presents measures that could avoid or reduce impacts of utility-scale onshore wind energy facilities on the visual environment.

3.6.2.2 New source of light or glare

The types of light and glare during operation would largely be the same as facilities without agriculture. For the most part, the lighting and glare impacts would be limited by design considerations, limited operational use, or distance from receptors and would be limited to the wind energy portion of the facilities, with the potential for periodic night lighting for emergency or other episodic use related to agricultural uses. Similar to facilities without agriculture, the lighting and glare impacts, including shadow flicker and blade glinting, would be limited by design considerations, limited operational use, distance from receptors, and other measures. For larger facilities with agriculture, similar to larger facilities without agriculture, the regulatorily required obstruction lighting would be visually distributed over a much broader area and seen at greater distances. However, developers of facilities would be required to apply to FAA for the installation of a light-mitigating technology system that complies with FAA lighting requirements and mitigations, including the installation of an ADLS that would result in obstruction lighting being activated only when aircraft come into the ADLS coverage area and deactivated at all other times. With the implementation of this regulatory requirement and other mitigative measures provided in Section 3.4.3, facilities would not introduce new substantial sources of light and glare that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people. Through compliance with laws and permits and with the implementation of measures that could avoid and reduce impacts, operations would likely result in **less than significant impacts** related to light or glare.

3.6.3 Measures to avoid, reduce, and mitigate impacts

The measures to avoid, reduce, and mitigate aesthetic and visual quality impacts would be the same as those in Section 3.4.3.

3.6.4 Unavoidable significant adverse impacts

Some utility-scale onshore wind energy facilities with agricultural use may result in **potentially significant and unavoidable adverse impacts** on visual quality, depending on location and design. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

3.7 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for utility-scale onshore wind energy facilities under existing state and local laws on a project-by-project basis. The potential impacts would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design, and would range from **less than significant** to **potentially significant adverse impacts**.

Lighting and glare impacts, including shadow flicker and blade glinting, would be limited by design considerations, limited operational use, distance from receptors, and other measures. For larger facilities, the light resulting from regulatorily required obstruction lighting would be mitigated by the requirement to apply for FAA-compliant light-mitigating ADLS. Overall, new sources of light and glare would result in a **less than significant impact**.

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