National Aeronautics and Space Administration

Environmental Assessment for the NASA Photovoltaic System at the Goddard Space Flight Center, White Sands Complex, New Mexico

June 10, 2020

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Location:	Goddard Space Flight Center (GSFC) White Sands Complex (WSC) is located in Doña Ana County, New Mexico.
Lead Agency:	National Aeronautics and Space Administration (NASA) Johnson Space Center (JSC) White Sands Test Facility (WSTF)
Proposed Action:	NASA proposes the construction of a photovoltaic (PV) system to provide sustainable renewable electricity to the WSC site.
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Executive Summary

NASA proposes to design and build a photovoltaic (PV) system that would generate renewable energy at the Goddard Space Flight Center (GSFC) White Sands Complex (WSC) facility. This PV system would be comprised of a large array of standard fixed tilt solar panels and may eventually include energy storage options that would optimize energy management and overall long-term performance. NASA is planning three separate locations for these PV arrays around the perimeter of the facility that would be completed over several years. The first solar array location (Location 1) would be constructed on approximately 12 acres of land just west of the WSC facility which is about 16 miles northeast of Las Cruces, New Mexico. The expected system size of Location 1 would be between 800 kilowatt (kW) to 1.1 megawatt (MW) of power which is expected to produce 1,712,000 kilowatt-hours (kWh) annually or approximately 20% of WSC current usage.

Construction of Locations 2 and 3 would follow the completion, testing, and operation of the Location 1 system. These two additional installations would require 11.5 additional acres for the solar panel installation and would eventually be located southwest and northeast of the WSC facility.

An energy storage capability using specialized battery systems would be considered at a later time to assist with managing and distributing the power in an effective and efficient manner. These types of commercially available PV systems and energy storage systems meet the guidelines and goals of federal Executive Order (EO) 13834 (*Efficient Federal Operations*) as well as the 2019 NASA Sustainability Plan. They are a proven and effective solution to reduce the facility's dependence on fossil fuel generated commercial electricity while saving resources over the life cycle of the PV system. Additionally, renewable energy projects would reduce greenhouse gas emissions and provide positive regional climate impacts. Construction of Location 1 is expected to begin in Fall 2020 with completion of the project in 2021. Construction of Locations 2 and 3 would follow the completion of Location 1 as funding becomes available.

This Environmental Assessment (EA) describes the proposed actions for a PV system at WSC. One reasonable alternative is considered, a no-action alternative.

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List of Acronyms and Abbreviations

°C	Degree(s) Celsius
°F	Degree(s) Fahrenheit
ac	Acre(s)
B.C.	Before Christ
BISON-M	Biota Information System of New Mexico
BOS	Balance-of-system
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cm	Centimeter
dB(A)	Decibel(s)
dc	Direct current
DOT	U.S. Department of Transportation
EA	Environmental assessment
EIA	Energy Information Administration
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPEC	El Paso Electric Company
ERD	Environmental Resources Document
ft	Foot/feet
GHG	Greenhouse Gas
GSFC	Goddard Space Flight Center
JSC	Johnson Space Center
km	Kilometer(s)
kph	Kilometer(s) per hour
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt-hour
m	Meter(s)
mi	Mile(s)
mph	Mile(s) per hour
MW	Megawatt
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act of 1969
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NREL	National Renewable Energy Laboratory
PV	Photovoltaic
TES	Threatened, endangered, and sensitive
U.S.C.	United States Code
USCB	United States Census Bureau
WSC	White Sands Complex
WSTF	White Sands Test Facility

1.0 Purpose and Need for Action

This Environmental Assessment (EA) has been prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 United States Code [U.S.C.] §§ 4321-4370d), and according to the Procedures of Implementation of NEPA for National Aeronautics and Space Administration (NASA) (Title 14, Code of Federal Regulations [CFR], part 1216 subparts 1216.3, 2012). The EA describes the proposed installation of a renewable energy photovoltaic (PV) system at the NASA Goddard Space Flight Center (GSFC) White Sands Complex (WSC). One reasonable alternative is also considered, a no-action alternative.

1.1 Background

On May 17, 2018 the "Efficient Federal Operations" Executive Order (EO) was published. This EO is a replacement to the previous sustainability EO but still calls for federal agencies to implement energy efficiency measures using renewable energy solutions that can reduce the agency's utility costs. Additionally, the 2019 NASA Sustainability Plan calls for an agency-wide renewable energy goal of 7.5% of total electricity requirements. The Sustainability Plan also tracks project implementations, prioritizes strategies, and identifies achievable actions that would assist NASA with meeting their renewal energy goals. The PV project at the GSFC WSC facility is a part of this renewable energy strategy.

The project proposes to use commercially available PV system solar panels arranged over 12 acres in a fixed tilt configuration with two additional locations added at a later date. This type of PV technology is a well-established and proven process, and many sizes and types of modules are commercially available from many different companies. A PV unit consists of semi-conductive silicon wafers that are metalized (given metal properties) using special metallic inks or thick pastes that create a working solar cell. The cell assemblies are contained in watertight modules for protection from moisture and impacts. The resulting assembly is referred to as a solar panel or module (Figure 1.1). The principle components of crystalline silicon PV modules are glass glazing, cover, silicon wafers and associated wiring, and a protective back sheet. These PV systems also include structures that support the panels and orient them to the sun, and components that take the direct-current (dc) electricity produced by the modules or arrays and then condition the electricity so that it can be utilized. These structures and components are referred to as the balance-of-system (BOS) (SNL, 2011). The PV effect is the physical process through which a PV cell converts sunlight into electricity. Special electrical properties of the PV cell provide the voltage needed to drive the current through an external load (Figure 1.2).

An energy storage capability using batteries is proposed for a future implementation timeframe. Recent advances in battery technology can provide long-term energy storage and reliability. Batteries continue to increase their efficiency while the overall cost of the batteries decreases. The wide range of batteries that are available provides different options for the proposed project. The lithium ion battery has been in existence for almost 30 years. They are used in several different daily applications from personal electronic devices to cars. The flexibility of this battery makes it suitable for a PV system energy storage solution. This technology is attractive because of lower costs and the batteries can be configured in several different ways to provide energy storage. A safe system design would be important when considering using lithium ion batteries. Nickel-cadmium batteries have been around since the early 1900s, are a proven energy storage solution, and their flexibility makes them another potential energy storage option. These batteries are routinely used in commercial energy storage.

1.2 Purpose and Need

The purpose and need for the new PV system is to generate renewable energy to offset the procurement of commercial electricity that is normally derived from fossil fuel sources. This project would align with Executive Order and NASA Sustainability Plan goals and objectives while saving resources over the life

cycle operation of the facility. Additionally, the PV system would also provide a secondary power source for WSC.

Extensive planning and evaluation have shown that renewable energy production in the WSC location would be effective, efficient, and achievable using the proposed PV system configuration. Knowing the biggest demand for electricity, or peak use, and average demand of a power system is critical to proper planning. The power system must be designed to serve the peak load, which is usually the busiest part of the day when the majority of the work force is present. WSC has a consistent load of ~900 to 1100 kW which produces 8,490,287 kWh annually or 707,523 kWh monthly. The peak use for WSC is from 12 pm to 6 pm during the summer months of June through September. Off peaks hours include all other hours during the summer months, and all hours from the months October through May. The design of the PV system would address operational costs related to peak demand, especially when the energy storage capability can be added to the system over time.

2.0 Description of Proposed Action and Alternatives

WSC operates as a component facility to GSFC located in Greenbelt, Maryland, with the primary purpose of providing support to NASA for the United States space program. WSC is located 16 miles (mi; 26 kilometers (km)) northeast of Las Cruces, NM, and 65 mi (104 km) north of El Paso, Texas (Figure 1.3). Geographic coordinates of WSC are 32°30’30” north latitude and 106°36’30” west longitude. The installation occupies approximately 45 acres along the western flank of the San Andres Mountains, a prominent north-south range in southwestern New Mexico.

2.1 Proposed Action

In 2018-2019, NASA contracted the National Renewable Energy Laboratory (NREL) to complete an analysis of fixed tilt and 1-axis tracking PV systems for use at the WSC. The 1-axis tracking system can capture 18.8% more kWh/year than fixed tilt but would require more annual maintenance. As such, it is not expected that 1-axis tracking systems would be part of the proposed project. Instead, NASA is planning a Design-Build-Maintain approach which would be open to different vendors proposing fixed tilt systems. The proposal that offers the most power output from each dollar (along with other standard technical requirements) would be chosen. Because of this procurement approach, the exact final dimensions, structure type, layout, etc. have not yet been determined, but the general requirements would meet all the following:

- The system must have minimum maintenance requirements and high reliability.
- The system must have a minimum 25-year design life.
- The system must be capable of normal unattended operation.
- Can be any technology that produces electricity from PV panels.
- Technologies that involve major use of water (other than for cleaning purposes) or any type of fuel in any stage of its production process would not be accepted.
- Maximum total height of the panels would be approximately 15 feet (ft; 4.6 meters (m)).
- The system must be simple to operate/maintain and be quiet.

The construction start date of the PV system is tentatively scheduled for the fall of 2020 at Location 1 (Figure 2.1). Three potential locations were selected based on a site evaluation that reviewed existing road locations, topography, drainage, proximity to the WSC power plant, levels of electromagnetic interference in the area, and the location of any available utility systems. It is the intent of this proposed project to use all three of the selected locations. The design build process would evaluate the maximum amount of PV system panels that can be incorporated into the available land area while requiring minimal energy storage requirements. As the PV system expands from Location 1 to Locations 2 and 3 a larger energy

storage system using specialized battery systems would be installed to assist with managing and distributing the power.

2.2 No-Action

With the no-action alternative, the proposed locations would remain undisturbed, with no PV system installation. There would be no change to WSC's current electrical energy system and WSC would continue to use their existing system for current and future demands. WSC would not benefit from renewable energy resources that would reduce electrical costs, meet federal requirements and goals, reduce greenhouse gas emissions, provide positive regional climate impacts, and provided a secondary electrical energy source.

3.0 Affected Environment and Environmental Consequences

NEPA requires a focused analysis of the areas and resources potentially affected by an action or alternative. The results of the analysis should be presented in a comparative fashion that allows decision makers and the public to see the differences among the alternatives. The Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 CFR Parts 1500-1508) also require the discussion of impacts in proportion to their significance, with only enough discussion of non-significant issues to show why more study is not warranted. The analysis in this EA considers the current conditions of the affected environment and compares those to conditions that might occur should WSC implement the proposed action at Locations 1, 2, and 3.

3.1 Affected Environment

The affected environment for this project includes three areas adjacent to the WSC complex, noted as Locations 1, 2, and 3 (Figure 2.1 - 2.3). All three proposed locations have similar traits as they are located in the same general area around WSC. Minor differences separate Location 1 from Locations 2 and 3. The differences in Locations 2 and 3 are described in Section 3.1.9 and 3.1.10. Only environmental resources that may be impacted are analyzed in detail. A complete description of all other WSC resource areas is available in the 2015 White Sands Test Facility (WSTF) Environmental Resources Document (ERD).

Table 3.1 presents the results of the process of identifying resources to be analyzed in this EA. This assessment evaluates potential impacts to land use, geology and soils, surface water, climate and greenhouse gases, air quality, energy, biological resources, noise, and socioeconomics. Other resources were assessed but warrant no further examination in this EA. The cumulative impacts for the project are also analyzed.

3.1.1 Land Use

The proposed locations for the PV system are adjacent to the WSC but are currently desert vegetation. Approximately 30 acres of desert vegetation would be cleared during installation of the PV system. An existing road would be used to access the PV systems at Location 1 and 2, but additional access road construction would be required for Location 3. The proposed Location 1 area is currently vacant, flat, with no arroyos, and is monitored by security. Locations 2 and 3 have some relatively minor drainage issues that would be addressed during the design phase. There is an abandoned sewer line in Locations 1 and 2 that could potentially be used for electrical line and underground feeder installation. Compared to the WSC location, existing nearby facilities, and the square miles of desert surrounding WSC, the proposed PV system would have no major impact on current land use.

3.1.2 Geology and Soils

The area topography consists of relatively flat plains west of the San Andres Mountains. The area soils are primarily the loamy soils of the Nickel-Tencee association (United States Department of Agriculture, Soil Conservation Service, 1976). The Nickel-Tencee soils tend to have gravelly fine sand to gravelly loam containing equal parts sand and silt with very little clay soil. Nickel-Tencee soils are typically related with alluvial fan deposits. These soils are moderately alkaline, and permeability is moderate but slow (Seager, 1981 and Seager et al., 1987).

As stated in the previous land use section, approximately 30 acres of desert vegetation would be cleared during installation of the PV systems. An existing road would be used to access the PV system at Locations 1 and 2 and some relatively minor roadwork would be needed to access Location 3. The proposed Location 1 area is flat with no arroyos while Location 2 and 3 may require some drainage improvements due to arroyos in the construction footprint. There would be minimal soil disturbance with the removal of vegetation, leveling the sites if needed, and installing the PV structures. As required, design and construction of the PV system would include elements such as diversion channels, berms, or grading to reduce the potential for soil erosion during construction and long-term operations.

3.1.3 Climate and Greenhouse Gases

Located in the northern portion of the Chihuahuan Desert, WSC has an arid to semi-arid climate with abundant sunshine, relatively low humidity, modest rainfall, and a relatively mild winter season typical of low latitude arid areas. Rainfall through the year is light and insufficient for any growth except desert vegetation. The average annual rainfall at WSC is around 10 in; 25 centimeters (cm)), with the most occurring in July and August. However, rainfall varies across the site with the highest amounts on or near the mountains. Temperatures at WSC are generally warm in the summer and mild during the winter. Temperatures during the day are often near 90 to 100 °F (32 to 38 °C) for the majority of the summer months. Mild daytime temperatures characterize winter, rising to 55 to 60 °F (13 to 16 °C) on average. The lowest temperatures occur in December and January, and night-time temperatures often drop below freezing (NASA, 2015).

Seasonal wind variations in the area are significant, with the strongest sustained winds occurring in late winter and spring months. This is primarily due to the surface winds colliding with the strong westerly winds and the natural terrain of the area. In the summer months, the surface winds are lighter except for the short-term variations caused by the thunderstorms and “dust devils.” Updrafts and downdrafts are always present with thunderstorms, adding to the surface wind variability by cooling the mountains and basins. Variability caused by frontal activity is generally confined to the winter and spring months, contributing to the stronger winds observed during these months. The winds may reach velocities as high as 30 to 40 miles per hour (mph) (48 to 64 kilometers per hour (kph)) or may exceed these velocities when a pressure gradient and a thermal gradient lie in the same direction.

Greenhouse gas (GHG) contributions take into account direct and indirect emissions such as carbon dioxide. Approximately half of the overall GHG contributions at WSC are indirect from electricity purchased from the local electrical utility company. NASA uses calendar year 2011 as a conservative baseline for GHG emissions, since 2011 was the last year Space Shuttle activities were conducted at nearby WSTF and recent testing has not reached the same GHG levels as 2011 (NASA, 2015). The proposed 1.1 MW PV system would produce approximately 1,712,000 kWh of renewable energy annually, and reduce carbon dioxide emissions by 1,210 metric tons. That is the same amount of carbon dioxide emissions as using 136,205 gallons of gasoline or the energy use of 140 homes each year.

The proposed action would not affect the climate at WSC or the surrounding area. However, the proposed action would effectively reduce the need for electricity generated using fossil fuels, resulting in an overall reduction in GHG and climate impacts.

3.1.4 Air Quality

The U.S. Environmental Protection Agency (EPA) regulates air quality through National Ambient Air Quality Standards (NAAQS). Air quality is assessed according to six criteria pollutants: carbon monoxide, ground level ozone, nitrogen oxides, sulfur dioxide, particulate matter, and lead (USEPA, 2019). WSC is in a section of Doña Ana County which is in attainment with NAAQS (NMED, 2019). However, high levels of particulate matter from natural sources (such as blowing dust storms) may occur temporarily during periods of high winds. The State of New Mexico, in accordance with federal clean air standards, has adopted a set of air quality control regulations that apply to stationary sources of air pollution. These regulations apply to stationary sources, such as diesel generators. They do not apply to mobile sources such as trucks or aircraft.

The ambient air quality and weather conditions in the proposed area are excellent. The atmospheric visibility (or seeing) conditions are in the 50 to 100 mi (80 to 160 km) range. However, Doña Ana County, where the proposed project is located, has been designated as an Air Quality Maintenance Area for carbon monoxide and total suspended particulate matter near Anthony and Sunland Park, NM. Both locations are more than 30 miles away from the proposed project location. The county itself is lightly populated and relatively pollution-free. However, air quality is sometimes temporarily affected by the cities of El Paso, Texas and Juarez, Mexico.

There would be minimal dust deposited in the air from the construction of the PV system and support structures at any of the proposed locations. There would also be temporary mobile sources of air emissions (vehicles, construction equipment) present during the construction. Ground vehicles and generators would be used for the installation of the new systems. There are no plans to keep portable generators at the PV system after installation is complete.

Overall, there would be no significant impacts on air quality at the project area. There would be a beneficial regional reduction in emissions resulting from the lowered use of electricity from the electric power generating plants currently supporting WSC operations.

3.1.5 Energy

The local electric utility company El Paso Electric (EPEC) provides electricity to WSC through a 69 kilovolt (kV) transmission line that runs parallel to the site’s access road easement and terminates at the Apollo Substation located adjacent to the WSTF main entrance gate. From the Apollo Substation power is sent to WSC through a 24.9 kV transmission line. WSC has a consistent load of ~900 to 1100 kW which produces 8,490,287 kWh annually or 707,523 kWh monthly.

WSC would continue to consume the same amount of energy it currently uses, with little or no change in the next 10 years. The difference would be in the fuel source of the electricity. Solar energy provides electrical energy without fossil fuel emissions. Capturing as much renewable energy as possible from the new PV system would help WSC meet current and future energy demands. As the PV system expands to Locations 2 and 3, batteries and energy storage are options that would be considered to store energy on site. This would allow WSC flexibility with how the renewable energy is used in the future.

3.1.6 Biological Resources

Major vegetation within the area includes a combination of woody shrubs and grasses characteristic of the Chihuahuan Desert Scrub Biotic Community. The proposed project's location is a xeric, poorly drained, and vegetative homogenous area. Shrubs provide a microhabitat for warm season grasses and various mammals, birds, amphibians, and reptiles.

The proposed area's vegetation group contains yucca (*Yucca* spp.), broom snakeweed (*Gutierrezia sarothrae*), and honey mesquite (*Prosopis glanulosa*). Other plant species include tarbush (*Flourensia cernua*), creosotebush (*Larrea tridentata*), Russian thistle (*Salsola kali*), fourwing saltbush (*Atriplex canescens*), silverleaf nightshade (*Solanum eleagnifolium*), desert globemallow (*Sphaeralcea ambigua*), plains pricklypear (*Opuntia polyacantha*), and the desert Christmas cactus (*Cylindropuntia leptocaulis*). The most abundant species of grasses around WSC are sand dropseed (*Sporobolus cryptandrus*), blue grama (*Bouteloua gracilis*), bush muhly (*Muhlenbergia porter*), and bristlegrass (*Setaria sp.*).

Construction and maintenance activities for the PV system would create vegetation disturbances. Most construction activities would take place next to established areas with human activity. Vegetation would not be allowed to grow back after the PV system is completed. In reviewing the surrounding desert area, there would be no long-term significant impacts to site's vegetation.

Common species of birds that could occur at or near the proposed area include quail (Family *Odontophoridae*), roadrunners (*Geococcyx californianus*), doves, hawks, owls, ravens, turkey vultures (*Cathartes aura*), sparrows, wrens, flycatchers, and a variety of other songbirds. Migratory bird species frequent WSC during the spring and fall. This is when the bird population is at its largest.

Common large and small mammals that are expected to occur at or near the proposed PV location include mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), raccoons (*Procyon lotor*), black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*), woodrats, and mice.

The list of lizards and snakes includes whiptails (*Aspidoscelis* sp.), collared lizards (*Crotaphytus collaris*), coachwhips (*Masticophis flagellum*), gopher snakes (*Pituophis catenifer*), prairie rattlesnakes (*Crotalus viridis*), and western diamondback rattlesnakes (*Crotalus atrox*). Amphibian species found in this area include true toads (*Bufo* sp.) and spadefoot toads (*Spea* and *Scaphiopus* sp.) (Sullivan & Houde-Nethers, 1996; Skarsgard, 2011). There are no habitats that contain fish in the proposed project area.

Fauna could be affected by construction activities, and operation and maintenance activities of the PV system. Noise from sources, such as vehicles, heavy machinery, and general human activities related to construction and operation and maintenance activities would lead to species-specific faunal reactions. Factors influencing faunal responses may be time and length of the noise, seasonality, time of day, stress and physiological effects, life history, naturally occurring and background noise, and habituation (Larkin, 1996; Brown, 2001). Most small mammals would avoid excessive noise by retreating into burrows while larger species of mammals and birds would temporarily vacate the area. Reproductive activities of some small mammals and birds may be temporarily disrupted by noise and the presence of humans while other animals may become increasingly habituated and display little modification in behavior with ongoing exposure. Overall, proposed activities would be adjacent to existing human disturbed areas and should have little to no impact on mammals, birds, reptiles, and amphibians.

3.1.7 Noise

There would be some noise generated during the construction phase of the PV system. Noise levels during construction may at times reach levels harmful to field personnel. Proper ear protection would

prevent hearing loss and tinnitus while using certain construction equipment. Table 3.2 lists common noise sources and their decibels (dB (A)) levels. Maintenance and operations activities should have no impact on current noise levels at WSC. Overall the proposed PV system project would have no significant impact on WSC noise levels.

3.1.8 Environmental Justice

Socioeconomics consists of the basic attributes and resources associated with the human environment especially in regard to population, economic activity, and environmental justice. The socioeconomic region of impact for the proposed action includes the areas surrounding Doña Ana County.

On February 11, 1994, the President of the U.S. signed EO 12898, entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." The general purposes of the EO are to: 1) focus the attention of federal agencies on the human health and environmental conditions in minority and low-income communities with the goal of achieving environmental justice; 2) foster nondiscrimination in federal programs that substantially affect human health or the environment; and 3) give minority and low-income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment (Executive Order No. 12898, 1994).

The EO directs federal agencies, including NASA, to develop environmental justice strategies. Further, EO 12898 requires NASA, to the greatest extent practicable and permitted by law, to make the achievement of environmental justice part of NASA's mission. Disproportionately high adverse human health or environmental effects on minority or low-income populations must be identified and addressed. In response, NASA established an agency-wide strategy, which, in addition to the requirements set forth in the EO, seeks to: 1) minimize administrative burdens; 2) focus on public outreach and involvement; 3) encourage implementation plans tailored to the specific situation at each Space Center; 4) make each Center responsible for developing its own Environmental Justice Plan; and 5) consider both normal operations and accidents. NASA has developed a plan so that WSTF complies with the EO and NASA's agency-wide strategy.

Based on the information from the U.S. Census Bureau (USCB, 2018), minority and low-income populations are believed to exist within the proposed action's region of influence. Statistics for minority populations in nearby Las Cruces, New Mexico indicate an average of 58.6% Hispanic. Caucasians who are not Hispanic were 34.9% of the population. Approximately 5.8% of the population is an ethnicity other than Hispanic or Caucasian. The population in poverty within the region of influence averages 24.4% (UCSB, 2018). The general minority population in the State of New Mexico averages 49.1% Hispanic of any race, 15.5% population other minority groups, and 37.1% Caucasians who are not Hispanic. The statewide population has 19.5% of the population living in poverty (USCB, 2018).

The private properties closest to WSC are several miles outside the project area and include low- and high-income properties, with different ethnicities occupying the properties. These properties are not considered to have high minority and poverty populations compared to the general population of Doña Ana County and New Mexico. Under the proposed action, the project locations are several miles from the nearest publicly accessible area so there would be no significant impact on, nor a potential for, disproportionately high and adverse effects on minority and low-income populations.

3.1.9 Location 2 Considerations

Location 2 is located on the west side of WSC and has minor issues with surface water. A large arroyo, a gully in arid regions that flows during rainstorms, cuts across Location 2. Flash flooding and soil erosion

can occur in and near arroyos. Engineering designs such as diversion and collection systems would be used to minimize impacts to the PV system and surrounding desert vegetation. Long-term maintenance costs could also increase with the large arroyo present.

3.1.10 Location 3 Considerations

Location 3 has minor issues with surface water and threatened and endangered species. Location 3 is on the east side of WSC, which is not near the power plant. There is no existing road at this location. There are no abandoned utility tunnels that could be used to run electrical lines. This location would need longer electrical lines, utility tunnels, and a road construction to use this area.

There is also an arroyo located in this area. The arroyo is small and shallow, almost even with the surrounding soil and vegetation. Surface water and flash flooding could be a minor problem in this small arroyo. Engineering controls would be installed to minimize the surface water impacts to this area. Near the arroyo are two state endangered night blooming cereus cacti (*Peniocereus greggii*). These cacti are protected by the state of New Mexico. The plants would need to be protected or moved to a nearby suitable habitat.

3.1.11 Cumulative Impacts

Cumulative impacts are those environmental impacts that result from the incremental effects of the proposed action when compounded by other past, present, or reasonably foreseeable future actions (40 CFR §1508.7, 2012). The installation of a PV system at the WSC would make minor contributions to the overall cumulative impacts at WSC. Waste generated during this project would be managed and disposed of in accordance with applicable local, state, and federal regulations. Overall greenhouse gas air emissions associated with power use at the site would be beneficially reduced by using onsite renewable energy. Noise associated with construction activities would be temporary and localized to areas with existing human activity. Vehicle traffic associated with construction and maintenance activities would slightly increase but would not significantly increase traffic loads on the existing and future road network. Reducing materials or recycling materials whenever possible during the project would reduce the overall project cost and resources used. These minor effects, when offset by the benefits of a renewable energy installation, do not represent any cumulative effects that would rise to a level of concern while constructing and operating this PV system.

3.2 No-Action

Under the no action alternative none of the resources listed in Section 3.1 would be affected. There would be no change to WSC’s current electrical energy system. WSC would continue to use the existing system for current and future demands. WSC would not benefit from renewable energy resources that would reduce electrical costs, meet federal goals, reduce greenhouse gas emissions, provide positive regional climate impacts, and provided a secondary electrical energy source.

4.0 Mitigation and Monitoring

To minimize potential environmental impacts associated with the proposed action, the following mitigations would be adopted. These mitigations are central to the determination of no significant impact. Mitigation efforts would be implemented at the discretion of WSC as needed during the construction and operations phases of the project. Any unexpected adverse impacts to the environment would require additional mitigation measures.

4.1 Air

Vehicles and heavy equipment would be used during the construction of the PV system. To minimize dust during these activities, dust control measures such as water trucks or dust suppressants would be used.

4.2 Biological Resources

Vehicles would use existing roads when available. If any threatened, endangered, or sensitive species were found following the completion of this EA, NASA would determine if additional mitigation is necessary to prevent impact to the listed species' populations. State endangered night blooming cereus cacti identified in Location 3 would be protected from construction activities or relocated to a suitable location.

4.3 Noise

Noise levels during construction may, at times, reach levels harmful to field personnel. For individual protection, all personnel are required to use appropriate protective hearing devices if 84 dB(A) are surpassed.

4.4 Hazardous Materials/Waste

The project would use some possible hazardous materials during construction activities. All hazardous materials would be received and shipped in accordance with U.S. DOT requirements. Hazardous materials would be stored and used in accordance with manufacturer recommendations to mitigate risks associated with their use on site. Hazardous materials and components reaching the end of their service life would be properly managed and disposed of in accordance with applicable local, state, and federal regulations. Any unplanned release of hazardous constituents would be immediately contained and addressed in accordance with WSTF procedures to minimize adverse impacts to the environment.

5.0 Agencies and Persons Consulted

Tom Nicklaus
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Figures

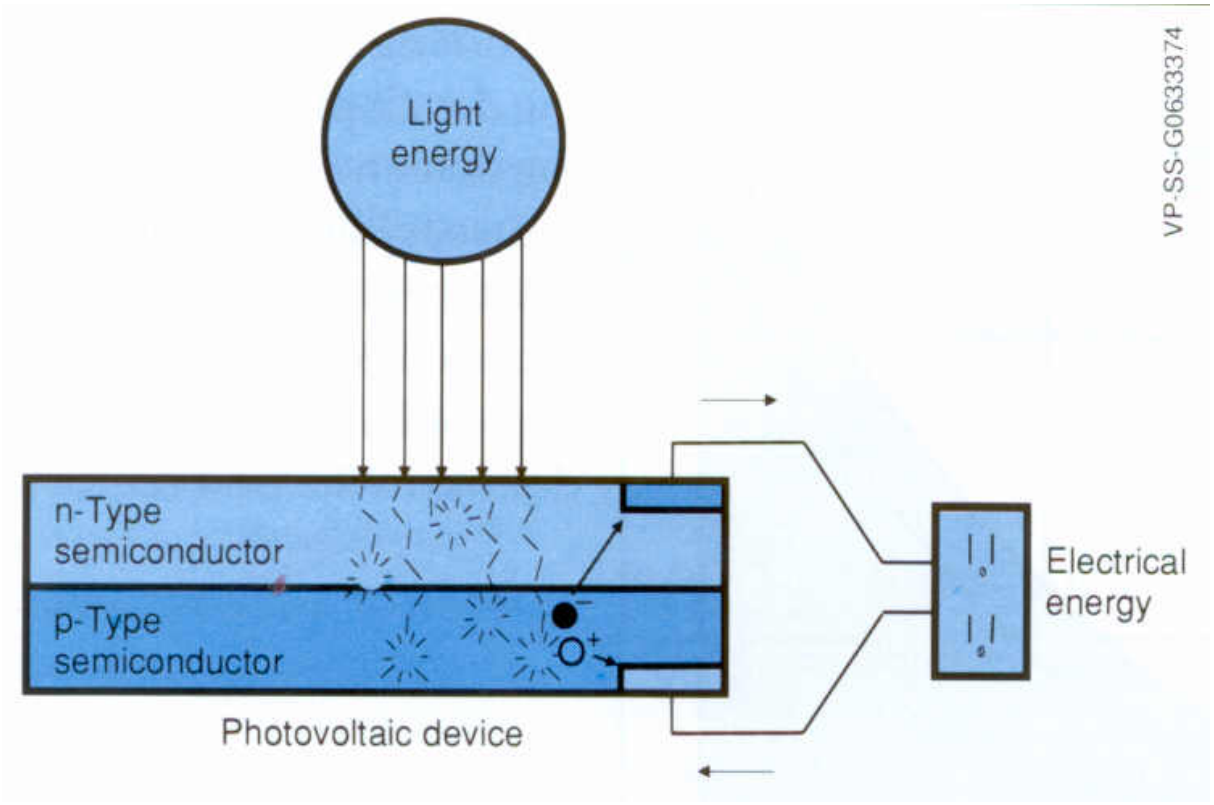
Figure 1.1 **Examples of Photovoltaic Systems**

(SEE NEXT PAGE)

NASA White Sands Test Facility Photovoltaic System off Well Road

Figure 1.2 **The Photovoltaic Effect**

(SEE NEXT PAGE)



https://energy.sandia.gov/energy/renewable-energy/solar-energy/photovoltaics

Figure 1.3 **WSC Location Map**

(SEE NEXT PAGE)

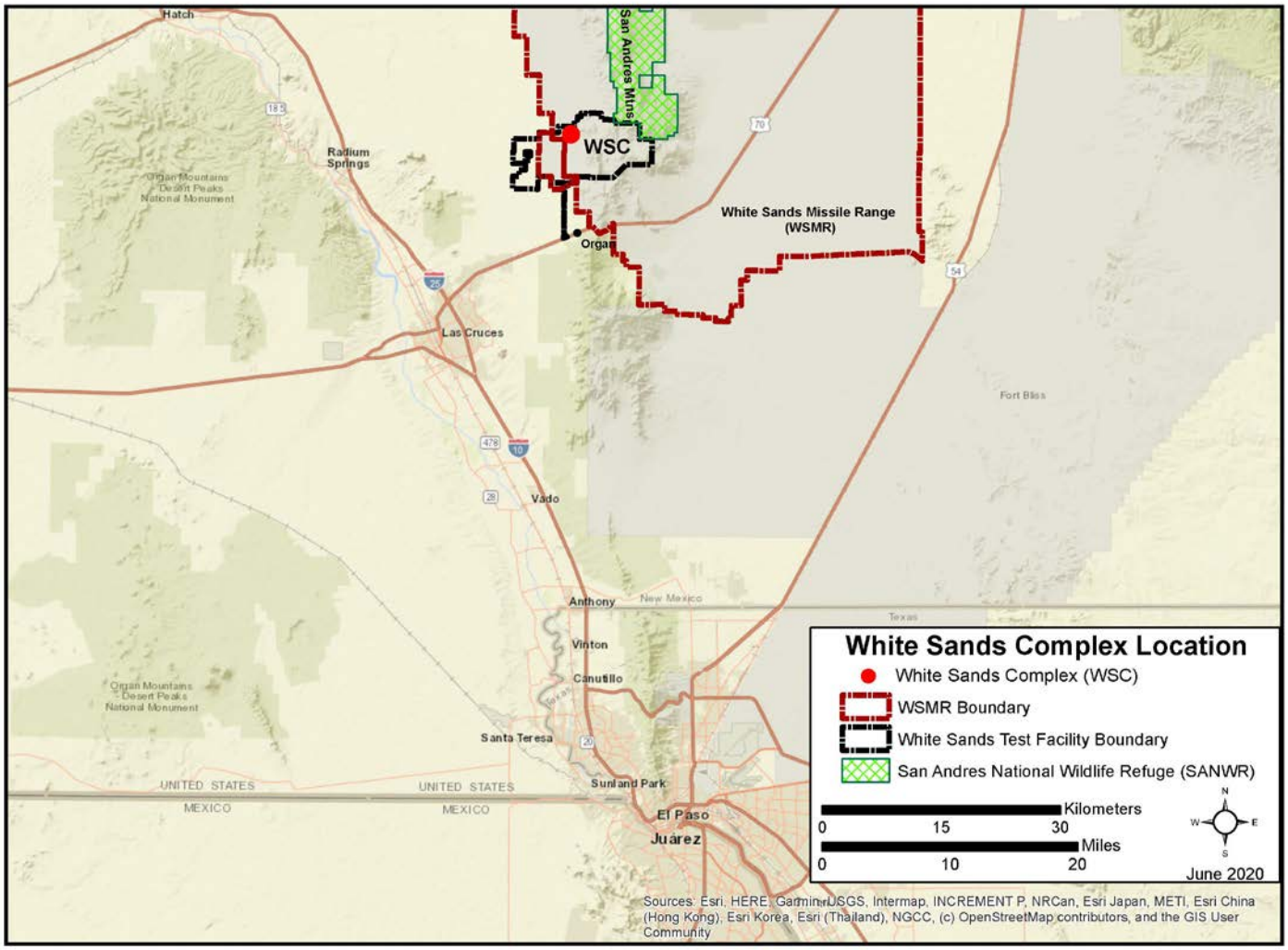

Hatch
San Andres Mtns
WSC
Radium Springs
Organ Mountains Desert Peaks National Monument
White Sands Missile Range (WSMR)
Organ
Las Cruces
Fort Bliss
Vado
Anthony
New Mexico
Texas
Vinton
Canutillo
Santa Teresa
Sunland Park
UNITED STATES
MEXICO
El Paso
Juárez
White Sands Complex Location
White Sands Complex (WSC)
WSMR Boundary
White Sands Test Facility Boundary
San Andres National Wildlife Refuge (SANWR)
Kilometers
0 15 30
Miles
0 10 20
June 2020
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Figure 2.1 WSC Photovoltaic System Proposed Location 1

(SEE NEXT PAGE)

Location #1

- Existing road
- Large, flat area
- Outside high-security
- Relatively near Power Plant Building
- Furthest from Antenna (EMI)
- Abandoned Sewer Line (8”) beneath road

Figure 2.2 WSC Photovoltaic System Proposed Location 2

(SEE NEXT PAGE)

Location #2

- Directly south of Location #1
- Existing road
- Large, flat area
- Outside high-security
- Relatively near Power Plant Building
- Far from Antenna (EMI)
- Abandoned Sewer Line (8") beneath road
- **Cross-cut by Arroyo**

Figure 2.3 WSC Photovoltaic System Proposed Location 3

(SEE NEXT PAGE)

Location #3

- East Location #1
- Large, flat area
- Outside high-security
- Far from Antenna (EMI)
- **Not near Power Plant Building**
- **No existing road**
- **Minor arroyo in area**
- **State endangered night blooming cereus in area**

Tables

Table 3.1 Resources Considered for WSC PV system EA

Resource	Analyzed in detail for this EA?	If Yes, EA Section If No, rationale for elimination
Land Resources		
Land Use	Yes	Section 3.1.1
Geology and Soils	Yes	Section 3.1.2
Topography	No	Topography would not change
Water Resources		
Surface Water	Yes	Section 3.1.9, 3.1.10
Groundwater	No	No additional groundwater usage
Wetlands	No	No wetlands present in project area
Stormwater	No	No stormwater issues in project area
Floodplains	No	No floodplains present in project area
Climate and Greenhouse Gases	Yes	Section 3.1.3
Air Quality	Yes	Sections 3.1.4, 4.1
Energy	Yes	Section 3.1.5
Noise	Yes	Sections 3.1.7, 4.3
Hazardous Materials and Hazardous Waste	Yes	Sections 3.1.11, 4.4
Biological Resources		
Vegetation	Yes	Section 3.1.6
Wildlife and Migratory Birds	Yes	Section 3.1.6
Threatened and Endangered Species	Yes	Sections 3.1.10, 4.2
Fish	No	No fish present at WSC
Social and Economic Environment		
Health and Safety	No	No additional health concerns with proposed project
Transportation	No	No added transportation needs for WSC employees
Cultural Resources	No	No identified resources present in proposed project area
Environmental Justice	Yes	Section 3.1.8
Population	No	No new permanent employees hired to support proposed action
Employment and Income	No	Minor short-term impacts during construction only

Table 3.2 Common Noise Sources

dB(A) Level	Source
60	Speech at 3 ft (0.9 m)
70	Normal street traffic
90	Operating a lawn mower
100	Operating a chain saw
140	Jet airplane takeoff at 50 ft (15 m)