EXHIBIT V
WASTE MINIMIZATION
OAR 345-021-0010(1)(v)

TABLE OF CONTENTS

V.1 INTRODUCTION

OAR 345-021-0010(1)(v) *Information about the applicant's plans to minimize the generation of solid waste and wastewater and to recycle or reuse solid waste and wastewater, providing evidence to support a finding by the Council as required by OAR 345-022-0120. The applicant shall include:*

Response: This Exhibit demonstrates how Madras PV1, LLC (Applicant) will minimize solid waste and wastewater generated during construction and operation of the Madras Solar Energy Facility (Facility). The Applicant will recycle and reuse solid waste, as outlined in the Applicant's solid waste and wastewater plans that are described in this Exhibit. In addition, the Applicant will manage solid wastes in a manner that will result in minimal impacts on surrounding and adjacent areas.

OAR 345-021-0010(1)(v) r*equires that the site certificate application for the Facility address waste minimization in accordance with OAR 345-022-0120, which states that:*

> *(1) Except for facilities described in section (2) and (3), to issue a site certificate, the Council must find that, to the extent reasonably practicable:*
>
> > *(a) The applicant's solid waste and wastewater plans are likely to minimize generation of solid waste and wastewater in the construction and operation of the facility, and when solid waste or wastewater is generated, to result in recycling and reuse of such wastes; [and]*
> >
> > *(b) The applicant's plans to manage the accumulation, storage, disposal and transportation of waste generated by the construction and operation of the facility are likely to result in minimal adverse impact on surrounding and adjacent areas.*

The information presented in this Exhibit is generally organized in accordance with OAR 345-021-0010(1)(v) and provides evidence needed to support a finding by the Energy Facility Siting Council (as required by OAR 345-022-0120).

V.2 MAJOR TYPES OF WASTE PRODUCED WITH QUANTITY ESTIMATES

OAR 345-021-0010(1)(v)(A) *A description of the major types of solid waste and wastewater that construction, operation and retirement of the facility are likely to generate, including an estimate of the amount of solid waste and wastewater.*

Response: The major types of solid waste and wastewater likely to be generated by the Facility are nonhazardous construction and demolition debris, as well as construction and operation-related wastewater. The following sections provide additional details of the major types of waste generated and volume estimates.

V.2.1 Construction

As presented in Exhibit G, nonhazardous construction waste will be generated. Primary sources of waste include general construction debris such as scrap steel, waste concrete, and excavated soil. Other materials such as packaging from the installed solar photovoltaic modules and associated electrical equipment and erosion control material (e.g., silt fencing and straw wattles) may also be generated during construction. The nonhazardous waste produced during construction will be accommodated by a local solid waste hauler. Estimated volume of construction waste will be one 40-cubic-yard roll-off per week during active construction, which is estimated to occur between 4 and 6 months.

Wastewater generated during construction will result from portable toilets. Portable toilets will be managed by a local contractor and wastewater will be disposed of in accordance with state law. An average of 15 portable toilets will be onsite during construction, including 40 portable toilets during peak construction.

During Facility construction and operation, it is also expected that a minimal amount of hazardous materials may be generated. Hazardous materials are expected to consist of paint, spent lubrication oils, and solvents. The hazardous materials required for Facility construction and maintenance will be stored in accordance with U.S. Environmental Protection Agency and U.S. Occupational Safety and Health Administration regulations, as applicable. Safety data sheets of

each hazardous material will be stored onsite. Facility personnel will receive guidelines and will be trained on the handling, storage, transport, and disposal of hazardous materials.

Contractors for the Applicant will be required to maintain a hazardous materials spill prevention program. Hazardous materials will be properly stored, and hazardous material containment and cleanup kits will be maintained and available onsite to minimize the impact resulting from a spill.

V.2.2 Operations

During operations, the primary waste generated will be solid waste from maintenance and housekeeping activities. Disposal of materials for routine maintenance and housekeeping, such as lubrication oils and cleaning supplies, will be managed according to the pertinent regulations and the guidelines outlined in Exhibit G. An estimated 2 yards of solid waste will be generated per month.

Restroom facilities will be provided in the form of portable toilets during construction, while any required water will be trucked in from offsite sources. Sanitary wastewater that is generated onsite will be collected in portable toilets and shipped offsite for treatment, with an estimated 10 gallons of sanitary wastewater generated per day.

Other than the washwater periodically generated from washing panels, which will be covered under an Oregon General Water Pollution Control Facilities 1700-B Permit if deemed necessary, industrial wastewater will not be generated through Facility operation. Solar panel washwater consisting of no added cleaning solvents will be generated and will be discharged by evaporation and seepage into the ground, as detailed in Exhibit O.

Waste such as universal waste (for example, lightbulbs and batteries) will be recycled according to applicable regulations.

In addition, solid waste will be generated when batteries are replaced within the battery storage system. Lithium-ion batteries will need to be changed out periodically (estimated at approximately every 5 to 10 years). Flow batteries have a life span of approximately 10 to 20 years and will need to be replaced at least once during Facility operation. With both battery technologies, self-contained battery components will be removed and disposed of or recycled by a qualified vendor.

V.2.3 Retirement

Waste produced from retirement activities will be managed in a similar manner to the waste produced during construction and operation. See Sections V.2.1 and V.2.2 above. When the Facility is retired, aboveground equipment will be removed and sold for scrap, reused, or disposed of at a local landfill. The underground electrical cables will be rendered inert and left in place. Concrete foundations will be removed, recycled, and replaced by suitable clean fill. Table V-1 describes the major types of waste materials associated with retirement of the Facility. The table provides an inventory of estimated waste stream quantities and proposed disposal methods.

The retirement of the battery storage system, if used, will involve disposing of battery components at an offsite facility approved for disposal or recycling of batteries. Battery disposal or recycling retirement will be similar to the protocol described above for operations.

Table V-1. Inventory of Waste Materials Associated with Facility Retirement

Material/Chemical	Description	Estimated Quantity Used During Operation	Disposal Method
Steel operations and maintenance enclosure	A single, 8.5-foot-tall, 320-square-foot dry-storage shed	One shed	Recycle or sell for scrap, if feasible. Alternatively, dispose of in licensed landfill
Steel battery storage containers and battery racks for lithium-ion battery technology	225 tons (approximately 3,750 pounds per battery container)	Up to 120 containers	Recycle or sell for scrap, if feasible. Alternatively, dispose of in licensed landfill
34.5-kilovolt electrical cable	Solar photovoltaic underground collection cables	4 miles	Render underground cables inert and leave in place

Table V-1. Inventory of Waste Materials Associated with Facility Retirement

Material/Chemical	Description	Estimated Quantity Used During Operation	Disposal Method
Solar photovoltaic modules, steel mounting racks, and steel trackers	Generate solar power via 60 module blocks. The solar PV modules will be installed aboveground to form approximately 60 module blocks of approximately 1.05 MW of alternating current each. A full-sized row within a given module is 400 feet long and 1,960 millimeters (6.4 feet) wide, with approximately 8 feet of clear space between each row. The crystalline silicon modules themselves will be approximately 6.6 feet long by 3.3 feet wide and approximately 0.13 foot thick. Each module is on a steel mounting rack and single-axis steel tracker.	Steel racks and 50,000 steel mounting posts	Recycle
Inverters	Convert direct current output from the PV modules into alternating current	19 inverters (aboveground)	Recycle or sell for scrap, if feasible. Alternatively, dispose of in licensed landfill
Transformers: main step-up, auxiliary station service transformers, and power conversion station transformers	Step up voltage	21 transformers (aboveground)	Recycle or sell for scrap, if feasible. Alternatively, dispose of in licensed landfill
Substation	Step up voltage to 230 kilovolts	Various aboveground pieces of equipment described in Section B.2 of Exhibit B	Recycle or sell for scrap, if feasible. Alternatively, dispose of in licensed landfill
Point of Interconnect	Interconnect Facility with Portland General Electric Pelton Dam to Round Butte 230-kilovolt transmission line	Various aboveground pieces of equipment described in Section B.2 of Exhibit B	Recycle or sell for scrap, if feasible. Alternatively, dispose of in licensed landfill
Concrete	Provide ballast for solar module trackers (20,000 cubic yards maximum) and foundations (200 cubic yards maximum)	20,200 cubic yards (maximum)	Recycle materials above 3 feet below ground; leave other material in place
Rock/gravel aggregate	Provide material for road construction	2,000 tons (maximum)	Recycle

V.3 STRUCTURES, SYSTEMS, AND EQUIPMENT TO MANAGE AND DISPOSE OF WASTE

OAR 345-021-0010(1)(v)(B) *A description of any structures, systems and equipment for management and disposal of solid waste, wastewater and storm water.*

Response: Construction waste minimization practices will be implemented to minimize the amount of solid waste generated. The practices will include implementing a detailed material usage estimating and procurement system to minimize the amount of excess materials ordered. In addition, a general procedure will be implemented to separate recyclable material from solid waste. Solid waste and recyclables generated during construction will be provided by local commercial haulers.

Madras Sanitary Service provides residential and commercial solid waste management services within the City of Madras and Jefferson County. Solid waste disposal for the Facility during construction and operations will be provided by private contract with a local commercial hauler or

haulers. The closest public transfer station is the Jefferson County Box Canyon Transfer Station operated by Madras Sanitary Service, located approximately 11 miles by car from the Facility. The closest public landfill is the Crook County Landfill operated by Crook County, located in Prineville approximately 40 miles by car from the Facility.

Recyclable materials consisting of scrap steel, cardboard, general packaging materials, and wood will be segregated from solid waste and transported to a recycling facility. Waste concrete and hardened concrete from concrete washout areas will be incorporated into the foundation excavations or transported offsite and disposed of at the Jefferson County Box Canyon Transfer Station. Solid waste that is not recyclable will be collected, sorted, and transported offsite for disposal at the Jefferson County Box Canyon Transfer Station.

Solar panels that are nonfunctional or are retired will be recycled to the maximum extent feasible through the Solar Energy Industries Association (SEIA) National PV Recycling Program (SEIA, 2019). The purpose of this program is to combine services offered by recycling partners in order to provide cost-effective and environmentally responsible. SEIA is sponsoring this program and research and development that could make the entire industry landfill free.

V.3.1 Construction

During construction, several structural and nonstructural best management practices (BMPs) will be implemented to prevent erosion and control sedimentation. As described in Section I.4 of Exhibit I, construction of access roads, foundations, and other facilities will be regulated by an erosion and sediment control plan and a 1200-C Construction Stormwater National Pollutant Discharge Elimination System Permit (see Attachment I-1 to Exhibit I) that will require BMPs to minimize possible impacts from erosion or other impacts to soils. The BMPs provided in Attachment I-1 and Section I.4 to be implemented during Facility construction include the following:

Runoff Control: Runoff controls will be installed to minimize stormwater velocity. Runoff controls will primarily consist of silt fencing and fiber rolls. Silt fencing will be installed on contours downgradient of land-disturbing activities.

Erosion Prevention: During construction, the focus will be on preventing erosion, rather than on implementing sediment control after erosion has already occurred. The types of BMPs that will be implemented during land-disturbing activities include mulching, deploying erosion control matting, and applying soil binders and tackifiers.

Wind Erosion and Dust Control: As a result of the arid weather conditions at the Facility site, the primary mechanism for soil and sediment transport will be wind. Dust suppression techniques will be used to minimize this transportation pathway. Water will be primarily applied to the graveled or rocked access roads for the duration of the dry months of construction. Additional BMPs, including the use of additives, may be implemented if water alone does not sufficiently address wind erosion or visible dust.

Vegetative Erosion Control: As feasible, existing vegetation will be preserved, and buffered to minimize erosion. The use of natural vegetative barriers may be implemented in conjunction with sediment controls (for example, silt fencing). Vegetative buffers minimize stormwater velocity and can effectively capture suspended particulate that mobilized through stormwater runoff.

Sediment Tracking Control: To prevent sediment discharge onto public roads, a stabilized construction entrance/exit will be installed and maintained at locations where newly constructed Facility access roads intersect existing paved roads, and at the construction staging areas. As part of the inspection protocol, these intersections will be routinely inspected. Additional BMPs may be implemented, including street sweeping and tire wheel wash, if sediment tracking is observed.

Stockpile Management: If soils are stockpiled, silt fencing or fiber rolls will be used as perimeter control, and the material will be covered either with a thick layer of mulch or plastic sheeting.

Pollutant Management: Potential pollutants will be stored within the contractor staging area with secondary containment. Construction vehicles will be fueled and maintained only in staging areas, with containment BMPs in place. Handling, storage, and disposal of materials will be consistent with federal, state, and local ordinances.

V.3.2 Operations

Solid waste generated during Facility operations will be disposed of though local haulers and will ultimately be disposed of at the Jefferson County Box Canyon Transfer Station. Solid waste during operations will likely consist of paper products and packaging. To the extent feasible, recyclable material will be separated for disposal at a recycling facility.

Lithium-ion battery modules will require replacement periodically as the modules lose their effectiveness through repeated charge/discharge cycles. The frequency of replacement will depend on operational parameters that are not yet fully designed. The following procedures will be implemented for lithium-ion battery replacement:

- The Facility operator will disconnect and de-energy battery system prior to removal from the installed racks, and package the batteries for transport to a licensed facility.
- At the recycling facility, the qualified contractor will dismantle battery modules and prepare individual cells for metals recovery.
- Individual cells will be processed in a furnace to recover metals. Recovered metals may include aluminum, calcium, lithium, and a metal alloy comprising cobalt, copper, nickel, and iron.
- Recovered metals will be recycled or separated to recover individual metals where economically viable.

Flow batteries will also require replacement at least once during Facility operation. Similar to the procedures for lithium-ion batteries, the batteries will be de-energized, removed, and transported to a licensed disposal facility where they will be recycled or properly disposed.

V.3.3 Retirement

Waste minimization during Facility retirement will consist largely of the same measures employed during Facility construction. To the extent practicable, Facility components will be sold for reuse or scrap, which will minimize the amount of waste requiring disposal at a solid waste facility. Similar BMPs will be implemented to protect stormwater quality.

The battery storage will require disposal of the metal container structures housing the batteries and their constituent parts. If flow technology is used, the nontoxic ionized fluids contained in the battery modules will be transported offsite for disposal at an approved wastewater disposal location. If lithium-ion technology is used, batteries will be disposed of at retirement in the same manner described above for operational replacement.

V.4 WATER USE REDUCTION

OAR 345-021-0010(1)(v)(C) *A discussion of any actions or restrictions proposed by the applicant to reduce consumptive water use during construction and operation of the facility.*

Response: Water use reduction actions will be implemented during construction and operation of the Facility. The following sections provide additional details.

V.4.1 Construction

Water will be used on an as-needed basis to construct concrete foundations and suppress dust on the roads (and other areas disturbed as a result of grading). To reduce the water used for dust suppression during construction, stabilization materials such as mulch, soil tackifiers, and soil binders may be placed on exposed soils to minimize dust generation without the use of daily water.

V.4.2 Operations

During Facility operation, water will be trucked to the Facility and held in a water tank. Water minimization practices and devices will be implemented in order to conserve water.

V.5 PLANS FOR RECYCLING AND REUSE

OAR 345-021-0010(1)(v)(D) *The applicant's plans to minimize, recycle or reuse the solid waste and wastewater described in (A).*

Response: Waste generated during construction will be minimized by implementing efficient construction practices and detailed estimates of material needed. Waste generated through construction, operation, and retirement of the Facility will be recycled as appropriate and feasible. Waste that can be recycled includes metals, glass, paper, and yard debris. Recyclable waste will be sorted, stored in dumpsters or other suitable containers, and then transported to the local transfer station or other recycling facility for recycling.

Wastewater generated during construction and operation will be regularly pumped and sent to a treatment facility. Wastewater generated during operation will be disposed of offsite.

V.6 ADVERSE IMPACTS OF WASTE DISPOSAL

OAR 345-021-0010(1)(v)(E) *A description of any adverse impact on surrounding and adjacent areas from the accumulation, storage, disposal and transportation of solid waste, wastewater and stormwater during construction and operation of the facility.*

Response: Adverse impacts on surrounding and adjacent areas are not anticipated as a result of Facility construction and operation. A minimal amount of solid waste, wastewater, and stormwater is anticipated to be accumulated, disposed of, and transported during construction and operation of this Facility. Additionally, a hazardous materials spill prevention program will be implemented, as described in Exhibit G. Solid waste disposed of at a landfill will be minimized through recycling and waste minimization practices employed during construction. The Facility will generate approximately one 40-cubic-yard roll-off per week during construction and one 8-cubic-yard dumpster every 2 months during operation. Therefore, the solid waste generated will not adversely affect the capacity at the local landfill.

Wastewater that is generated will be captured and treated offsite. During construction, portable toilets will be serviced a minimum of once per week. Wastewater generated during construction will be transported via trucks by a local contractor to a treatment facility. Water used for dust suppression will percolate into the ground.

Stormwater generated onsite during construction and operation is expected to be minimal. Stormwater controls will be implemented onsite as needed. During operation, the stormwater will infiltrate into the ground.

V.7 EVIDENCE THAT ADVERSE IMPACTS WILL BE MINIMAL

OAR 345-021-0010(1)(v)(F) *Evidence that adverse impacts described in (D) are likely to be minimal, taking into account any measures the applicant proposes to avoid, reduce or otherwise mitigate the impacts.*

Response: The Applicant's proposed measures to avoid, reduce, or otherwise mitigate any possible impacts on the site or surrounding and adjacent areas (as discussed in this Exhibit and in Exhibit G) will result in minimal impacts caused by the construction, operation, and retirement of the Facility. Examples of such measures include a hazardous materials spill prevention program and recycling measures that will be implemented to minimize the amount of waste that is disposed of as landfill waste. Furthermore, waste will be disposed of at a properly licensed facility and by a licensed contractor.

Solid waste that is generated during construction, operation, and retirement of the Facility will be sorted for recycling and then transported offsite for disposal. Wastewater generated during construction and operation will be pumped from portable toilets and removed regularly and disposed offsite.

V.8 PROPOSED MONITORING PROGRAM

OAR 345-021-0010(1)(v)(G) *The applicant's proposed monitoring program, if any, for minimization of solid waste and wastewater impacts.*

Response: Given the minimal generation of solid waste and wastewater, as well as proposed recycling measures and waste minimization practices, the Facility is not expected to incur significant effects onsite or on surrounding and adjacent areas. Therefore, no monitoring program is proposed. Waste management practices will comply with applicable regulations and will be inspected periodically by the Applicant.

V.9 SUMMARY

The evidence provided in this Exhibit demonstrates that the Energy Facility Siting Council's waste minimization standard (OAR 345-022-0120) is met because waste will be minimized, reused, or recycled where feasible and because minimal adverse impacts on the surrounding or adjacent areas will result from the management of waste related to the Facility.

V.10 REFERENCE

Solar Energy Industries Association (SEIA). 2019. *SEIA National PV Recycling Program*. Accessed July 2019. http://www.seia.org/seia-national-pv-recycling-program.