Exhibit G

Materials Analysis

Sunstone Solar Project
June 2023

Prepared for

Sunstone Solar, LLC

Prepared by

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Acronyms and Abbreviations

Applicant	Sunstone Solar, LLC, a subsidiary of Pine Gate Renewables, LLC
EPA	U.S. Environmental Protection Agency
Facility	Sunstone Solar Project
kV	kilovolt
Li-ion	lithium-ion
MW	megawatt
O&M	operations and maintenance
OAR	Oregon Administrative Rules
SPCC	Spill Prevention, Control, and Countermeasure

1.0 Introduction

Sunstone Solar, LLC, a subsidiary of Pine Gate Renewables, LLC (Applicant), proposes to construct and operate the Echo Solar Project (Facility), a solar energy generation facility and related or supporting facilities in Morrow County, Oregon. This Exhibit G was prepared to meet the submittal requirements in Oregon Administrative Rules (OAR) 345-021-0010(1)(g).

2.0 Construction Materials Inventory

OAR 345-021-0010(1)(g) A materials analysis including:

(A) An inventory of substantial quantities of industrial materials flowing into and out of the proposed facility during construction and operation;

The Applicant is requesting to permit a range of technology in order to preserve permitting flexibility and will stipulate the precise details of photovoltaic solar energy generation and supporting facilities during final design and engineering prior to construction. Therefore, this exhibit analyzes the maximum number of materials anticipated within the Facility site boundary to address the maximum impact.

For the Facility, the Applicant will use photovoltaic solar modules composed of mono- or poly-crystalline cells supported on non-specular, galvanized steel racks. The modules are inert and will not introduce any hazardous materials to the Facility. Each tracker will be supported by steel posts. Other onsite equipment will include overhead and buried conduits, inverters, combiners, and transformers.

The Applicant proposes using either a lithium-ion (Li-ion) or zinc-based battery energy storage system. Li-ion batteries are modular in that each unit contains multiple smaller battery pouch cells. The cells are the primary containment for the electrolyte materials. The cells are contained within a module (approximately 10 cells/module), which are collected in a pack (approximately 3 modules/pack), and then wired into a string (approximately 14 packs/string) and finally into the full modular unit (approximately 840 cells, 84 modules, 28 packs, 2 strings). The quantities per modular unit could change based on the most current model procured for the project, but the general framework is typical for utility-scale Li-ion systems. Alternatively, zinc-based energy storage systems are also provided in outdoor rated, modular, metal container-based units. The smallest indivisible unit of the system is a battery module, with 12 modules per string and 12 strings per container (144 battery modules/container), typically. Although leaks from the modules are very unlikely, because any leak will require failure of the sealed module, any material that might leak from the module to the floor of the container will easily be contained within the container. The technology options will be manufactured, assembled, and inspected off-site and will be shipped to the site as outdoor-rated prefabricated modules, which will be installed and electrically connected on-site.

The primary construction materials for the Facility are rock and gravel (aggregate), steel, water, concrete, and assorted electrical equipment. Table G-1 provides an inventory of materials that will be used during Facility construction, based on current engineering estimates. The amount of water required for construction is discussed in Exhibit O. Solid wastes generated and flowing out of the Facility during construction are discussed in Section 5.1 and outlined in greater detail in Exhibit W.

Table G-1. Inventory of Construction Materials

Material	Quantity/Units	Ultimate Disposition
Solar modules	Maximum 3,937,536 modules	Throughout each solar module string
Steel solar module tracker posts	535,056 posts, 40.2 tons steel (150 pounds per post)	Throughout each solar module string
Solar modules per string	32 modules (64 modules per rack, max 123,048 strings)	Throughout each solar module string
Aggregate (rock and gravel)	1,995,802 tons total	See below by location
• Battery storage	777,192 tons (up to 14,946 containers, collocated with the 319 inverter/transformer stations)	On-site graveled area
• Access roads	147,389 tons (55 miles new road)	On-site graveled area
• Substations/Switchyards	68,880 tons (6 substations, 1.6 acres each and 3 acres for the two switchyards)	On-site graveled area
• Operations and maintenance (O&M) buildings	12,320 tons (4 O&M buildings, 2.8 acre each [including graveled areas outside of the foundations])	On-site graveled area
• Temporary construction areas	993,101 tons (5 acres each, 54 temporary construction areas)	On-site graveled area
Concrete	644,756 cubic yards (yd^3) total	See below by location
• Battery storage	3,668 yd^3	Foundation
• Solar array (tracker posts)	160,518 yd^3	Foundation
• Transmission line	330 yd^3	Foundation
• Inverters/Transformers	633,990 yd^3	Foundation
• Substations/Switchyards	6,568 yd^3	Foundation
• O&M buildings	200 yd^3	Foundation
Battery components	Li-ion: 10 cells per module, 3 modules per pack, 14 packs per string (840 cells, 84 modules, 28 packs, 2 strings), typical; or Zinc: 12 modules per string, 12 strings per containers (144 battery modules/container), typical	Battery energy storage system
Batteries	Li-ion: 12,000 containers; or Zinc: 14,946 containers)	Battery energy storage system

Material	Quantity/Units	Ultimate Disposition
Combiner boxes	61,524 boxes	Aboveground throughout each solar module string
Substation generator step-up transformers	Up to 6 transformers	Within the supporting substation footprints
Collector lines (34.5 kilovolt [kV])	81.7 miles (underground); 4.3 miles (aboveground)	Between solar array and substations, either buried underground or aboveground
Aboveground collector line (34.5-kV) support structures	Up to 152 structures that may be either single or double circuit wood monopole structures	Aboveground structures
Transmission line (230-kV)	9.5 miles	Interconnecting the collector substations to the switchyards and then to the existing Umatilla Electric Cooperative 230-kV Blue Ridge Line
Transmission line (230-kV) support structures	Up to 41 structures that may be either H-frames or monopoles, likely wood or steel	Aboveground structures
Inverter/transformers	319 (4,200 kilovolt amps) stations	Aboveground throughout solar array
Fencing	303,506 feet	Will remain around solar array areas and collocated infrastructure

2.1 Rock and Gravel

Road construction will utilize rock and gravel (aggregate) for new, permanent access roads. No improvements or alterations are proposed for existing roads. Rock and gravel will also be used as ground-surfacing material for the battery energy storage system, around inverter/transformer stations in the solar array, access roads, collector substations, the O&M buildings, and the temporary construction areas. Table G-1 provides the estimated tons of aggregate for each of these purposes.

The gravel placed at temporary construction areas will be removed following construction. The construction contractor will acquire the rock and gravel from existing or new commercial gravel pit sources in Morrow County.

2.2 Water and Concrete

Concrete will be required to create foundations for the battery energy storage system, inverter/transformer stations, collector substations, and O&M buildings (Table G-1).

Water will be required during construction for dust control, road compaction, concrete mixing, and drinking/sanitation.[1] The amount of water needed for construction will depend on site weather

[1] Note that other dust suppressants besides water may be utilized as necessary during extreme drought conditions (synthetic polymer emulsions, chemical suppressants, organic glues, and wood fiber materials)

conditions during the construction period, as well as the final design of Facility components. Exhibit O provides detail on water quantities, assumptions, and sources.

2.3 Steel

Large quantities of steel will be needed for the solar array, as listed in Table G-1. The estimate is based on the proposed solar array layout using 535,056 steel posts to support the solar module trackers. Each post is assumed to have an average length of 12 feet, requiring approximately 150 pounds of steel per post.

2.4 Other Typical Construction Materials

A number of other materials will be brought on site to construct the solar array, battery energy storage system, and other related or supporting facilities (Table G-1). Electrical cable and combiner boxes will be used to connect the solar strings within the array and to the collector substations. The Facility will include 81.7 miles of underground 34.5-kilovolt (kV) collector line and up to 4.3 miles of aboveground 34.5-kV collector line. Generator step-up transformers will be located at the supporting substations; the primary interconnection switchyards will not contain transformers. The solar array will be constructed from prefabricated solar modules composed of mono- or poly-crystalline cells supported on non-specular, galvanized steel racks. Additional elements associated with the battery energy storage system will include fire-suppression systems (for Li-ion batteries specifically, if selected), battery containers, racks, and the batteries themselves. The Facility will include 9.5 miles of new 230-kV transmission line (with up to 41 support structures) interconnecting the collector substations to the switchyards and then to the existing Umatilla Electric Cooperative 230-kV Blue Ridge Line. The transmission system will be aboveground (see Exhibit B for example support structures). The solar array will include up to 319 inverter and transformer stations, which will be placed together on the same slab of concrete. Chain-link or Fixed-Knot (wildlife friendly) fencing will be used to enclose the solar array area, substations, and potentially the battery energy storage system (to be determined prior to construction; see Exhibit C, Figure C-2).

3.0 Operational Materials Inventory

It is possible that major solar module or electrical components may need to be replaced during the lifetime of the Facility. Major maintenance issues may require the replacement of solar modules or other associated components; however, due to the unpredictable nature of major maintenance problems, no estimate has been provided for the amount of major components that may be needed. Minor maintenance may also require the replacement and removal of smaller components, which are not expected to constitute substantial amounts of industrial materials.

Table G-2 provides an inventory of industrial materials that will be used in substantial quantity during operation of proposed Facility elements.

Table G-2. Inventory of Operational Materials

Material	Quantity/Units	Ultimate Disposition
Spare solar modules	7,845,040 modules	Stored at the O&M buildings and within 50 Conex containers to be evenly dispersed throughout the site boundary.
Batteries	24,000 Li-ion batteries 29,892 zinc batteries	Disposed of at approved facility
Transformer oil	Substation transformers: 263,387 gallons Solar array transformers: 255,200 gallons (800 gallons per station)	Within transformer boxes for cooling (No extra oil stored outside of transformers. Additional oil only required due to failure, provided on an as-needed basis.)
Round-up and 2,4-D (weed control)	2 gallons for spot weed control; subcontract out for major weed control per year.	Up to 2 gallons stored in each O&M building.

3.1 Solar Array and Collector Substations

Aside from spare solar modules, no substantial quantities of industrial materials will be brought onto, stored, or removed from the Facility site during operations. The materials that will be brought onto or removed from the site will relate to maintenance or replacement of damaged equipment (e.g., spare solar module and related components, electrical equipment). Besides spare solar modules, the materials replaced and removed will not constitute significant amounts. It is estimated that a total of approximately 7,845,040 spare solar modules will be replaced during operations and ultimately stored on-site at the O&M buildings and within Conex containers (50 total, each a standard 40 feet long and 8 feet wide) dispersed throughout the site boundary; this assumes a 0.5 percent breakage of modules per year during the 40-year Facility lifespan. Table G-2 includes materials and amounts that will be used during operation of the transformers for the solar array and collector substations.

Solar modules may require periodic washing to minimize the effects of solar module dust and dirt on energy production (referred to as soiling) although this is not anticipated and will be dependent on weather conditions; during drought conditions when there is more dust, the panels may require washing. For the purpose of this analysis, it is assumed that all modules will be washed once per year and require 0.2 gallon per solar module, for a total of approximately 790,000 gallons per year. Water will be applied via robotic panel cleaners and will not have any cleaning solvents in it. Wash water will be discharged by evaporation and seepage into the ground. See Exhibit O for further information.

3.2 Battery Energy Storage System

The types and quantities of industrial materials used during operation of the battery energy storage system are listed in Table G-2. Energy storage systems degrade over time and may require replacement during the 40-year Facility lifetime.

Batteries will be replenished at a rate depending on usage. For example, a battery that is cycled more often will degrade faster than one that is used less often. For this analysis, it is assumed that the battery will be fully discharged each day and the useful life of the battery will be 20 years requiring possible replacement after year 20. This assumption likely overestimates the number of batteries that will be replaced over the life of the Facility, because not all batteries will be replaced during each replenishment cycle (e.g., fewer batteries will need replacing early in the Facility life). Thus, approximately 24,000 Li-ion batteries and 29,892 zinc batteries will be needed for the 1,200-megawatt (MW) storage system (assuming a 40-year Facility lifespan).

Both types of battery systems are typically air cooled, and do not have a liquid component. However, some Li-ion battery systems are liquid cooled, such as the Tesla Powerpack, which uses coolant similar to automotive antifreeze. The coolant, if used, is recirculated through a closed system to cool the batteries. Zinc batteries will have fans and a heating unit for climate control.

3.3 Other Typical Construction Materials

Small quantities of herbicides and pesticides may be stored in the O&M buildings for use during Facility operations. None will be present in substantial reportable quantities; the amounts present (if any) will be no greater than household quantities.[2]

4.0 Hazardous Substances

> *OAR 345-021-0010(1)(g)(B) The applicant's plans to manage hazardous substances during construction and operation, including measures to prevent and contain spills;*

All potentially hazardous substances, for both phases, will be used in a manner that is protective of human health, protective of the environment, and that complies with all applicable local, state, and federal environmental laws and regulations. For any necessary, potentially hazardous substance used during the Facility's construction or operation, Safety Data Sheets will be made available and located at the construction area or the relevant Facility component. Extremely hazardous substances in excess of threshold planning quantities, highly toxic substances, or explosive materials will not be necessary to support either the construction or the operations phase of the Facility. Additionally, materials used during the construction and operations of the Facility will be selected so that they minimize the potential for producing "hazardous waste," as defined by the Resource Conservation and Recovery Act. Accidental releases of hazardous materials will be prevented or minimized through proper containment of these substances during use and transportation to the Facility site as described in the Spill Prevention, Control, and Countermeasure Plan (SPCC) Plan.

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[2] "Household quantity" refers to container sizes designed for consumer use, which are sized such that each container would hold less than a reportable quantity of any constituent hazardous chemical.

4.1 Construction Materials

Potentially hazardous materials that will be used for construction include herbicide, paint, unused solvents, and spent vehicle and equipment fluids and components (e.g., used oil, used hydraulic fluids, spent fluids, oily rags, and spent lead-acid or nickel-cadmium batteries). Potentially hazardous substances will not be permanently present within the construction areas in quantities that exceed Oregon State Fire Marshal Reportable Quantities.[3]

Fuels will be the only hazardous material that may be stored in substantial quantities on-site during construction; the Applicant anticipates that up to 1,000 gallons of diesel fuel and 1,000 gallons of gasoline may be kept on-site for fueling of construction equipment, two tanks total. These will both be stored in temporary aboveground tanks in the construction yard(s), within an area that provides for secondary containment. The gasoline tank is expected to be filled once per month and the diesel tank will be filled twice per month. Secondary containment and refueling procedures for on-site fuel storage will follow the contractor's SPCC Plan. Secondary containment will be compliant with requirements in 40 CFR §112.7(c), which requires secondary containment for all above ground, buried, and partially buried containers. It is anticipated that the majority of fuel containers will have self-contained secondary containment (e.g., double-walled containers) that provide capacity for the entire container plus precipitation, but in some cases smaller containers (e.g., drums) will be placed in a constructed secondary containment area that is impervious and is diked or otherwise contained to provide the required fuel and precipitation capacity. Fuel for construction equipment will be delivered to the site via a specialized mobile vehicle by a licensed service contractor on an as-needed basis. Following the completion of fueling activities, these vehicles will not remain on-site longer than necessary to complete their fueling tasks. Construction-based equipment will be regularly inspected to detect potential leaks or other issues that may require maintenance. Potentially hazardous substances related to the maintenance of the construction equipment will only be brought to the construction site by a maintenance technician on an as-needed basis, and any unused or waste substances will be removed during the same service call. Refueling will take place a substantial distance from waterways or wetlands to prevent water quality impacts in the event of an accidental release.

In the unlikely event that an accidental spill occurs, any spilled or released substances will be cleaned up, and any contaminated media impacted by the spill will be managed in accordance with all applicable regulations as described in the SPCC Plan. As specified in the contractor's SPCC Plan, larger spill kits with absorbents, absorbent pads, spill socks, and disposable bags will be maintained in proximity to construction activities. In addition, to reduce the response time to a spill, smaller spill kits containing absorbent pads will be located on key pieces of construction equipment. All employees will be instructed in the location, handling, and usage of the spill kits. Any reportable

[3] "Reportable quantity" refers to the amount of hazardous substance that has to be released into the environment before the U.S. Environmental Protection Agency requires notification of the release to the National Response Center pursuant to the Comprehensive Environmental Release, Compensation, and Liability Act, also known as Superfund. These numerical designations are listed under 49 Code of Federal Regulations 172.101 Appendix A, Table 1 and Table 2.

spills will be immediately called in to the Oregon Emergency Management Division's Oregon Emergency Response System, per OAR Chapter 340 Division 142. See Exhibit CC for a listing of applicable regulations.

4.2 Operational Materials

Use of the battery energy storage system may include hazardous substances within internal battery components; however, batteries are integrated to safely operate when used according to the recommendations of the manufacturer and as long as their integrity is maintained (not damaged and internal seal is intact). Li-ion batteries specifically (if selected) present a flammability hazard and require cooling systems to prevent overheating. Regardless of the battery technology selected, the battery energy storage system will have integrated safety systems that monitor battery performance to detect malfunctions and implement response measures (for example: notifying operators, depowering the system, or deploying fire suppression devices). Batteries will be housed in leak-proof containers to prevent inadvertent releases of hazardous materials. O&M staff will conduct inspections of the battery cells for damage. Note that used Li-ion and zinc batteries may contain hazardous waste and will be handled and disposed of per the most up-to-date guidelines at the end of their life.

Small quantities of herbicides, or other chemicals may be stored in the O&M buildings. Storage of these chemicals will follow label instructions. Given the nature of the materials, no secondary containment systems are planned for the O&M buildings for these materials. However, sorbent materials will be maintained on site to capture any small spills that may occur. No underground storage tanks will be installed at the O&M buildings. However, each O&M building may have an aboveground fuel storage tank sized to contain up to 500 gallons of diesel fuel or gasoline. Secondary containment and refueling procedures for on-site fuel storage during will continue to follow the SPCC Plan and requirements for secondary containment. No extremely hazardous materials (as defined by 40 Code of Federal Regulations 355) are anticipated to be produced, used, stored, transported, or disposed of at this Facility during operation.

For the replacement of Li-ion batteries specifically (if selected) during operation, the Applicant will follow the handling guidelines of 49 Code of Federal Regulations 173.185 – Department of Transportation Pipeline and Hazardous Material Administration related to the shipment of Li-ion batteries. The regulations include requirements for prevention of a dangerous evolution of heat, prevention of short circuits, and prevention of damage to the terminals. They also require that no battery will come into contact with other batteries or conductive materials. Regardless of the batteries selected for the Facility, licensed third-party battery suppliers will be responsible for transporting batteries to and from the Facility in accordance with applicable regulations, as required through their licensure. Spent batteries will be disposed of at a facility permitted to handle them in compliance with applicable Resource Conservation and Recovery Act and Toxic Substances Control Act regulations administered by the EPA or Oregon Department of Environmental Quality. Adherence to the requirements and regulations (including personnel training, safe interim storage, and segregation from other potential waste streams) will minimize safety hazards related to transport, use, or disposal of batteries.

Secondary containment is optional for the transformers, as these are classified as qualified oil-filled operational equipment under the EPA's Amended Spill Prevention, Control, and Countermeasure Rule issued in 2006 (EPA-550-F-06-008). Per this amended rule, instead of providing secondary containment for qualified oil-filled operational equipment, an owner or operator may prepare an oil spill contingency plan and a written commitment of personnel, equipment, and materials to quickly control and remove discharged oil; the plan must include an inspection or monitoring program for the equipment to detect a failure and/or discharge. Alternatively, the transformers may be installed on foundations that provide secondary containment, or sorbent materials may be kept on-hand to capture minor leaks. The Applicant plans to install secondary containment for the substation transformers, and the specific design will be determined prior to construction of the substations. All secondary containment will meet EPA requirements to have sufficient capacity to contain at least 10 percent of the total volume of the primary containers or 100 percent of the volume of the largest container, whichever is greater. The transformers in the substation yards will have polychlorinated biphenyl–free insulating oil inside the units, which have their own oil containment systems; at no time will oil be able to discharge from the proposed oil containment system. Due to the quantity of oil in the transformers (see Table G-2), the Applicant will maintain an SPCC Plan for the substation operations.

The Applicant will have an operational SPCC Plan to detail appropriate response measures. In the unlikely event of an accidental hazardous materials release, any spill or release will be cleaned up and the contaminated soil or other materials disposed of and treated according to applicable regulations. Employees will be trained to be aware of the potential hazards of the contents of the module through the availability of Material Safety Data Sheets, and to handle such releases in accordance with applicable regulations. See Exhibit CC for a list of applicable regulations. Spill kits containing items such as absorbent pads will be located on equipment and in on-site temporary storage facilities to respond to accidental spills, if any were to occur. Employees handling hazardous materials will be instructed in the proper handling and storage of these materials, as well as where spill kits are located. The Applicant will report spills or releases of hazardous materials during operation as noted above to the Oregon Emergency Response System, per reporting requirements detailed in OAR Chapter 340 Division 142.

5.0 Non-Hazardous Waste Materials

> *OAR 345-021-0010(1)(g)(C) The applicant's plans to manage non-hazardous waste materials during construction and operation;*

The Applicant will fully comply with all applicable waste handling and disposal regulations on all lands associated with the Facility, during both construction and operation. Solid waste will be stored in a manner that does not constitute a fire, health, or safety hazard until such time as it can be hauled off for recycling or disposal, as appropriate. Exhibit W provides details on the types and amounts of waste, and procedures and systems for the handling and disposal of waste materials.

5.1 Construction Materials

Waste construction materials generated from construction may include scrap steel, wood, concrete waste, excavated soil, and packaging material waste. When feasible, the waste generated during construction will be recycled. Steel scraps will be separated and recycled to the extent feasible. Wood from concrete forms will be reused when practicable and then recycled. Excess excavated material will be used to restore ground contours after construction, and to provide fill on-site or be transported off-site for disposal. Construction will not require the use of specialized structures, systems, or equipment for waste management or disposal. Standard construction waste bins will be kept on-site to keep construction debris until it is hauled off-site by a licensed waste hauler (see Exhibit U for waste service provider information). Further information regarding waste materials is included in Exhibit W.

The only material that has the potential to be disposed of on-site will be waste concrete generated during construction. Waste concrete will consist of concrete solids contained in the concrete chute washout water. Washdown methods will be determined by the contractor, and may occur at contractor-owned batch plants or a designated concrete washout. Any excess concrete will be incorporated into the foundation, rather than disposed of. There will be no disposal of hardened waste concrete on-site other than as described here.

Packaging waste (such as paper and cardboard) and refuse will be separated, accumulated in dumpsters, and periodically removed for recycling or disposal at the Finley Buttes Landfill or the Columbia Ridge Landfill (see Exhibit U). Portable toilets will be provided for on-site sewage handling during construction and will be pumped and cleaned regularly by the construction contractor. Construction stormwater will be generated at the location of the solar array and battery energy storage construction sites. Such stormwater will be covered under the Facility's National Pollutant Discharge Elimination System 1200-C construction permit and its associated Erosion and Sediment Control Plan.

5.2 Operational Materials

Little solid waste will be generated from Facility operations. The solar array and battery energy storage system will rely on on-site wells (or water obtained from existing private or municipal water sources with valid water rights and trucked to the site) and portable toilets for sanitation. Therefore, it will not generate any additional sewage streams. Administrative activities related to the solar array and battery energy storage system will be conducted at the O&M buildings. Office waste generated at the O&M buildings will be disposed of at the Finley Buttes Regional Landfill or other local contractors. Septic waste will be handled by a licensed contractor for treatment and disposal at a municipal water treatment facility.

Solar panels will be washed, but this limited quantity of washwater will evaporate or will infiltrate into the ground near the point of use (see Exhibit W). No additional industrial wastewater streams will be generated at the solar array.

6.0 Submittal Requirements and Approval Standards

6.1 Submittal Requirements

Table G-3. Submittal Requirements Matrix

Requirement	Location
OAR 345-021-0010(1)(f) A materials analysis including:	–
(A) An inventory of substantial quantities of industrial materials flowing into and out of the proposed facility during construction and operation;	Sections 2.0 and 3.0
(B) The applicant's plans to manage hazardous substances during construction and operation, including measures to prevent and contain spills; and	Section 4.0
(C) The applicant's plans to manage non-hazardous waste materials during construction and operation.	Section 5.0

6.2 Approval Standards

OAR 345 Division 22 does not provide an approval standard specific to Exhibit G.