Appendix H

Decommissioning Plan

Xcel Energy
Docket No. E-002/GS-23-217
August 2023

A DECOMMISSIONING PLAN FOR

Sherco 3 Solar Project

Sherburne County, Minnesota

AUGUST 4, 2023

PREPARED FOR:

Xcel Energy®

PREPARED BY:

Westwood

Westwood

Decommissioning Plan

Sherco 3 Solar Project

Sherburne County, Minnesota

Prepared for:

Xcel Energy
414 Nicollet Mall, 414-6A
Minneapolis, MN 55401

Prepared by:

Westwood Professional Services
12701 Whitewater Drive, Suite 300
Minnetonka, MN 55343
(952) 937-5150

Project Number: 0036476.00

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Attachments

1.0 Introduction / Project Description

This Decommissioning Plan ("Plan") has been prepared for the Sherco 3 Solar Project, which is seeking a Site Permit from the Minnesota Public Utilities Commission (PUC). Although the Project is not subject to county-level land use permitting processes, this Plan has been developed in accordance with decommissioning requirements set forth by Sherburne County due to the lack of state-level requirements. The purpose of the Plan is to describe the means and methods that can be used to remove all structures, foundations, underground cables, and equipment and to reclaim and restore the land altered during the construction and operation of the solar project to its predevelopment condition to the extent feasible.

The Sherco 3 Solar Project (Facility) is a 250-Megawatt (MW) alternating current (315.01-MW direct current) solar power generation project proposed by Xcel Energy (Applicant) in Sherburne County, Minnesota. Upon completion, the Facility will comprise a solar array consisting of ground-mounted photovoltaic panels and electrical support equipment, underground collection lines, access roads, and fencing. The Facility is located on approximately 1303 acres.

The useful life of solar panels is generally considered to be 35 years. At that time, the project will either be decommissioned or repowered with newer technology.

2.0 Proposed Future Land Use

Prior to the development of the Facility, the land use of the project area was primarily agricultural production. After all equipment and infrastructure is removed during decommissioning, any holes or voids created by poles, concrete pads, and other equipment will be filled in with native soil to the surrounding grade, and the site will be restored to pre-construction conditions to the extent practicable. All access roads and other areas compacted by equipment will be decompacted to a depth necessary to ensure drainage of the soil and root penetration prior to fine grading and tilling to a farmable condition. Please refer to Section 3.2 for a detailed description of reclamation activities.

3.0 Decommissioning Activities

Decommissioning of the solar facility will include removing the solar panels, solar panel racking, steel foundation posts and beams less than 48 inches below grade, inverters, transformers, overhead and underground cables and lines less than 48 inches below grade, equipment pads and foundations, equipment cabinets, and ancillary equipment. The civil facilities, access roads, security fence, and drainage structures and sedimentation basins are included in the scope. Standard decommissioning practices will be utilized, including dismantling and repurposing, salvaging/recycling, or disposing of the solar energy improvements. During decommissioning, the landowners will be consulted to identify the extent and type of work to be completed. Some Facility infrastructure, such as the access roads, may be left in place at the landowners' requests.

Decommissioning will include the removal and transportation of all project components from the Facility site. All dismantling, removal, recycling, and disposal of materials generated during decommissioning will comply with rules, regulations, and prevailing Federal, State, and local laws at the time decommissioning is initiated and will use approved local or regional disposal or recycling sites as available. Recyclable materials will be recycled to the furthest extent practicable. Non-recyclable materials will be disposed of in accordance with State and Federal law.

3.1 Decommissioning of Project Components

3.1.1 Modules

Modules will be inspected for physical damage, tested for functionality, and disconnected and removed from racking. Functioning modules will be packed, palletized, and shipped to an offsite facility for reuse or resale. Non-functioning modules will be shipped to the manufacturer or a third party for recycling or disposal. The decommissioning estimate has been prepared to show the costs for the current year.

3.1.2 Racking

Racking and racking components will be disassembled and removed from the steel foundation posts, processed to appropriate size, and sent to a metal recycling facility.

3.1.3 Steel Foundation Posts

All structural foundation steel posts will be pulled out to a minimum of 48 inches below grade, removed, processed to appropriate size, and shipped to a recycling facility. The posts can be removed using back hoes or similar equipment. During decommissioning, the area around the foundation posts may be compacted by equipment and, if compacted, the area will be decompacted in a manner to adequately restore the topsoil and sub-grade material to a density consistent for vegetation.

3.1.4 Underground Cables and Lines

All underground cables and conduits installed less than 48 inches below grade will be removed. Topsoil will be segregated and stockpiled for later use prior to any excavation and the subsurface soils will be staged next to the excavation. The subgrade will be compacted per standards. Topsoil will be redistributed across the disturbed area.

3.1.5 Inverters, Transformers, and Ancillary Equipment

All electrical equipment will be disconnected and disassembled. All parts will be removed from the site and reconditioned and reused, sold as scrap, recycled, or disposed of appropriately, at the Owner's sole discretion, consistent with applicable regulations and industry standards.

3.1.6 Equipment Foundations and Ancillary Foundations

The ancillary foundations are pile foundations for the equipment pads. As with the solar array steel foundation posts, the foundation piles will be pulled out to a minimum depth of 48 inches below grade. Duct banks will be excavated to full depth. All unexcavated areas compacted by equipment used in decommissioning will be decompacted in a manner to adequately restore the topsoil and sub-grade material to a density similar to the surrounding soils. All materials will be removed from the site and reconditioned and reused, sold as scrap, recycled, or disposed of

appropriately, at the owner's sole discretion, consistent with applicable regulations and industry standards.

3.1.7 Fence

All fence parts and foundations will be removed from the site and reconditioned and reused, sold as scrap, recycled, or disposed of appropriately, at the Owner's sole discretion, consistent with applicable regulations and industry standards. The surrounding areas will be restored to pre-solar farm conditions to the extent feasible.

3.1.8 Access Roads

Facility access roads will be used for decommissioning purposes, after which removal of roads will be discussed with the Landowner and one of the following options will be pursued:

1. After final clean-up, roads may be left intact through mutual agreement of the landowner and the owner unless otherwise restricted by federal, state, or local regulations.
2. If a road is to be removed, aggregate will be removed and shipped from the site to be reused, sold, or disposed of appropriately, at the Owner's sole discretion, consistent with applicable regulations and industry standards. Clean aggregate can often be used as "daily cover" at landfills for no disposal cost. Any ditch crossing connecting access roads to public roads will be removed unless requested by the landowner to remain in place and approved by the County. The subgrade will be decompacted using a chisel plow or other appropriate subsoiling equipment. All rocks larger than four inches will be removed. Topsoil that was stockpiled during the original construction will be distributed across the open area. The access roads and adjacent areas that are compacted by equipment will be decompacted.

3.1.9 Substation

The Facility will connect into the previously permitted West Collector Substation under the Sherco I/II application. Its decommissioning is therefore not included in this Plan.

3.2 Reclamation

The Owner will restore and reclaim the site to the pre-solar farm condition consistent with the site lease agreement. The Owner assumes that most of the site will be returned to farmland and/or pasture after decommissioning through implementation of appropriate measures to facilitate such uses. If no specific use is identified, the Owner will vegetate the site with a seed mix approved by the local soil and water conservation district or similar agency. The goal of restoration will be to restore natural hydrology and plant communities to the greatest extent practicable while minimizing new disturbance and removal of native vegetation. In addition to the reclamation activities described above for each decommissioning activity, all unexcavated areas compacted by equipment and activity during the decommissioning will be decompacted to a depth of 18 inches, or to a different depth as needed, to ensure proper density of topsoil consistent and compatible with the surrounding area and associated land use. All materials and debris associated with the Facility decommissioning will be removed and properly recycled or disposed of at off-site facilities.

4.0 Best Management Practices (BMPs)

During decommissioning, erosion and sediment control BMPs will be implemented to minimize potential for erosion of site soils and sedimentation of surface waters and waters of the state. Because decommissioning will entail disturbance of more than one acre of soil, the Applicant will prepare a Stormwater Pollution Prevention Plan (SWPPP) and obtain coverage under the state-specific National Pollutant Discharge Elimination System (NPDES) permit prior to initiating soil disturbing activities. Potential BMPs to be implemented during decommissioning activities are described below and will be subject to refinement in the SWPPP. The decommissioning team will review the permitting requirements at the time of decommissioning and obtain any other necessary permits, which may include a US Army Corps of Engineers Section 404 Permit to Discharge Dredged or Fill Material.

4.1 Erosion Control

Erosion control measures will be refined based on the standard of practice current at the time the SWPPP is developed for decommissioning. All disturbed areas without permanent impermeable or gravel surfaces, or planned for use as crop land, will be vegetated for final stabilization. All slopes steeper than 4:1 should be protected with erosion control blankets. Restoration should include seed application prior to application of the blanket. All slopes 4:1 or flatter should be restored with seed and mulch, which will be disc anchored.

Project Phasing/Design BMP: Time periods during which disturbed soils are exposed should be minimized to the degree possible. Stabilization of soils will generally be accomplished immediately following decommissioning and removal of the access roads, fencing, modules and racking, equipment, and electrical cables. Where this is not possible, temporarily exposed soils will be temporarily stabilized with vegetation in accordance with the SWPPP for decommissioning.

Erosion Control Blankets and Seed BMP: Erosion control blanket (double-sided netting with wood fiber or weed-free straw fiber blanket) will be used as temporary stabilization for areas of slopes steeper than 4:1 and for areas of concentrated flow, such as ditches, swales, and similar areas around culverts. Additionally, seed will be applied in these areas as necessary for temporary and/or permanent vegetative growth. The SWPPP developed for decommissioning will provide detailed specifications for erosion control blankets to be used under various slope and drainage conditions.

Ditch/Channel Protection: Where new channels are formed, as in the case of culverts removed from access roads and the removal of low water crossings, the resulting channel will be protected with erosion control blankets as described in the section above.

Surface Roughening: Surface roughening, or slope tracking, is the act of running a dozer or other heavy tracked equipment perpendicular to the grade of disturbed slopes. The tracks will provide a rough surface to decrease erosion potential during an interim period until a smooth grade, seed, and erosion control blanket can be applied.

Temporary Mulch Cover and Seed BMP: Temporary mulch cover (wood fiber to resist loss from grazing by wildlife or domestic animals) will be applied at a rate of two tons per acre to provide temporary erosion protection of exposed soils on slopes flatter than or equal to 3:1. Seed will be applied with the mulch for temporary and/or permanent vegetative growth as called for in the

SWPPP. Mulch will be used for all soil types where slopes are flatter than 3:1 and no significant concentrated flows are present. The mulch will be disc-anchored to the soil to keep it from blowing away. The mulch prohibits raindrop impact from dislodging soil and subsequently carrying the soil away during sheet drainage. If there is a challenge securing mulch to sandy soils, tackifier may be used to assist in disc anchoring.

Soil Stockpiles: Topsoil and subsoils that are stripped from the construction site will be stockpiled separately on site. Stockpiles will be located in areas that will not interfere with the decommissioning activities nor encroach upon pavement, site drainage routes, or other areas of concentrated flow. Stockpiles should also be located away from wetlands and surface waters. Perimeter controls, such as silt fence, will be installed around all stockpiles that are not placed within existing silt fences or other sediment control, where the potential exists for material to be eroded and transported to sensitive natural resources. Soils that are stockpiled for longer durations will be temporarily seeded and mulched or stabilized with a bonded fiber polymer emulsion.

Permanent Seed and Temporary Mulch and/or Erosion Control Blanket BMP: In areas at final grade that will not be used for agriculture, permanent seed will be applied to promote vegetative cover for permanent erosion control. Temporary mulch and/or erosion control blanket will be applied where appropriate to provide temporary erosion protection until the permanent seed is established.

4.2 Sediment Control

Removal of Ditch Crossing BMP: Temporary ditch crossings may be needed to accommodate the movements of cranes or other heavy equipment. Perimeter controls such as silt fence will be used at crossing locations to minimize runoff from exposed soils. Crossings will occur during dry conditions, if possible. If a stream is wet at the time of the crossing, alternative BMPs may be used, such as installing a temporary dam or using a bypass pump to create dry conditions at the proposed crossing location. Timber construction mats will be used as needed to prevent compaction and rutting at crossing locations. All temporary fills and construction mats will be removed immediately after the crossing is successfully completed and the temporarily disturbed area is restored using the appropriate BMPs as described above.

Dewatering: A temporary sump and rock base will be used if a temporary pump is used to dewater an area of accumulated water. If a rock base cannot be used, the pump intake will be elevated to draw water from the top of the water column to avoid the intake and discharge of turbid water. Energy dissipation riprap will be applied to the discharge area of the pump hose. The water will be discharged to a large flat vegetated area for filtration/infiltration prior to draining into receiving waters of conveyances/ditches. If discharge water is unavoidably turbid, dewatering bags, temporary traps, rock weepers, or other adequate BMP will be used to control sediment discharge.

Silt Fence BMP or Fiber Logs: Silt fences or fiber logs will be used as perimeter controls downgradient of exposed soils during construction to capture suspended sediment particles on site, to the extent possible. The standard silt fence or fiber logs will also be used in smaller watershed areas where the contributing areas are typically less than 1/4 acre of drainage per 100 feet of standard silt fence or fiber logs. Standard silt fence or fiber logs will also be used for stockpiles eight feet high or higher which have slopes of 3:1 or steeper. Standard silt fence or fiber logs should not be used in areas of highly erodible soils which are found within streams,

slopes, or banks of creeks and streams within the Facility's site.

Rock Entrance/Exit Tracking Control BMP: Rock construction entrances will be installed where access to a construction area from adjacent paved surfaces is needed.

Street Scraping/Sweeping BMP: Street scraping and sweeping will be used to retrieve sediment tracked or washed onto paved surfaces at the end of each working day, or as needed.

4.3 Controlling Stormwater Flowing Onto and Through the Project

Given the low gradient of the slopes in the project area, controlling stormwater flow that enters the project area will likely require minimal effort during decommissioning activities. Only newly disturbed areas may require new, temporary stormwater control.

Diversion Berms/Swales/Ditches: It may be necessary to direct diverted flow toward temporary settling basins via berms, swales, or ditches. If diversion controls are deemed necessary for decommissioning activities, these must be stabilized by temporary mulch and seeding, erosion control blankets, or by installing riprap to protect the channel from erosive forces.

Rock Check Dams: It may be necessary to install temporary check dams within swales or ditches that convey stormwater from areas disturbed by decommissioning activities. Rock check dams effectively control flow velocity and sediment, augmenting temporary stabilization of channels. Filter fabric can help filter the flow, minimize the scour of the soil under the rock, and facilitate removal of the check dams once permanent stabilization is achieved. The height of check dams should be at least two feet. Spacing depends upon slope. Downgradient rock checks should have a top elevation equal to the bottom elevation of the previous (upgradient) rock check.

Temporary Sedimentation Basins: Sedimentation basins serve to remove sediment from runoff from disturbed areas of the site. The basins detain runoff long enough to allow the majority of the sediment to settle out prior to discharge. The location and dimensions of temporary sedimentation basins, if any are necessary, will be verified in accordance with Minnesota Pollution Control Agency (MPCA) requirements at the time of decommissioning.

4.4 Permitting

All decommissioning and reclamation activities will comply with Federal and State permit requirements. Decommissioning activities that will disturb more than one acre of soil will require coverage under the state-specific NPDES permit for construction stormwater. The permits will be applied for and received prior to decommissioning construction activities commencing. A SWPPP will be developed prior to filing for construction stormwater permit coverage.

If necessary for decommissioning activities, wetlands and waters permits will be obtained from the US Army Corps of Engineers (USACE) or the Minnesota Department of Natural Resources (DNR). A Spill Prevention, Control, and Countermeasure (SPCC) Plan for decommissioning will likely also be required for decommissioning work.

4.5 Health and Safety Standards

Work will be conducted in strict accordance with the Applicant's health and safety plan. The construction contractor hired to perform the decommissioning will also be required to prepare a

site-specific health and safety plan. All site workers, including subcontractors, will be required to read, understand, and abide by the Plans. A site safety office will be designated by the construction contractor to ensure compliance. This official will have stop-work authority over all activities on the site should unsafe conditions or lapses in the safety plan be observed.

5.0 Timeline

It is anticipated that the decommissioning activities for the project can be completed in one year. The estimated costs for decommissioning are tied to assumptions about the amount of equipment mobilized, the crew sizes, weather and climate conditions, and the productivity of the equipment and crews.

6.0 Decommissioning Costs

The decommissioning costs are calculated using current pricing. There are currently active markets for scrap steel, aluminum, and copper, used transformers and electrical equipment, and used solar panels. Scrap metal prices have been discounted from posted spot prices found on www.scrapmonster.com. Pricing for used panels has been discounted from prices received from We Recycle Solar for a similar project. The pricing of the used panels has incorporated the degradation from five years of use as warrantied by the manufacturer (not more than 0.5% per year).

The total estimated cost of decommissioning the Sherco 3 Solar Project is approximately $20,192,400 ($64,101 per MW). Estimated salvage/scrap value of the modules, racking, transformers, and other materials in the first five years of operation is approximately $34,013,600. The net decommissioning costs after accounting for resale and salvage values is approximately $13,821,200 in surplus, or $43,876 in surplus per MW.

Xcel Energy will utilize the net salvage rate methodology used for all its generation facilities. At the time of decommissioning, the costs of removal will be treated as a debit to Xcel Energy's depreciation reserve and the reserve balance will be reduced. This preliminary decommissioning plan for the Project reflects this methodology and, in a separate docket, the Company will seek Commission approval of the net salvage rates used for the Project.

Attachment A

Decommissioning Cost Estimate

Sherco 3 Solar Project

	Quantity	Unit	Unit Cost	Total Cost
Mobilization/Demobilization	1	Lump Sum	$1,280,500.00	$1,280,500
Mobilization was estimated to be approximately 7% of total cost of other items.				
Permitting				
County Permits	1	Lump Sum	$10,000.00	$10,000
State Permits	1	Lump Sum	$20,000.00	$20,000
Subtotal Permitting				**$30,000**
Decommissioning will require SWPPP and SPCC Plans. Cost is an estimate of the permit preparation cost.				
Civil Infrastructure				
Remove Gravel Surfacing from Road	40,562.4	Cubic Yards (BV)	$2.76	$111,952
Haul Gravel Removed from Road to Landfill (Becker, MN)	50,702.9	Cubic Yards (LV)	$8.96	$454,406
Dispose of Gravel Removed from Road (Landfill uses as Daily Cover)	65,711.0	Tons	$0.00	$0
Remove and Load Culvert from Beneath Access Roads	11	Each	$420.00	$4,620
Haul Culvert Removed from Access Roads to Landfill (Becker, MN)	3.3	Tons	$6.57	$22
Dispose of Culvert	3.3	Tons	$81.00	$267
Remove Low Water Crossing from Access Road	7.0	Each	$3,400.00	$23,800
Haul Low Water Crossing Materials to Landfill (Becker, MN)	280	Ton	$6.57	$1,840
Dispose of Low Water Crossing Materials	280	Ton	$30.00	$8,400
Grade Road Corridor (Re-spread Topsoil)	102,673	Linear Feet	$1.66	$170,856
Decompact Road Area	47.1	Acres	$89.03	$4,197
Remove Agricultural Fence	92,235	Linear Feet	$2.66	$245,345
Haul Agricultural Fence to Metal Recycling (Becker, MN)	143	Tons	$4.99	$714
Subtotal Civil Infrastructure				**$1,026,420**
Civil removal costs are a combination of MnDOT unit costs where applicable, RSMeans cost for St. Cloud, MN, and industry standards provided to Westwood.				
Structural Infrastructure				
Remove Steel Foundation Posts (Arrays, Equipment, Met Towers)	93,689	Each	$15.31	$1,434,461
Haul Array Steel Post to Metal Recycling (Becker, MN)	6,746	Tons	$4.23	$28,540
Remove Tracker Racking per String	21,444	Each	$185.13	$3,969,970
Haul Tracker Racking to Metal Recycling (Becker, MN)	16,508	Tons	$4.23	$69,844
Remove Drive Motor Posts	7,353	Each	$15.31	$112,581
Haul Drive Motor Posts to Metal Recycling (Becker, MN)	529	Tons	$4.23	$2,240
Subtotal Structural Infrastructure				**$5,617,636**
Steel removal costs were calculated by using RSMeans information for demolition of steel members. Hauling calculations are based on the locations of metals recyclers.				
Electrical Collection System				
Remove PV Panels	557,544	Each	$9.75	$5,436,054
Haul PV 95% of Panels to Reseller (Louisville, KY)	16,873	Tons	$156.54	$2,641,392
Haul 5% of PV Panels to Landfill (Becker, MN)	888	Tons	$6.57	$5,837
Dispose of PV Panels	888	Tons	$81.00	$71,934
Remove Combiner Boxes	70	Each	$60.00	$4,200
Remove Equipment Skids	70	Each	$1,107.22	$77,505
Remove Equipment Pad Frames and Foundations	70	Each	$6,105.52	$427,387
Haul Concrete Foundations	71	Tons	$19.98	$1,420
Dispose of Concrete from Transformer Foundation	71	Tons	$81.00	$5,755
Haul Equipment to Transformer Disposal (Albany, MN)	70	Each	$225.46	$15,782
Remove SCADA Equipment	1	Each	$2,000.00	$2,000
Remove DC Collector System Cables	315.01	Per MW	$2,000.00	$630,020
Remove Underground (AC) Collector System Cables	393,975	Linear Feet	$2.64	$1,039,188
Load and Haul Cables for Recycling	2,676.0	Tons	$4.23	$11,322
Subtotal Electrical Collection				**$10,369,796**
Electrical removal costs of PV Panels and Combiner Boxes were based industry standard installation rates. Equipment pads, MV Equipment, and SCADA Equipment removal cost are based on removal of equipment, concrete pads, and conduits using a truck mounted crane and RSMeans information on crew production rates.				

Site Restoration				
Stabilized Construction Entrance	12	Each	$2,000.00	$24,000
Perimeter Controls (Erosion and Sediment Control)	46,118	Linear Feet	$3.60	$166,023
Permanent Seeding (Assume 5% of site area)	67.5	Acres	$13,116.40	$885,450
Till to Farmable Condition within Fence	1,283	Acres	$158.78	$203,657
Subtotal Site Restoration				**$1,279,129**
Project Management				
Project Manager	52	Weeks	$3,749.00	$195,484
Superintendent	52	Weeks	$3,525.00	$183,804
Field Engineer	52	Weeks	$3,269.00	$170,455
Clerk	52	Weeks	$750.00	$39,107
Subtotal Project Management				**$588,849**
Standard industry weekly rates from RSMeans.				
Subtotal Demolition/Removals				**$20,192,400**
Salvage				
Fencing (Wire/Agricultural)	143	Tons	$234.73	$33,559
Steel Posts	6,746	Tons	$234.73	$1,583,426
Module Racking	16,508	Tons	$234.73	$3,875,086
PV Modules	529,667	Each	$43.22	$22,893,523
Transformers and Inverters	466,515	Pounds	$0.30	$139,955
Transformers (Oil)	53,200	Gallons	$0.70	$37,240
DC Collection Lines (Copper)	4,367,160	Pounds	$1.04	$4,520,011
AC Collection Lines (Aluminum)	984,938	Pounds	$0.95	$930,766
Subtotal Salvage				**$34,013,600**
Salvage values are a combination of the following factors; current market metal salvage prices, current secondary market for solar panel module recycling, discussions with national companies that specialize in recycling and reselling electrical transformers and inverters, and the assumption that care is taken to prevent any damage or breakage of equipment.				
Total Demolition Minus Salvage				**($13,821,200)**

Notes:
1. Prices used in analysis are estimated based on research of current average costs and salvage values.
2. Prices provided are estimates and may fluctuate over the life of the project.
3. Contractor means and methods may vary and price will be affected by these.

Cost Estimate Assumptions

To develop a cost estimate for the decommissioning of the Sherco 3 Solar Project, Westwood engineers made the following assumptions and used the following pricing references. Costs were estimated based on current pricing, technology, and regulatory requirements. The assumptions are listed in order from top to bottom of the estimate spreadsheet. When publicly available bid prices or Minnesota Department of Transportation (MnDOT) bid summaries were not available for particular work items, we developed time- and material-based estimates considering composition of work crews and equipment and material required. While materials may have a salvage value at the end of the project life, the construction activity costs and the hauling/freight costs are separated from the disposal costs or salvage value to make revisions to salvage values more transparent.

1. A project of this size and complexity requires a full-time project manager with full-time support staff.
2. Common labor will be used for the majority of tasks, supplemented by electricians, steel workers, and equipment operators where labor rules may require. Since MnDOT unit prices

are used, where possible, and the other costs are based on RSMeans Construction Costs, the labor rates will reflect union labor rates.

3. Mobilization was estimated at approximately 7% of total cost of other items.
4. Permit applications will require the preparation of a Stormwater Pollution Prevention Plan (SWPPP) and a Spill Prevention, Control, and Countermeasure (SPCC) Plan. The cost for these documents was split between the two phases.
5. Road gravel removal was estimated on a time and material basis. Since the material will not remain on site, a hauling cost is added to the removal cost. Clean aggregate can typically be used as "daily cover" at landfills without incurring a disposal cost. The road gravel may also be used to fortify local driveways and roads, lowering hauling costs but incurring placing and compaction costs. The hauling costs to a landfill represents an upper limit to costs for disposal of the road gravel.
6. Grade Road Corridor reflects the cost of mobilizing and operating light equipment to spread and smooth the topsoil stockpiled on site during construction to replace the aggregate removed from the road.
7. Erosion and sediment control along road reflects the cost of silt fence on the downhill side of the road adjacent to wetlands and drainage swales.
8. Topsoil is required to be stockpiled on site during construction, so no topsoil replacement is expected to replace the road aggregate. Subsoiling cost to decompact roadway areas is estimated as $89.03 per acre, and tilling to an agriculture-ready condition is estimated as $158.78 per acre.
9. Tracker array posts are lightweight "I" beam sections installed with a specialized piece of equipment and can be removed with a standard backhoe with an attachment for gripping the piles. We estimate crew productivity at 240 posts per day, resulting in a per post cost of approximately $15.31.
10. A metal recycling facility (EMR Northern Metal Recycling) is located in Becker, MN, approximately eight miles from the project site. Pricing was acquired from both facilities and from www.scrapmonster.com. The posts weigh approximately 150 pounds each, and we estimate the hauling costs at approximately $0.53 per ton mile. The pricing from ScrapMonster was reduced to reflect the processing required for the posts to fit recycling requirements.
11. It is assumed that the racking structures weigh approximately 15 pounds per linear foot of array. Each solar panel has a width of 44.65 inches. The facility has 557,544 modules, 2,201,119 feet of array, weighing 17,762 tons. The arrays are made of steel pipes; a crew with hand tools can disassemble and cut the pieces to sizes for recycling at a rate of about 240 pieces per person per day.
12. Hauling the steel to Becker, MN costs about $4.23 per ton.
13. The solar panels for this project measure approximately 3.72 feet by 7.46 feet and weigh 64 pounds. They can easily be disconnected, removed, and packed by a three-person crew at a rate we estimate at 36 panels per hour.
14. The equipment skids will consist of inverter(s), a transformer, and a panel on a metal frame approximately 19 feet long by eight feet wide by eight feet six inches tall. The skids weigh approximately 36,000 pounds and can be disconnected by a crew of electricians. They must be lifted by a mobile crane for transport to the recycler. They contain copper or aluminum windings.
15. The transformers contain either copper or, more commonly, aluminum windings that have significant salvage value. They are typically oil filled, but most transformer recyclers will

accept the transformers with oil. The estimated costs include removal of metal frame and conduits feeding the equipment.

16. Medium voltage (MV) equipment and SCADA equipment are mounted on the same equipment skids as the inverters and transformers, and they are enclosed in weatherproof cabinets. Their size requires light equipment to remove them. The costs for the removal of the pile foundations are included in the "Remove Steel Foundation Posts" estimate.
17. The underground collector system cables are placed in trenches with a minimum of 18 inches of cover. Several cables/circuits are placed side by side in each trench. The conduits and cables can be removed by trenching.
18. Perimeter control pricing is based on silt fence installation around downgradient sides of the project perimeter.
19. Metal salvage prices (steel, aluminum, copper) are based on April 2023 quotes from www.scrapmonster.com for the US Midwest. Posted prices are three months old. These prices are based on delivery to the recycling facility with the material prepared to meet size, thickness, cleanliness, and other specifications. A reduction of 25% has been taken from this price to reflect the processing by the contractor to meet the specifications.
20. The steel posts and array racking are priced at $234.73 per ton based on #1 HMS (heavy melting steel).
21. Solar module salvage valuation reflects the resale value of working panels within the first five years of operation. Module value was estimated based on EnergyBin's 2022 Module Price Index average price per watt for used solar modules. Pricing was further discounted by 25% to reflect market variation. Module value may be assumed to degrade at approximately 0.50% per year, or 88% after 25 years. We have assumed that as long as the modules are producing power, they will have economic value. Shipping to a resale facility has been included in the cost estimate.
22. There is an active market for reselling and recycling electrical transformers and inverters with several national companies specializing in recycling. However, we have assumed that the electrical equipment will be obsolete at the time of decommissioning, so we have based the pricing on a percentage of the weight that reflects the aluminum or copper windings that can be salvaged. Pricing was obtained from www.scrapmonster.com. We have assumed a 25% recovery of the weight of the transformers and inverters for aluminum windings.
23. The collection lines are priced assuming copper conductor wire for the direct current circuits, which is typical. The prices reflect a reduced yield of copper resulting from the stripping of insulation and other materials from the wire prior to recycling. The estimate uses the Midwest price of #2 insulated copper wire with a 50% recovery rate as found on www.scrapmonster.com in April 2023 (but representative of three months prior), which is $1.38 per pound.
24. Care to prevent damage and breakage of equipment, PV modules, inverters, capacitors, and SCADA must be exercised, but removal assumes unskilled common labor under supervision.