Appendix D

Noise and Traffic Study

Noise and Traffic Study

Banjo Creek Solar Project

Prepared for: GreenGo Energy US, Inc. on behalf of Banjo Creek Solar LLC

Prepared by: HDR, Inc.

Case No. 2023-00263

Graves County, Kentucky
September 7, 2023

This page intentionally left blank.

Contents

Contents i
Tables ii
Figures ii
List of Acronyms iii
1 Introduction 1
2 Noise Study 1
2.1 Existing Noise Conditions 1
2.1.1 General Background 1
2.1.2 Local Noise Ordinances 2
2.1.3 Nearest Receivers in the Vicinity of the Site 3
2.1.4 Existing Noise On-Site and Surrounding Area 2
2.2 Proposed Construction Noise Conditions 5
2.2.1 Equipment and Machinery 5
2.2.2 Roadway Noise During Construction 8
2.2.3 Assembly of solar array and construction of facilities 8
2.3 Proposed Operational Noise Conditions 8
2.3.1 Mitigated Alternative 1 – Not to exceed target machine noise emissions 13
2.3.2 Mitigated Alternative 2 - noise wall 13
2.3.3 Solar Array and Tracking System 14
2.3.4 Site Operations and Maintenance 14
2.4 Noise Summary and Conclusions 15
3 Traffic Study 15
3.1 Existing Road Network and Traffic Conditions 15
3.2 Construction Traffic 16
3.2.1 Traffic Safety Precautions 16
3.2.2 Impact on Road Infrastructure 17
3.2.3 Operational and Maintenance Traffic 17
3.3 Traffic Summary and Conclusions 17
4 Fugitive Dust Impacts 17
5 Railroad Effects 18
6 References 18

Tables

Table 1. Noise levels of common activities/situations 2
Table 2. Distances of Receivers to Project Property Boundary and Receiver Type 1
Table 3. Estimated Ambient Noise at Receivers 3
Table 4. Spectral Noise Emissions of Project Machinery/Noise Sources 8
Table 5. L_{eq} (dBA) at Receivers around the Site during Project Operation 9
Table 6. Target Noise Level Emissions for Project Machinery/Noise Sources 13
Table 7. Unmitigated Hourly L_{eq} and Distance to BESS facility Centroid (feet) 14
Table 8. Average Annual Daily Traffic Counts on Roadways near the Project 16

Figures

Figure 1. Banjo Creek Solar Project Noise Receivers 4
Figure 2. Banjo Creek Solar Project Pile-Driving Noise Buffer to 75 dBA Lmax/ 68 dBA Leq 7
Figure 3. Noise Contours during Proposed Project Operations 12

List of Acronyms

AC	Alternating current
BESS	Battery Energy Storage System
dB	Decibels
dBA	Decibels weighted for human sound
FTA	Federal Transportation Administration
KTC	Kentucky Transportation Cabinet
L_{dn}	Day-night average sound
L_{eq}	Time-weighted average sound pressure
MRLC	Multi-resolution Land Cover
PV	Solar photovoltaic
U.S.	United States
USEPA	U.S. Environmental Protection Agency
USCB	U.S. Census Bureau

1 Introduction

The Banjo Creek Solar Project (Project) is a proposed 120-megawatt alternating current (AC) solar photovoltaic (PV) facility and 30-megawatt AC battery energy storage system (BESS) on approximately 1,106 acres[1] located approximately eight miles southeast of the city of Mayfield and 10 miles west of the city of Murray in Graves County, Kentucky. The Project site consists of multiple land parcels that are currently used for agricultural practices; a Project location map is included in Volume I, Attachment A.

The Project would connect to Tennessee Valley Authority's adjacent existing Paris–Mayfield 161-kilovolt transmission line and would be owned and operated by Banjo Creek Solar LLC. The proposed facility would consist of a solar array with crystalline silicon or thin film PV panels attached to ground-mounted single-axis trackers, central inverters, several medium voltage transformers and main power transformers, a substation, BESS, a switching station, an operations and maintenance building, access roads, and all associated cabling and safety equipment.

The Project site is within a rural agricultural area and is bisected by KY Route 339 /Antioch Church Road, KY Route 564, and Wilferd Road. The site is bounded to the east by Beech Grove Road and KY Route 339/Antioch Church Road extends east-west through the southern portion of the Project site while KY Route 564 extends north-south through the eastern portion of the Project. The Project site is predominantly flat to gently sloping agricultural land with strips of forested areas buffering property lines and some areas of wetlands, streams, and ponds. Residences and agricultural structures (barns, garages, silos) are present, primarily along roads within or contiguous to the Project site.

According to the U.S. Geological Survey National Land Cover Database (MRLC 2021), surrounding Project land use consists of agricultural, forested, herbaceous, and low intensity development. Data indicate the Project site consists primarily of cultivated crops and hay/pasture (90.8 percent total), with scattered areas of deciduous and mixed forest (6.6 percent total), open space (1.6 percent), and developed areas, herbaceous, and open water (0.9 percent total). According to review of historical aerial imagery and topographic quadrangle maps, land use in the Project vicinity has remained relatively unchanged since at least 1950.

2 Noise Study

2.1 Existing Noise Conditions

2.1.1 General Background

Noise is generally described as unwanted sound, which can be based either on objective effects (hearing loss, damage to structures, etc.) or subjective judgments (such as community annoyance). The human ear does not perceive all sound frequencies equally well. Therefore,

[1] Banjo Creek Solar LLC controls a total of 1,270 acres of land in Graves County; however, due to development restrictions, the Project site as referenced in this report is 1,106 acres.

measured sound levels are often adjusted or weighted to correspond more closely to noise perceived by human hearing. A-weighting (i.e., dBA) is an adjustment applied to each frequency band to reflect the frequency-specific sensitivity of human hearing.

A day-night average sound (L_{dn}) is a 24-hour noise descriptor used to assess noise impacts for land uses where people sleep and there is a heightened sensitivity to nighttime noise. The L_{dn} noise metric is recommended by United States Environmental Protection Agency (USEPA) and has been adopted by most federal agencies (USEPA 1974). The L_{eq} is a time-weighted average sound pressure level metric that averages sound pressure level over a period of time. Common time periods to average over include 1 hour and 24 hours.

An L_{dn} of 65 dBA is most commonly used for noise planning purposes, and areas exposed to an L_{dn} above 65 dBA are generally not considered suitable for residential use. An L_{dn} of 55 dBA, which is equivalent an hourly average L_{eq} of 48.6 dBA, was identified by USEPA as a level below which there is no adverse impact (USEPA 1974). For reference, approximate noise levels (measured in dBA) of common activities/situations are provided in Table 1.

Table 1. Noise levels of common activities/situations

Activity/Event	dBA
Lowest audible sound to person with average hearing	0
Quiet rural, nighttime	25
Quiet urban, nighttime	45
Large business office	60
Normal speech at 3 feet	70
Noisy urban area, daytime	75
Food blender at 3 feet	90
Gas lawn mower at 3 feet	100
Jet flyover at 1000 feet	110

Source: Caltrans 2013

2.1.2 Local Noise Ordinances

The State of Kentucky repealed most of its noise control statutes in 2017 and now delegates the development of noise regulation programs to local governments (2021 Kentucky Revised Statutes, Chapter 278.30-175[2]). The Project spans two Census Designated Places, Sedalia, KY and Farmington, KY, neither of which have published noise ordinances. Graves County also does not have a noise ordinance.

The Kentucky Public Service Commission regulates electricity generation and requires facilities to apply for a certificate to construct a merchant generating facility. As part of this application process, a facility is required to include a statement certifying that the proposed plant will comply with local ordinances and regulations concerning noise control (2022 Kentucky Revised Statutes, Chapter 278.706). As described above, no noise regulations applicable to the Project site exist.

[2] https://apps.legislature.ky.gov/law/statutes/chapter.aspx?id=38583

In lieu of existing governmental ordinances, the USEPA threshold of adverse impacts of an L_{dn} of 55 dBA (hourly L_{eq} of 48 dBA) is selected as the design goal for the Project.

2.1.3 Nearest Receivers in the Vicinity of the Site

The Project site and a surrounding 0.5-mile radius were examined to identify potential noise-sensitive receptors. Noise-sensitive receptors are defined as those locations or areas where dwelling units or other fixed, developed sites of frequent human use occur. Sixty-nine noise sensitive receptors are within the area examined. Of these 69 receptors, 68 are rural residences and one is a church (Antioch Church of Christ, 1261 Antioch Church Rd, Farmington, KY 42040; identified as Receiver ID 47 in Figure 1 and Table 2). Residential land exists throughout the Project site, with concentrations around major roadways. Figure 1 shows the receivers in the vicinity of the Project.

Table 2 lists the distance from each receptor to the project build-out area of the Project site. Closest receptors are located at a setback distance of 300 feet from the panels.

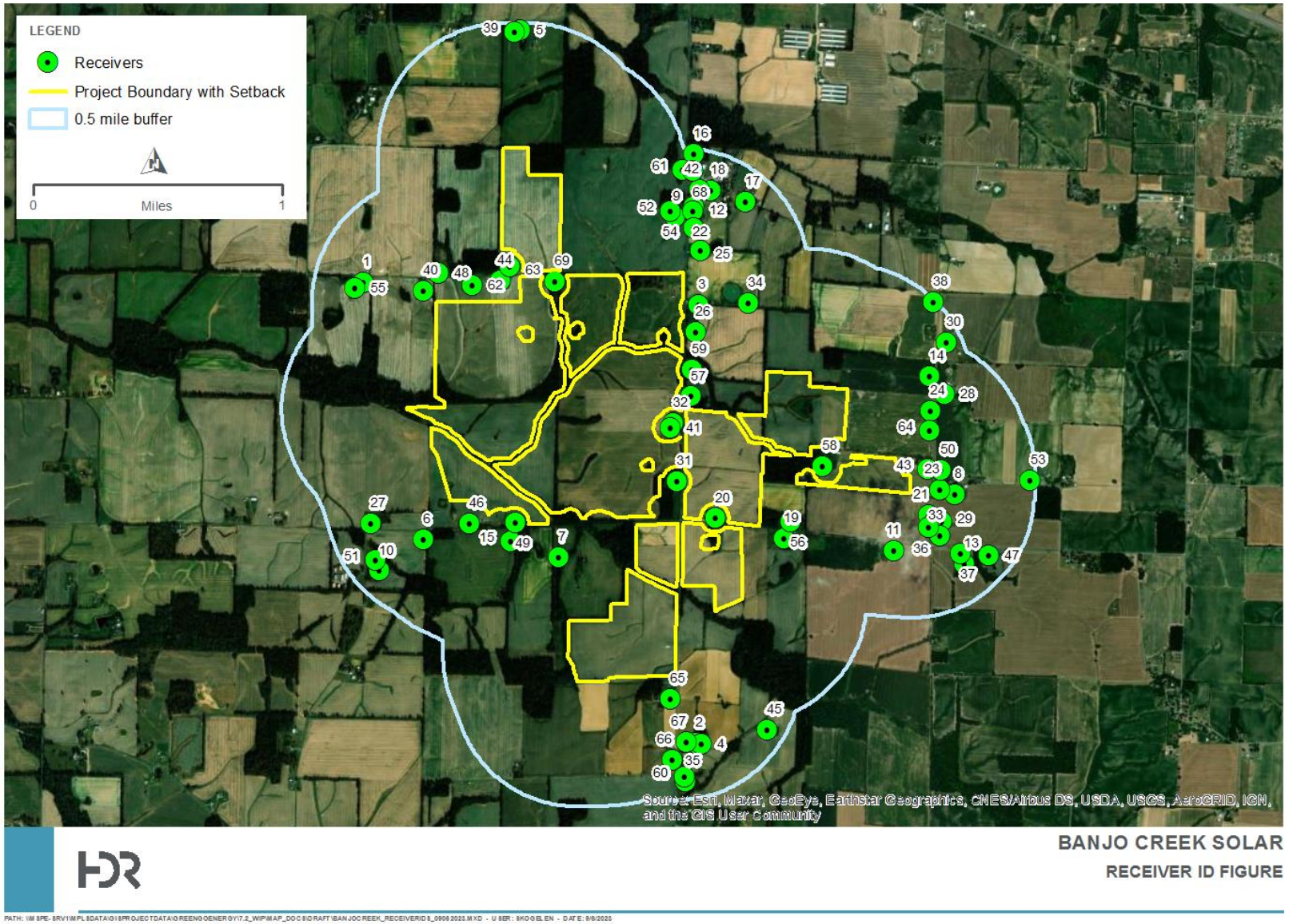

Figure 1. Banjo Creek Solar Project Noise Receivers

Table 2. Distances of Receivers to Project Build-out Area and Receiver Type

Receiver ID	Distance to Build-out Area	Receiver Type
1	1611	Residential
2	1488	Residential
3	344	Residential
4	1538	Residential
5	2502	Residential
6	1009	Residential
7	750	Residential
8	946	Residential
9	1189	Residential
10	2115	Residential
11	1232	Residential
12	1432	Residential
13	1873	Residential
14	1764	Residential
15	522	Residential
16	2540	Residential
17	1997	Residential
18	1837	Residential
19	578	Residential
20	300	Residential
21	605	Residential
22	1339	Residential
23	629	Residential
24	1240	Residential
25	597	Residential
26	300	Residential
27	1761	Residential
28	1715	Residential
29	908	Residential
30	2319	Residential
31	297	Residential
32	300	Residential
33	1089	Residential
34	1368	Residential
35	2255	Residential
36	825	Residential
37	1669	Residential
38	2596	Residential
39	2472	Residential
40	369	Residential
41	300	Residential
42	1811	Residential
43	392	Residential
44	412	Residential
45	2243	Residential
46	405	Residential

Receiver ID	Distance to Build-out Area	Receiver Type
47	2125	Church
48	620	Residential
49	298	Residential
50	635	Residential
51	2035	Residential
52	1316	Residential
53	2531	Residential
54	978	Residential
55	1768	Residential
56	649	Residential
57	300	Residential
58	300	Residential
59	300	Residential
60	2140	Residential
61	2192	Residential
62	344	Residential
63	300	Residential
64	928	Residential
65	489	Residential
66	1773	Residential
67	1417	Residential
68	2173	Residential
69	300	Residential

2.1.4 Existing Noise On-Site and Surrounding Area

Existing ambient noise conditions on and near the Project consist of typical sounds produced from farming and agriculture activities (e.g., trucks, all-terrain vehicles, tractors, and other farming equipment used during hay harvesting, bailing operations, as well as feed and animal transportation). In addition to noise from agricultural activity, traffic is also a source of ambient noise. State Highway 339 and State Highway 564 are two lane roadways that bisect the Project in both the north-south and east-west directions and are a source of traffic noise to the existing sound-scape. Other ambient noise sources include rural wildlife (i.e., insects, birds, and frogs).

Ambient outdoor noise levels were estimated at each of the 69 noise-sensitive receptor locations using methods developed by the USEPA and Federal Transit Administration published in Table 5-7 of “Estimating Existing Noise Exposure for General Assessment” from the Federal Transportation Administration (FTA) Transit Noise and Vibration Assessment manual, 2018 edition. This methodology uses proximity to major roads and railroads, and population density to estimate ambient day-night noise levels (L_{dn}). Each receptor was evaluated based on its distance from State Highway 339 and State Highway 564. Slower, two-lane roads in the Project vicinity were not considered using this methodology. The U.S. Census Bureau (2020) was used to identify population density. All receptors are within Census Tract 209 and Census Tract 204, with population densities of 49 people per square mile and 27 people per square mile, respectively (USCB 2020).

Using this approach, HDR assigned two L_{dn} values to each receptor; one for its proximity to the highway, and one based on the population density based on the FTA (2018) methodology. For receptors located more than 800 feet from the highways, only the L_{dn} value based on population density was considered. Per the FTA (2018) method, the highest of the two estimated ambient day-night noise levels for each receptor was considered to be the existing L_{dn} (see Table 3).

Table 3. Estimated Ambient Noise at Receivers

Receptor ID	Distance from Road (feet)	Population Density (people/mi)	Day-Night Noise Level (L_{dn}) in A-weighted Decibels (dBA)		
			Noise Level Based on Road Distance (dBA)	Noise Level Based on Population Density (dBA)	Maximum Resulting Noise Level (dBA)
1	>800	49	NA	35	35
2	390	49	55	35	55
3	259	49	55	35	55
4	519	49	50	35	50
5	>800	49	NA	35	35
6	199	27	60	35	60
7	673	27	50	35	55
8	>800	49	NA	35	55
9	273	49	55	35	60
10	>800	27	NA	35	65
11	160	49	60	35	60
12	126	49	60	35	60
13	329	49	55	35	55
14	>800	49	NA	35	35
15	293	27	55	35	55
16	103	49	60	35	60
17	>800	49	55	35	55
18	461	49	50	35	50
19	147	49	NA	35	50
20	118	49	60	35	60
21	660	49	NA	35	35
22	97	49	65	35	65
23	>800	49	60	35	60
24	>800	49	NA	35	55
25	271	49	55	35	60
26	220	49	55	35	55
27	156	49	60	35	60
28	>800	49	70	35	70
29	537	49	50	35	50
30	>800	49	65	35	65

Receptor ID	Distance from Road (feet)	Population Density (people/mi)	Day-Night Noise Level (L_{dn}) in A-weighted Decibels (dBA)		
			Noise Level Based on Road Distance (dBA)	Noise Level Based on Population Density (dBA)	Maximum Resulting Noise Level (dBA)
31	109	49	60	35	60
32	205	49	55	35	55
33	251	49	55	35	55
34	>800	49	65	35	65
35	197	49	60	35	60
36	394	49	NA	35	35
37	119	49	60	35	60
38	>800	49	NA	35	35
38	>800	49	NA	35	35
40	>800	49	50	35	60
41	259	49	55	35	65
42	224	49	55	35	55
43	>800	49	50	35	50
44	>800	49	60	35	60
45	>800	49	50	35	60
46	114	49	60	35	60
47	144	49	60	35	60
48	>800	49	NA	35	35
49	99	49	65	35	65
50	>800	49	NA	35	35
51	615	27	50	35	55
52	367	49	55	35	55
53	>800	49	55	35	55
54	123	49	60	35	60
55	>800	49	55	35	55
56	226	49	55	35	55
57	145	49	60	35	60
58	>800	49	NA	35	35
59	174	49	60	35	60
60	162	49	60	35	60
61	126	49	60	35	60
62	>800	49	NA	35	35
63	>800	49	55	35	55
64	>800	49	NA	35	35
65	157	27	60	35	60
66	96	27	65	35	65
67	195	49	60	35	60

Receptor ID	Distance from Road (feet)	Population Density (people/mi)	Day-Night Noise Level (L_{dn}) in A-weighted Decibels (dBA)		
			Noise Level Based on Road Distance (dBA)	Noise Level Based on Population Density (dBA)	Maximum Resulting Noise Level (dBA)
68	82	49	65	35	65
69	>800	49	55	35	55

Source: FTA 2018

Estimated noise levels range from 65 dBA L_{dn} for receivers that directly abut one of the two state highways, to 35 dBA L_{dn} for receptors located more than 800 feet from the state highways.

2.2 Proposed Construction Noise Conditions

2.2.1 Equipment and Machinery

Direct and indirect noise impacts associated with implementation of the Project would primarily occur during construction. Construction equipment, such as delivery trucks, dump trucks, water trucks, service trucks, bulldozers, chain saws, bush hogs, or other large mowers for tree clearing produce maximum noise levels at 50 feet of approximately 84 to 85 dBA. This type of equipment may be used for approximately 12 - 18 months at the Project site; however, most of the proposed equipment would not be operating on site for the entire construction period and would be phased in and out according to the progress of the Project and would not be operating in the same location on the site for more than a few days. The Project will limit construction activity, process, and deliveries to the hours between 7 a.m. and 7 p.m. local time, Monday through Saturday. Construction activities that create a higher level of noise, such as pile-driving, will be limited to 8 a.m. to 6 p.m. local time, Monday through Friday. Non-noise causing and non-construction activities can take place on the site between 6 a.m. and 11 p.m. local time, Monday through Sunday, including field visits, arrival, departure, planning, meetings, and surveying. Construction noise would cause temporary adverse impacts to the ambient sound environment in the Project area, at several noise sensitive land uses such as residences within 0.5 mile of the Project boundary and Antioch Church of Christ. Construction would primarily occur during daylight hours, between sunrise and sunset; therefore, the Project would not affect ambient noise levels at night during the construction period.

The Project will use pile-driving to install solar panel platforms, which typically is the loudest construction activity. To estimate noise emissions due to Project pile-driving activities, a construction noise modeling exercise was performed according to the methods outlined below. Noise emission estimates for impact pile driving activity were referenced from published Federal Highway Administration (FHWA) and Federal Transit Authority (FTA) sources, which give maximum instantaneous (Lmax) sound pressure level emissions for a single pile-driver to be 101 dBA at 50 feet, equal to a sound power level of 132.8 dBA. FTA (2018) advises that the equivalent hourly L_{eq} for pile-driving activities can be calculated using a usage factor of 20 percent. With a usage factor of 20 percent, equivalent hourly L_{eq} is roughly 7dBA lower than the Lmax.

Given that pile-driving noise is a loud, but intermittent and temporary activity, a noise design goal of 75 dBA Lmax, equal to 68 dBA hourly L_{eq} at the receiver is chosen for this construction noise analysis. From Table 1 above, an Lmax of 75 dBA is roughly equal to a busy urban daytime soundscape. A modeling exercise was performed to investigate the distance at which pile-driving noise for one pile-driver attenuates to 75 dBA Lmax, equal to 68 dBA (L_{eq}). Modeling shows that this distance is 992 feet.

The 300-foot panel setback from receivers is the closest the pile-drivers will be to receivers and is thus where pile-driving noise will be the highest at any receiver. Modeling results show that at 300 feet, pile-driving noise are 85 dBA Lmax, equal to 78 dBA L_{eq}.

Figure 2 below shows the 75 dBA Lmax / 68 dBA L_{eq} buffer from each of the receivers. Whenever a pile-driver is within these buffers, pile-driving related noise at the receiver from which the buffer originates are expected to be greater than 75 dBA Lmax / 68 dBA L_{eq}.

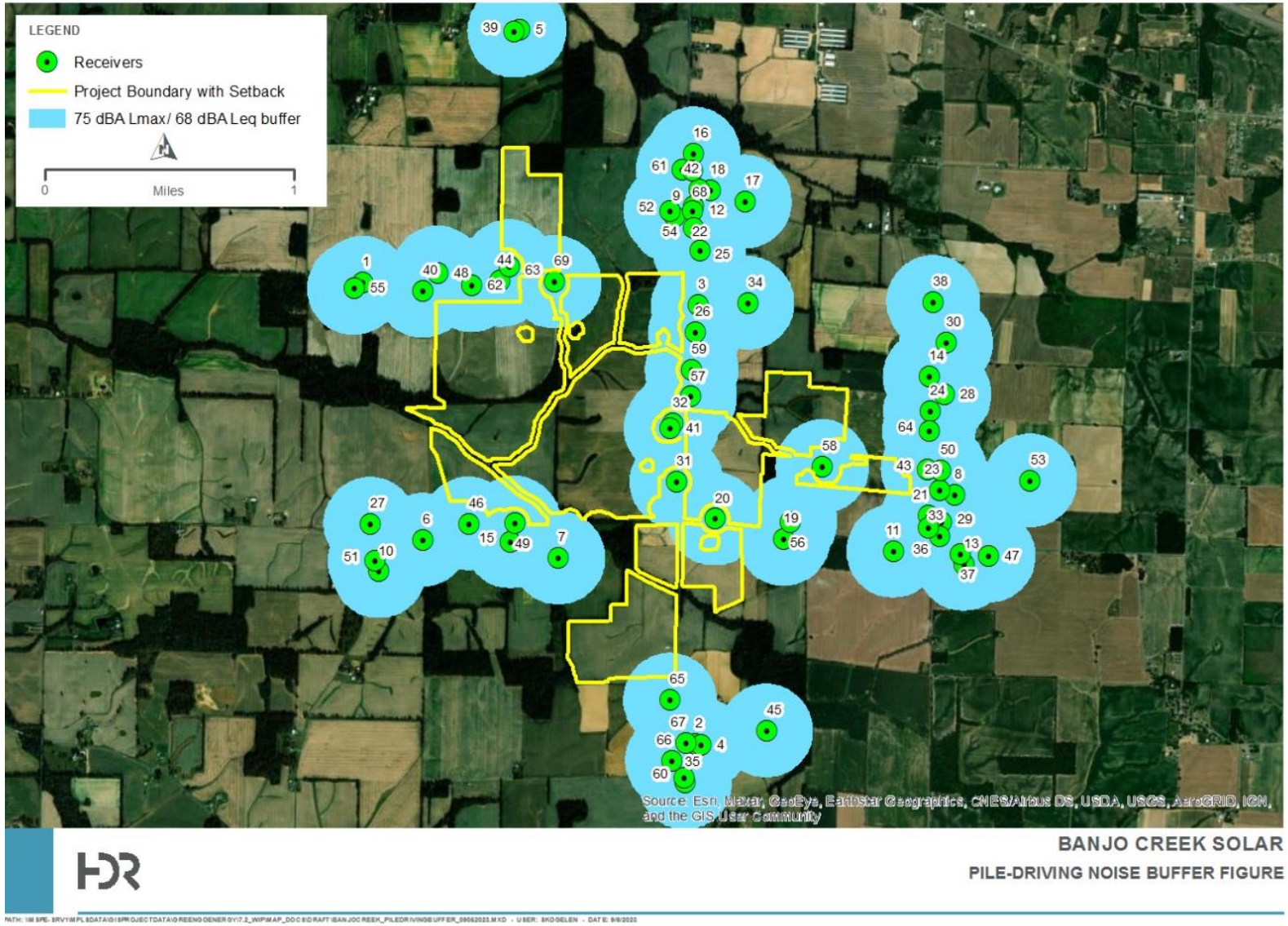

Figure 2. Banjo Creek Solar Project Pile-Driving Noise Buffer to 75 dBA Lmax/ 68 dBA Leq

To keep as low as possible receiver's exposure to pile-driving noise, Banjo Creek Solar will endeavor to keep to a minimum the number of pile-drivers within these buffers at any time, and also minimize the amount of time each of the pile-drivers spend within these buffers.

2.2.2 Roadway Noise During Construction

A temporary increase in traffic is anticipated during the construction phase. Banjo Creek Solar anticipates noise contributed by construction vehicles, such as cranes, dump trucks, and light passenger cars and trucks would be in short duration and would not occur between the hours of 11 PM and 6 AM. The loading and unloading of equipment would occur primarily during daytime hours and would occur several hundred feet inside the Project site.

2.2.3 Assembly of solar array and construction of facilities

Assembly of the panel tracking system and the installation of the solar panels, inverters, and other electrical equipment associated with the Project would likely employ typical manual hand tools and power tools. These assembly operations would occur several hundred feet to thousands of feet inside the Project site and during normal business hours on weekdays. Noise generated by power equipment would be short in duration.

2.3 Proposed Operational Noise Conditions

There are several mechanical components that will generate noise and contribute to the noise-scape when the Project is operating. These are listed below:

i) BESS system
   a. CATL battery units (300 total)
   b. Power Conditioning System
      i. Inverters (45 total)
      ii. 2.4kVA transformer (7 total)
ii) Project Substation Transformer (130 MVA)
iii) PV Inverters (5 per skid, 33 skids)
iv) PV Transformer (4.4 MVA, 1 per skid; 33 skids)
v) PV array tracking motors

The spectral sound power level of each of the above machines are tabulated in Table 4.

Table 4. Spectral Noise Emissions of Project Machinery/Noise Sources

Machine	Spectral Sound Power Level emission (dB)/Frequency (Hz)									Overall	
	31.5	63	125	250	500	1000	2000	4000	8000	dBA	dB
PV & BESS Inverters	63.6	63.6	77.6	91.6	90.6	88.6	86.6	78.6	73.6	93.4	95.9
BESS CATLs	76.5	83.2	95	88.8	88.9	86.1	83	77.9	70.6	91.2	97.5
BESS Transformer	72.1	78.1	80.1	75.1	75.1	69.1	64.1	59.1	52.1	75.5	84.1
4.4MVA skid Transformer	75.9	81.9	83.9	78.9	78.9	72.9	67.9	62.9	55.9	79.3	87.9
130MVA Transformer	52.4	71.6	83.7	86.2	91.6	88.8	85	79.8	70.7	95.2	103.8

The solar array tracking motors generate noise periodically and are omitted from this modeling exercise and are evaluated in Section 2.3.1.

While the PV array tracking motors only function in the daytime, other project components such as inverters and transformers may operate at night, and thus steady-state operation is conservatively assumed.

To estimate Project related noise levels at receivers within 0.5-mile of the Project boundaries, a predictive model was developed in Cadna/A, (Computer Aided Noise Abatement) an industry-accepted 3-D environmental noise propagation software based on ISO-9613 (the international acoustical standard for outdoor sound propagation). This software calculates frequency-dependent sound propagation from the proposed equipment sources to surrounding receivers in the study area. Modeled receiver heights are located five feet above the ground. Model calculations include the factors important to sound propagation over distance, such as geometrical spreading, downwind conditions in all directions (that conservatively overestimates sound propagation), acoustical absorption characteristics of the ground surface in the propagation path, temperature, and relative humidity, among others.

Table 5 below shows the calculated hourly L_{eq} at each receiver, sorted in descending order of L_{eq}. Project related noise is highest at Receiver 46, located about 1,100 feet southeast of the centroid of the proposed BESS facility. Figure 3 shows the modeled project related L_{eq} noise contours and the point of highest noise emission.

Table 5. L_{eq} (dBA) at Receivers around the Site during Project Operation

Receiver ID	Hourly L_{eq} (dBA)
46	52
6	48
49	47
20	46
44	46
69	45
15	45
62	45
27	45
63	45
51	42
41	42
10	42
31	42
32	42
7	41
26	41
3	41

Receiver ID	Hourly L_{eq} (dBA)
57	40
59	40
48	40
40	40
58	38
65	36
1	36
55	36
25	36
56	35
43	35
19	35
34	35
9	34
54	34
52	34
64	34
22	33
50	33
12	33
24	32
23	32
42	32
21	31
18	31
61	31
67	31
68	31
2	31
11	30
17	30
36	30
4	30
8	30
66	30
14	30
16	30
28	30
29	30
33	29
60	29

Receiver ID	Hourly L_{eq} (dBA)
35	29
45	28
30	28
37	27
39	27
5	27
38	27
13	26
47	25
53	25

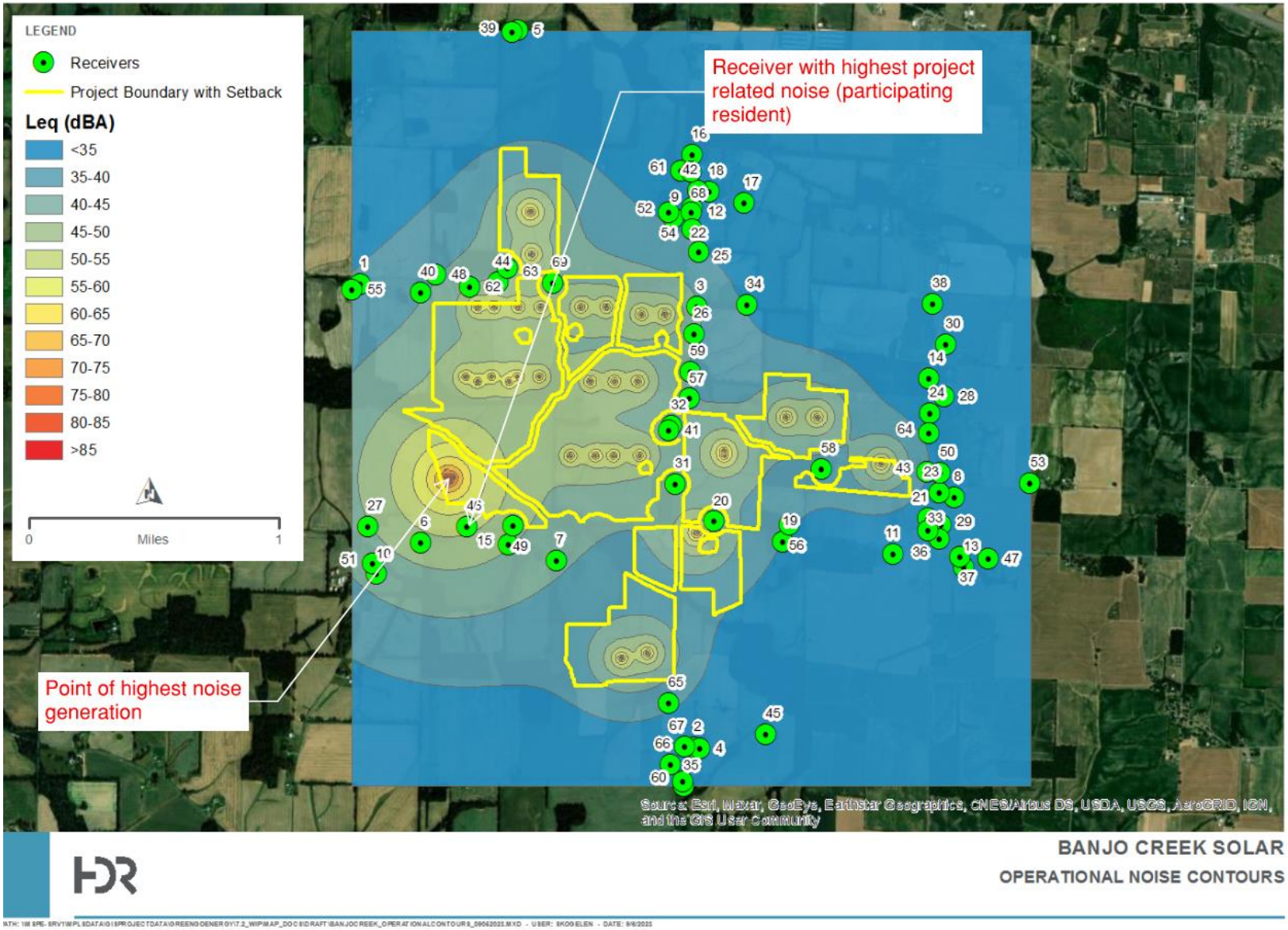

Figure 3. Noise Contours during Proposed Project Operations

Modeled noise levels indicate an exceedance of the 48 dBA design goal at receiver 46, which is a participating receiver. Project related noise levels at this receiver are dominated by the numerous BESS CATL noise sources. Other dominant noise sources include the BESS inverters and substation transformer. The three mitigation alternatives below are offered as options Banjo Creek may consider to mitigate project related noise at receivers in the vicinity.

2.3.1 Mitigated Alternative 1 – Not to exceed target machine noise emissions

Modeling results show that reducing the noise emissions from each of the BESS units by 4dBA will reduce project related noise levels at Receiver 46 to below 48dBA, meeting the design goal. Under this mitigation alternative, noise emissions from other site machinery will be kept at or under design levels tabulated in Table 5 above. Under this alternative, project machinery will be selected not to exceed the following overall Sound Power Levels listed in Table 6 or an equivalent sound pressure level and distance of measurement.

Table 6. Target Noise Level Emissions for Project Machinery/Noise Sources

Machine	Spectral Sound Power Level emission (dB)/ Frequency (Hz)									Overall	
	31.5	63	125	250	500	1000	2000	4000	8000	dBA	dB
PV & BESS Inverters	63.6	63.6	77.6	91.6	90.6	88.6	86.6	78.6	73.6	93.4	95.9
BESS CATLs	72.5	79.2	91	84.8	84.9	82.1	79	73.9	66.6	87.2	93.5
BESS Transformer	72.1	78.1	80.1	75.1	75.1	69.1	64.1	59.1	52.1	75.5	84.1
4.4MVA skid Transformer	75.9	81.9	83.9	78.9	78.9	72.9	67.9	62.9	55.9	79.3	87.9
130MVA Transformer	52.4	71.6	83.7	86.2	91.6	88.8	85	79.8	70.7	95.2	103.8

2.3.2 Mitigated Alternative 2 - Noise wall

Alternative to meeting the target SWLs in Table 6 in section 2.3.1 above, installing a 10- foot-tall noise barrier around the footprint of the BESS facility will also bring noise levels at all receivers to below the 48 dBA design goal. If Banjo Creek chooses to implement this alternative (10-foot-tall noise wall) machine target sound power levels may be relaxed to the design values reported in Table 6 above.

To illustrate the distances of the receivers with the five highest project related noise levels, Table 7 below shows the distance of the receiver from the loudest project noise source (BESS facility), and the Project related L_{eq}.

Receivers 46, 6, 49 are in the immediate vicinity of the BESS facility, whereas receivers 20 and 44 are further away. Noise levels at receivers 20 and 44 are based on proximity to PV skid inverters and transformers.

Table 7. Unmitigated Hourly L_{eq} and Distance to BESS facility Centroid (feet)

Receiver ID	Hourly L_{eq} (dBA)	Distance to BESS centroid (feet)
46	52	1063
6	48	1470
49	47	1700
20	46	5643
44	46	4072

2.3.3 Mitigated Alternative 3 – Repositioning the BESS facility

In addition to the two mitigated alternatives above, a third mitigated alternative may also be considered where the entire BESS facility will be moved further away from the receivers where project related noise is currently projected to be the highest (Receivers 46, 6 and 49). Noise modeling has not been done for this third alternative at the time of writing this report, and thus a quantitative distance required for mitigation is not reported. This however remains an option Banjo Creek Solar is open to exploring to mitigate project related noise at receivers 46,6 and 49.

2.3.4 Solar Array and Tracking System

The solar array associated with the Project includes single-axis tracking motors distributed evenly across the site. Tracking systems involve the panels being driven by small, 24-volt brushless DC motors to track the arc of the sun. Moving parts of the solar facility would be restricted to the east-to-west facing tracking motion of the solar modules, which amounts to a movement of less than a one degree angle every few minutes. This movement maximizes the collection of solar energy by rotating with the sun and is barely perceptible. The sound typically produced by panel tracking motors (NexTracker or equivalent) is approximately 70 dBA at a distance of one foot.

Proposed placement of the tracking motors was conservatively assumed to represent the closest possible locations to receptors. Tracking motors are not anticipated to operate continuously and will move one-quarter inch over 15 seconds every five minutes as the solar panels track the sun (three minutes in an hour). Based on this, the equivalent hourly L_{eq} at receivers in the vicinity will be 12 dBA lower than if the tracking motor operates continuously for 60 minutes over the hour-long period.

Because the Project setback is 300 feet, the nearest possible location of a tracking motor to a receiver will be 300 feet. Modeling results indicated that at a distance of 300 feet, hourly L_{eq} of a tracking motor that emits 70dBA at a distance of one foot, operating three minutes in an hour, attenuates down to 0 dBA. This indicates that at this distance, tracking motor noise will be negligible in comparison to other project related noise sources.

2.3.5 Site Operations and Maintenance

Typical maintenance activities on solar facilities include minor repair and maintenance of the solar panels, tracking systems, electrical wiring, or maintenance/inspections of the inverters.

Post-construction, the Project site would be seeded using a mixture of certified weed-free, low-growing native and/or noninvasive grass and herbaceous plant seed containing species that tend to attract pollinators. In general areas of the facility, vegetation will be less than 26 inches in height and be controlled by a once-per-year application of pre-emergent herbicide spray and up to two mows per year. Vegetation from mowing and trimming would be left in place. Noise levels from maintenance activities such as these are anticipated to be consistent with ambient noise levels in the area.

2.4 Noise Summary and Conclusions

Noise during the construction phase is expected to temporarily increase during daylight hours due to heavy equipment, passenger cars and trucks, and tool use during assembly of the solar facilities. The Project will limit construction activity, process, and deliveries to the hours between 7 a.m. and 7 p.m. local time, Monday through Saturday. Construction activities that create a higher level of noise, such as pile-driving, will be limited to 8 a.m. to 6 p.m. local time, Monday through Friday. Non-noise causing and non-construction activities can take place on the site between 6 a.m. and 11 p.m. local time, Monday through Sunday, including field visits, arrival, departure, planning, meetings, and surveying.

Noise would be present on the Project site during construction; however, due to the size of the Project and the distance to the nearest noise receptors, construction would not contribute to a significant noise increase when compared to noise currently occurring on or near the Project (i.e., the operation of farming equipment for livestock, hay production, and crop harvesting), except during pile-driving activities. Pile-driving noise will be managed by reducing amount of time and number of pile-drivers within the 75 dBA Lmax/68dBA Leq buffers around each receiver.

In addition, periodic noise associated with the solar panel tracking system and the relatively constant noise of other site machinery would occur during operation. Modeling results indicate that if site machinery noise emissions do not exceed the targets reported above in Table 6, noise levels at receivers in the vicinity can meet the 48 dBA hourly L_{eq} design goal. Site visits and maintenance activities would take place during daylight hours and will not significantly contribute to noise. The noise associated with these site activities is very similar to those currently generated onsite by farming activities and offsite by commercial and farm uses.

3 Traffic Study

3.1 Existing Road Network and Traffic Conditions

The Project is bisected by KY Route 339/Antioch Church Road, KY Route 564, and Wilferd Road, and is bounded to the east by Beech Grove Road. KY Route 339/Antioch Church Road is a two-lane paved public road that extends east-west through the southern portion of the Project and provides access to the Project site through its connections with KY routes 564, 893, 97, and 303, and U.S. Route 45. KY Route 564 is a two-lane paved public road that extends north-south through the eastern portion of the Project and provides access to the Project site through its connections with KY Route 339/Antioch Church Road, KY Route 121, and KY Route 94. Wilferd

Road is a two-lane paved public road that extends east-west through the northern portion of the Project and provides access to the Project through its connections with KY Route 564 and Dove Road. Beech Grove Road is a two-lane paved public road that extends north-south along the eastern boundary of the Project and provides access to the Project through its connections with Antioch Church Road and KY Route 121. The nearest major highway is KY Route 80, approximately 1.5 miles north of the Project. KY Route 80 provides a route northwest to the city of Mayfield, which provides throughfare to Interstate 69.

Existing traffic volumes on roadways in the Project vicinity were determined using 2017, 2020, 2021, and 2022 Average Annual Daily Traffic counts, depending on availability, measured at existing Kentucky Transportation Cabinet (KTC) stations (KTC 2023; Table 8).

Table 8. Average Annual Daily Traffic Counts on Roadways near the Project

Station	Roadway	Distance from Project	AADT
042286	KY 564	Adjacent to northeast corner of the Project	919[b]
042278	KY 339	1.0 mile west of the Project	250[b]
042280	KY 121 (west of KY 564)	2.5 miles north of the Project	1,342[d]
042282	KY 121 (east of KY 564)	2.6 miles northeast of the Project	1,025[c]
042284	KY 564 (between KY 121 and KY 80)	2.6 miles northeast of the Project	655[b]
042287	KY 94 (west of KY 893)	2.8 miles southeast of the Project	1,549[b]
042370	KY 80 (west of KY 564)	3.5 miles north of the Project	7,541[b]
042371	KY 80 (east of KY 564)	4.9 miles northeast of the Project	6,234[d]
042273	KY 303 (south of KY 1890)	7.0 miles northwest of the Project	3,372[b]
018576	KY 94 (east of KY 893)	8.4 miles southeast of the Project	3,158[d]
042270	KY 303 (north of KY 1890)	9.4 miles northwest of the Project	5,320[a]

Source: KTC 2023
[a] 2017 AADT
[b] 2020 AADT
[c] 2021 AADT
[d] 2022 AADT

3.2 Construction Traffic

Subject to weather, construction activities would take approximately 12 to 18 months to complete using a crew of approximately 323 workers. During construction, a temporary increase in traffic volume associated with travel of construction laborers, delivery of construction equipment and material, and delivery of solar panel components and equipment is anticipated, primarily along KY 339/Antioch Church Road, KY 564, KY 121, KY 80, KY 94, and KY 303. Laborer commutes with passenger vehicles and trucks would occur daily with traffic peaks in the morning, at lunch, and at the end of the workday, whereas deliveries of equipment would occur on trailers, flatbeds, or other large vehicles periodically throughout the construction process at various times of day.

3.2.1 Traffic Safety Precautions

Permanent road or lane closures are not anticipated for the construction of the proposed solar facility. However, the presence of signage, signaling, personnel flagging traffic, and temporary lane closures may be employed to reduce risk of collision on the roadway. For instance, the presence of a flag person to temporarily stop traffic to allow for a delivery truck and trailer to

safely turn into the site may be necessary at times of large equipment deliveries. Appropriate signage of trucks entering the highway or slow-moving vehicles would be used to warn oncoming traffic of potential risk.

3.2.2 Impact on Road Infrastructure

Significant degradation to the existing roadways is not anticipated for the proposed Project. The increase in localized traffic and the continued entry and exit of heavy trucks or equipment has potential to result in additional wear of the existing roadway or shoulder at Project entry points. Damage resulting from Project construction would be rectified.

Access drives and internal roads would be constructed or improved as needed to accommodate appropriate vehicles and equipment to construct the proposed solar facility. Internal roads would be compacted gravel, which may result in an increase in airborne dust particles. During construction, water may be applied to internal road system to reduce fugitive dust.

3.2.3 Operational and Maintenance Traffic

The Project would be monitored remotely via security cameras to identify any security or operational issues during operation of the solar facility. If a problem is discovered during nonworking hours, a local repair crew or law enforcement personnel would be contacted if an immediate response were warranted. Employees will conduct periodic site visits to inspect the site, ensure proper equipment operation, and note any maintenance needs. Permanent access to the Project substation, switching station, battery energy storage system, and operations and maintenance building for maintenance and repairs would be within the Project site, via KY Route 339 (Volume II, Attachment C).

Long-term impacts to the road infrastructure and vehicle traffic are not anticipated as daily traffic to the site will be minimal. For example, employees would generally contribute less to vehicle traffic than a typical single-family home would. Vehicular traffic around the Project would be limited to typical weekday work hours and would not significantly contribute to additional traffic in the Project vicinity.

3.3 Traffic Summary and Conclusions

Traffic in the Project vicinity is predicted to increase temporarily during the construction phase of the Project. This includes daily morning, midday, and evening peaks for construction laborers entering and exiting the Project site and periodic delivery of construction materials and equipment. Appropriate signage and traffic directing would occur as necessary to increase driver safety and reduce risk of collisions for approaching traffic. There are no anticipated impacts to the existing roadway infrastructure. During facility operation and maintenance, there would be no significant increase in traffic. Long-term impacts to the road infrastructure and vehicle traffic are not anticipated as daily traffic to the site will be minimal.

4 Fugitive Dust Impacts

Land disturbing activities associated with the Project may temporarily contribute to airborne materials. A Kentucky Pollutant Discharge Elimination System permit will be required and will provide specific measures for dust control that Banjo Creek Solar LLC will implement. To reduce

fugitive dust emissions from construction areas and paved and unpaved roads, Banjo Creek Solar LLC will implement the application of water or covering of spoil piles. Water in sufficient quantity and quality would be made available through the use of on-site groundwater wells or by delivery via water trucks. Wet suppression can reduce fugitive dust emissions from roadways and unpaved areas by as much as 95 percent (USEPA 1998). In addition, any open-bodied truck transporting dirt will be covered when the vehicle is in motion. Therefore, fugitive dust impacts associated with construction activities would be expected to be minor with the implementation of the proposed mitigation. Erosion control measures would be maintained until vegetation in the disturbed areas has returned to the preconstruction conditions or the site is stable thereby limiting the amount of dust present post-construction.

5 Railroad Effects

A regional railroad, Paducah & Louisville Railway, extends north-south through the city of Mayfield, approximately 8.2 miles northwest of the Project site. The proposed Project would have no effect on this railroad, nor would the Project utilize the rail for deliveries.

6 References

California Department of Transportation (Caltrans). 2013. Technical Noise Supplement to the Traffic Noise Analysis Protocol. September 2013. URL: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf. Accessed August 2023.

Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Assessment, FTA Report No. 0123. September 2018. URL: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf . Accessed August 2023.

Federal Highway Administration (FTA). 2018. Roadway Construction Noise Manual User Guide, FHWA. August 2006. URL: https://www.fhwa.dot.gov/Environment/noise/construction_noise/rcnm/rcnm01.cfm. Accessed August 2023

Kentucky Transportation Cabinet (KTC). 2023. Traffic Counts. URL: https://maps.kytc.ky.gov/trafficcounts/. Accessed August 2023.

Multi-Resolution Land Characteristics Consortium (MRLC). 2021. National Land Cover Data (CONUS). Available at https://www.mrlc.gov/data?f%5B0%5D=category%3Aland%20cover. Accessed August 2023.

U.S. Environmental Protection Agency (USEPA). 1974. Information On Levels Of Environmental Noise Requisite To Protect Public Health and Welfare With An Adequate Margin Of Safety. March 1974.

_____. 1998. Emission Factor Documentation for AP-42 Section 13.2.2. Unpaved Roads. Final Report. URL: https://www.epa.gov/sites/default/files/2020-10/documents/ap-42_13.2.2_background_report_unpaved_roads.pdf. Accessed August 2023.

U.S. Census Bureau (USCB). 2020. 2020 Census Demographic Data Map Viewer. URL: https://mtgisportal.geo.census.gov/arcgis/apps/MapSeries/index.html?appid=2566121a73de463995ed2b2fd7ff6eb7. Accessed 21 April 2022.

440 S Church Street
Suite 1200
Charlotte, NC 28202-2075
704.338.6700
hdrinc.com