DOCKETED	
Docket Number:	24-OPT-05
Project Title:	Corby Battery Energy Storage System Project
TN #:	266307
Document Title:	Data Response Set #4
Description:	Applicant responses to Data Requests REV 1 DR WS/FP/PH-1 through 4 and REV2 DR ALT-1 through 2
Filer:	Doug Urry
Organization:	Tetra Tech
Submitter Role:	Applicant Consultant
Submission Date:	10/3/2025 3:08:13 PM
Docketed Date:	10/3/2025

Data Request Response #4

Corby Battery Energy Storage System Project (24-OPT-05)

October 2025

Prepared for

NextEra Energy Resources
700 Universe Boulevard
Juno Beach, FL 33408

Prepared by

Tetra Tech
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614

Table of Contents

List of Tables

List of Figures

List of Appendices

Acronyms and Abbreviations

AEGL	Acute Exposure Guideline Level
Applicant	North Bay Interconnect, LLC and Corby Energy Storage, LLC
Application	Opt-in Application
BESS	battery energy storage system
BOS	Board of Supervisors
CAISO	California Independent System Operator
CARB	California Air Resources Board
CEC	California Energy Commission
CNDDB	California Natural Diversity Database
CO	carbon monoxide
CO_2	carbon dioxide
ESA	Energy Storage Agreement
gen-tie	generation tie
IDLH	Immediately Dangerous to Life or Health
HI	hazard index
MMA	Material Modification Assessment
MW	megawatt
OEHHA	Office of Environmental Health Hazard Assessment
PG&E	Pacific Gas and Electric
POI	point of interconnection
Project	Corby Battery Energy Storage System Project
REL	Reference Exposure Level
SR	State Route
TAC	toxic air contaminant
UTM	Universal Transverse Mercator

1.0 INTRODUCTION

This Data Request Response #4 to North Bay Interconnect, LLC and Corby Energy Storage, LLC's (Applicant)[1] Opt-in Application (Application) for the Corby Battery Energy Storage System Project (Project) (24-OPT-05) responds to comments that California Energy Commission (CEC) Staff have made as a result of their data adequacy review of the Application, including REV 1 DR WS/FP/PH-1 through -4 documented in their email request for additional information dated July 31, 2025 (docketed on August 1, 2025) and REV 2 DR ALT-1 and -2 documented in their email request dated September 26, 2025 (docketed October 2, 2025). The intention of this supplement is to provide all additional information necessary for Staff to find that the Application contains adequate data to begin an Opt-in Renewables site certification proceeding under California Code of Regulations, Title 20, Section 1877, and Public Resources Code, Section 25545, et seq. We respectfully request that CEC Staff deem the Application complete immediately upon acceptance of this Data Request Response #4 consistent with Public Resources Code, Section 25545.4(c)(2). The CEC's timely completeness determination is critically important because the Applicant has a binding commitment under its Energy Storage Agreements (ESAs) to deliver capacity from this battery energy storage system (BESS) facility to its customers by April 1, 2027, for them to meet the California Public Utilities Commission 2027 electric system reliability procurement directives. The Applicant will continue to work expeditiously to respond to any additional information requests by CEC Staff (e.g., pursuant to Public Resources Code, Section 25545.4(d)) after the Application is deemed complete.

Table 1-1 provides a summary of the technical areas requiring additional information to be deemed complete and indicates which of these are addressed in this Data Request Response #4. For each technical area included, the responses are complete and address all identified deficiencies.

Table 1-1. Completeness Review Status

Technical Area	Addressed in Data Request Response #1	Addressed in Data Request Response #2	Addressed in Data Request Response #3	Addressed in Data Request Response #4
Incomplete				
Mandatory Opt-in Requirements	X			
Air Quality		X		X
Alternatives		X	X	X
Biological Resources	X		X	
Cultural and Tribal Cultural Resources		X	X	
Geologic Hazards	X			
Greenhouse Gas Emissions		X		X
Hazardous Materials Handling		X		

[1] North Bay Interconnect, LLC and Corby Energy Storage, LLC are both wholly-owned subsidiaries of NextEra Energy Resources. North Bay Interconnect, LLC will own and operate the interconnection facilities for the Project; and Corby Energy Storage, LLC will own and operate the BESS components of the Project.

Technical Area	Addressed in Data Request Response #1	Addressed in Data Request Response #2	Addressed in Data Request Response #3	Addressed in Data Request Response #4
Land Use	X		X	
Paleontological Resources	X			
Project Description	X			
Reliability		X		
Public Health		X		X
Socioeconomics		X		
Traffic and Transportation		X		
Transmission System Safety and Nuisance	X			
Transmission System Design	X			
Visual Resources	X			
Waste Management		X		
Water Resources	X			
Wildfire		X		
Worker Safety and Fire Protection		X	X	X
Complete				
Efficiency, Energy, and Energy Resources	NA			
Executive Summary				
Facility Design				
Noise and Vibration				
Public Health				
Soils				

Each data request is followed by the Applicant's response to the information requested. All figures referenced in responses are provided following the set of responses for the technical discipline. If the response requires additional appended material, it is included in numbered appendices at the end of the document.

2.0 ALTERNATIVES

2.1 Data Request REV 2 DR ALT-1

Per California Code of Regulations, title 20, Appendix B (f) (1) and (f) (2), an application must include a discussion of a range of reasonable alternatives to the project, or alternative locations for the project, and a comparative evaluation of the engineering, economic, and environmental merits of the alternatives.

On July 25, 2025, CEC staff submitted data request REV 1 DR ALT-1 to the applicant via an email, which was uploaded to the docket on August 1, 2025 (TN 265205). REV 1 DR ALT-1, part b, requested a discussion of the feasibility of the following non-lithium-ion battery technologies: flow battery, sodium-ion battery, and iron-air battery.

On September 5, 2025, the applicant submitted Data Request Response #3 to the docket (TN 265885), which provided a partial response to REV 1 DR ALT-1. In Data Request Response #3, the applicant provided a discussion of the feasibility of flow batteries, sodium-ion batteries, and lead-acid batteries. The applicant's response did not include a discussion of the feasibility of iron-air batteries as requested.

REV 2 DR ALT-1. Please provide a discussion of the feasibility of iron-air battery technology. If this technology is infeasible for the project, please provide justification of its infeasibility.

Response: Due to the competitive nature and selection process to obtain ESAs, only the most efficient and highest energy density technologies are commercially viable. Specifically, non-lithium-ion battery technologies, including iron-air batteries, have certain disadvantages and constraints when compared with lithium-ion, making them uncompetitive in the marketplace, as described below.

Iron-Air Batteries. Iron-air batteries have a number of disadvantages as compared with lithium-ion batteries, including slow reaction time and lower efficiencies. Iron-air batteries have a discharge efficiency of around 40 to 50 percent, while lithium-ion batteries have a discharge efficiency of around 80 to 90 percent.[2] Ramp-up rates for iron-air batteries are significantly longer than for lithium-ion and would require several hours to ramp up to 300 megawatts (MW) of discharge capacity.

Iron-air batteries are more suitable for very long duration storage (approximately 100 hours), as they are much slower to recharge as compared with lithium-ion batteries (approximately 4 hours). This slower recharge rate and long duration storage makes iron-air batteries less suitable for peak-demand discharge, which is a primary advantage of lithium-ion batteries. Rather, this technology is better suited for supplying continuous power over a longer duration during extreme weather conditions and grid outages.

Finally, the first grid-connected iron-air battery storage project (East Road Storage Project in Redwood Valley, CA) was approved in 2023.[3] This project was awarded a $30 million grant from the CEC to support demonstration of this technology at scale.[4] This iron-air battery storage facility is not yet operational. The East Road Storage Project would deliver 5 MW of capacity for a duration of 100 hours on approximately 3.5 acres. The Project ESAs require the Applicant to deliver a guaranteed install capacity of 300 MW for 4 hours. In order to deliver 300 MW with an iron-air battery system, to meet the contractual delivery commitments, approximately 210 acres would be needed, assuming a similar acreage requirement per MW of capacity. Therefore, iron-air batteries are an infeasible technology alternative for the proposed Project site due to space constraints.

[2] https://www.thechemicalengineer.com/news/cleantech-uses-reversable-rusting-to-develop-100-hour-battery/#:~:text=Long%2Dduration%20batteries,where%20renewable%20generation%20is%20low.
[3] https://ceqanet.lci.ca.gov/2023100833
[4] https://www.energy.ca.gov/news/2023-12/cec-awards-30-million-100-hour-long-duration-energy-storage-project

Together, long duration energy storage such as iron-air batteries and short duration energy storage such as lithium-ion batteries could complement each other in grid reliability for different purposes. However, iron-air batteries would not be a suitable alternative technology for the proposed Project due to the slower reaction time, lower efficiency, and increased footprint requirements per MW of installed capacity, which limit feasibility for peak-demand energy discharge. Additionally, this technology is not a proven technology and has not been deployed at utility scale in the U.S., to our knowledge. It is therefore uncertain whether projects using iron-air technology can be developed in an economically feasible and commercially financeable manner.

2.2 Data Request REV 2 DR ALT-2

On January 23, 2024, the Solano County Board of Supervisors (BOS) adopted an interim ordinance (Ordinance No. 2024-1852-U) to prohibit new front-of-the-meter BESS facilities, and directed County planning staff to develop policy recommendations and standards for BESS facilities. On August 12, 2025, the Solano County BOS provided feedback and direction to County planning staff on the proposed policy recommendations and standards for BESS facilities. On August 26, 2025, the County BOS amended Ordinance No. 2024-1852-U to remove the complete prohibition on front-of-the-meter BESS facilities in Manufacturing and Industrial Zoning Districts, subject to specific standards. On September 18, 2025, the Solano County Planning Commission recommended approval to the County BOS of a proposed permanent ordinance that would amend Chapter 28 of the Solano County Code to allow front-of-the-meter BESS in specific Manufacturing and Industrial zoning districts, subject to siting and permitting requirements.

During the County BOS meetings on August 12, 2025, and August 26, 2025, County Supervisors discussed the Lambie Industrial Park as a suitable site for a BESS facility within Solano County (https://www.solanocounty.gov/government/board-supervisors/board-supervisors-agendas-minutes-videos). Public comments submitted to the project docket have also identified Lambie Industrial Park as a possible site alternative (TN 265599). Lambie Industrial Park is an approximately 1,461-acre property bounded by Lambie Road, Goose Haven Road, and Creed Road. County Supervisors identified this property as potentially suitable for a BESS facility for the following reasons:

- The property has a Solano County Land Use designation of Industrial and is zoned Manufacturing General;
- The property is located farther away from sensitive receptors (residences, schools, hospitals, etc.) than sites along the I-80 corridor; and
- The Lambie Energy Center is located in the southwest corner of the property.

CEC staff reviewed parcel maps of the area surrounding the Lambie Industrial Park and noted that the Montezuma Wind Energy Center, which is owned by the applicant, is located approximately 1.6 miles south of the industrial park. A substation and switchyards are located within the Montezuma Wind property.

Staff requests additional information on the Lambie Industrial Park and Montezuma Wind Energy Center sites to inform staff's alternatives analysis.

REV 2 DR ALT-2. Please provide the information below for each of two alternative project sites in southern Solano County being considered: (1) Lambie Industrial Park, and (2) Montezuma Wind Energy Center:

a. A map illustrating the alternative site location;

b. Size (acreage and megawatt capacity) of a BESS facility that could be constructed;

c. Details on project components including access roads, substation/switching station, generation tie (gen-tie) line, and ancillary facilities;

d. How the site meets the project objectives; and

e. Any other site considerations that would facilitate or inhibit the development of a BESS.

Response:

a. The following new figures have been prepared depicting potential alternative sites at the Lambie Industrial Park and Montezuma Wind Energy Center:

- Figure 2-1: Alternative Sites Location Map
- Figure 2-2: Lambie Industrial Park Alternative Site
- Figure 2-3: Montezuma Wind Energy Center Alternative Site

b. Each of these two alternative sites would be approximately 25 acres, which would be sufficient to construct a BESS facility of similar size and capacity to the proposed Project (300-MW, 1,200-megawatt-hours).

c. At both of these alternative sites, a potential BESS facility would include the same project components as the proposed Project (BESS array, on-site substation, access roads, water tank, gen-tie line, and ancillary facilities). Access to both alternative sites would be provided via Interstate 80 to California State Route 12 (SR-12). For the Lambie Industrial Park Alternative Site, access would be provided from SR-12 to Lambie Road. For the Montezuma Wind Energy Center Alternative Site, access would be provided from SR-12 to Birds Landing Road to Montezuma Hills Road.

   The most notable difference between both of these alternative sites and the proposed Project site would be a substantially longer gen-tie line needed to connect to the Vaca-Dixon Substation. Construction of a BESS facility at the Lambie Industrial Park would require a gen-tie line of at least 13 miles, and construction of a BESS facility at the Montezuma Wind Energy Center would require a gen-tie line of at least 19.5 miles. These distances were conservatively measured point-to-point to provide shortest possible lengths; however, both gen-tie lines would likely be longer due to land ownership and right-of-way constraints that would need to be navigated when determining feasible transmission routes. The point-to-point gen-tie routes shown on Figure 2-1, Alternative Sites Location Map, cross 59 parcels for the Lambie Industrial Park Alternative and 72 parcels for the Montezuma Wind Energy Center Alternative.

d. Neither the Lambie Industrial Park Alternative nor the Montezuma Wind Energy Center Alternative would meet the primary Project objective:

- Construct and operate a 300-MW BESS close to Pacific Gas and Electric's (PG&E's) Vaca-Dixon Substation in Solano County to meet contractual obligations to provide energy storage services.
  - The PG&E Vaca-Dixon Substation is the only high-voltage transmission substation within 50 miles and crucial for power delivery and reliability for the region.
  - The Applicant has signed contracts with PG&E, Marin Clean Energy, and CleanPowerSF to ensure grid reliability for the region to connect renewable energy resources in Solano County to the local area.

These alternative site locations are not close to PG&E's Vaca-Dixon Substation and would require significantly longer gen-tie lines to interconnect. Compared with the proposed 1.1-mile-long gen-tie line, the Lambie Industrial Park Alternative would require a gen-tie line of at least 13 miles and the Montezuma Wind Energy Center would require a gen-tie line of at least 19.5 miles. A gen-tie line of these lengths would introduce significant site control challenges, round-trip energy losses decreasing Project efficiency, and increased environmental impacts including those associated with land disturbance (aesthetics, biological resources, cultural and tribal cultural resources, and potentially agricultural resources), and those associated with increased construction (air quality and greenhouse gas emissions, noise, transportation, and water usage).

The Project ESAs require the Applicant to deliver 300 MW of capacity for 4 hours specifically to the Vaca-Dixon Substation. Additionally, any changes to the proposed point of interconnection (POI) would require a Material Modification Assessment (MMA) evaluation by the California Independent System Operator (CAISO), which currently takes a minimum of 6 months assuming a re-study is not required. CAISO will only approve MMAs if it is conclusively determined that the proposed POI change improves interconnection costs and benefits. Therefore, deviating from this primary Project objective to interconnect at a location closer to either of these alternative sites, should a feasible location exist, would delay the Project and thus not allow the Applicant to meet contractual power delivery commitments.

Both the Lambie Industrial Park Alternative and the Montezuma Wind Energy Center Alternative would meet the other Project objectives:

- Develop a BESS that supports grid stability and helps prevent local and regional blackouts.
- Develop a BESS that supports the efficient use of renewable energy and California's Renewable Portfolio Standard goals.

If the land at these two alternative sites was available and feasible to develop, then a BESS facility of similar size and capacity to the proposed Project could be developed meeting the above two Project objectives. However, both alternative sites would require substantially more transmission infrastructure to connect with the Vaca-Dixon Substation.

e. In addition to the longer gen-tie lines required to interconnect the Lambie Industrial Park Alternative site and the Montezuma Wind Energy Center Alternative site with the Vaca-Dixon Substation, both sites have additional disadvantages as compared with the proposed Project site.

Lambie Industrial Park Alternative

For the Lambie Industrial Park Alternative site, there is no certainty that site control is feasible. No contact with this landowner has been conducted to date as the site is not close to the Vaca-Dixon Substation and would not meet the primary Project objective of constructing and operating a 300-MW BESS close to PG&E's Vaca-Dixon Substation.

Additionally, this alternative site consists of a natural grassland, which is generally higher quality foraging habitat for many species including Swainson's hawk (*Buteo swainsoni*) and burrowing owl (*Athene cunicularia*) as compared with the proposed Project site. There are also numerous recorded occurrences of burrowing owl and Swainson's hawk within 5 miles of this parcel, according to the California Natural Diversity Database (CNDDB).[5] Based on aerial imagery, this alternative site also has signatures of vernal pool habitat, which are known to support a number of federally and state listed rare and threatened plant and wildlife species in this area (such as California tiger salamander [*Ambystoma californiense*], vernal pool fairy shrimp [*Branchinecta lynchi*], vernal pool tadpole shrimp [*Lepidurus packardi*], Keck's checkermallow [*Sidalcea keckii*], Bogg's Lake hedge-hyssop [*Gratiola heterosepala*], dwarf Downingia [*Downingia pusilla*], Baker's navarretia [*Navarretia leucocephala* ssp. *bakeri*], and Solano grass [*Tuctoria mucronata*]).

Multiple potential raptor nest trees are also located south of this alternative site. If raptors are actively nesting during construction, potential delays may occur due to buffer restrictions. There is also an historical Swainson's hawk nest (2004) less than 0.5 mile east of this alternative site, according to CNDDB.[6]

Finally, this location is also within 3 miles of previously documented tricolored blackbird (*Agelaius tricolor*) nesting colonies. Thus, there is potential for tricolored blackbird to forage in this area.

Overall, the Lambie Industrial Park Alternative site is less suitable due to the increased distance from the PG&E Vaca-Dixon Substation, uncertainty with site control, and higher potential to impact sensitive and protected biological resources.

Montezuma Wind Energy Center Alternative

Based on existing site infrastructure, the most suitable BESS development location at the Montezuma Wind Energy Center would be near the existing Montezuma Hills Wind Energy Center collector substation, as depicted on Figure 2-3. However, in addition to requiring a gen-

[5] https://www.wildlife.ca.gov/data/cnddb
[6] https://www.wildlife.ca.gov/data/cnddb

tie line of at least 19.5 miles, BESS development in this area would have additional constraints and impacts as discussed below.

Although the Montezuma Wind Energy Center is owned and operated by the same parent company as the Applicant, all land on which this project is sited is based on lease arrangements and is not owned by the Applicant. Additional leases would need to be negotiated with landowners to obtain site control for a stand-alone 300-MW BESS project.

This alternative site is located on rolling hills, which is characteristic of land throughout the Montezuma Hills area. Development of a BESS facility on this alternative site or generally within the Montezuma Wind Energy Center would require significantly more grading as compared with the proposed Project site. This alternative site ranges from 210 feet to 280 feet above mean sea level, whereas the proposed Project site is relatively flat. Accordingly, the site preparation and potentially construction phase for this alternative site would be longer than for the Project site, which would increase the overall Project schedule and potentially increase environmental impacts associated with site preparation and construction. This additional site preparation work and/or a more highly constrained Project construction site would also jeopardize the Applicant's ability to meet contractual obligations for energy delivery.

Additionally, this alternative site has similar biological constraints to the Lambie Industrial Park Alternative site. This alternative site also consists of a natural grassland, which is generally higher quality foraging habitat for many species including Swainson's hawk and burrowing owl as compared with the proposed Project site. There are also numerous recorded occurrences of burrowing owl and Swainson's hawk within 5 miles of this alternative site according to CNDDB.[7] This location is also within 3 miles of previously documented tricolored blackbird nesting colonies. Thus, there is potential for tricolored blackbird to forage in this area.

Based on aerial imagery, there is also a ponded aquatic feature approximately 200 feet west of this alternative site. California tiger salamanders are known to occur in this area and may utilize this pond for breeding as well as the alternative site for upland dispersal habitat.

Finally, existing transmission lines and collector lines associated with the Montezuma Wind Energy Center are located in the immediate vicinity of this alternative site, including along the western and southern boundaries. If raptors are actively nesting in the towers associated with these electrical lines during construction, potential delays may occur due to buffer restrictions.

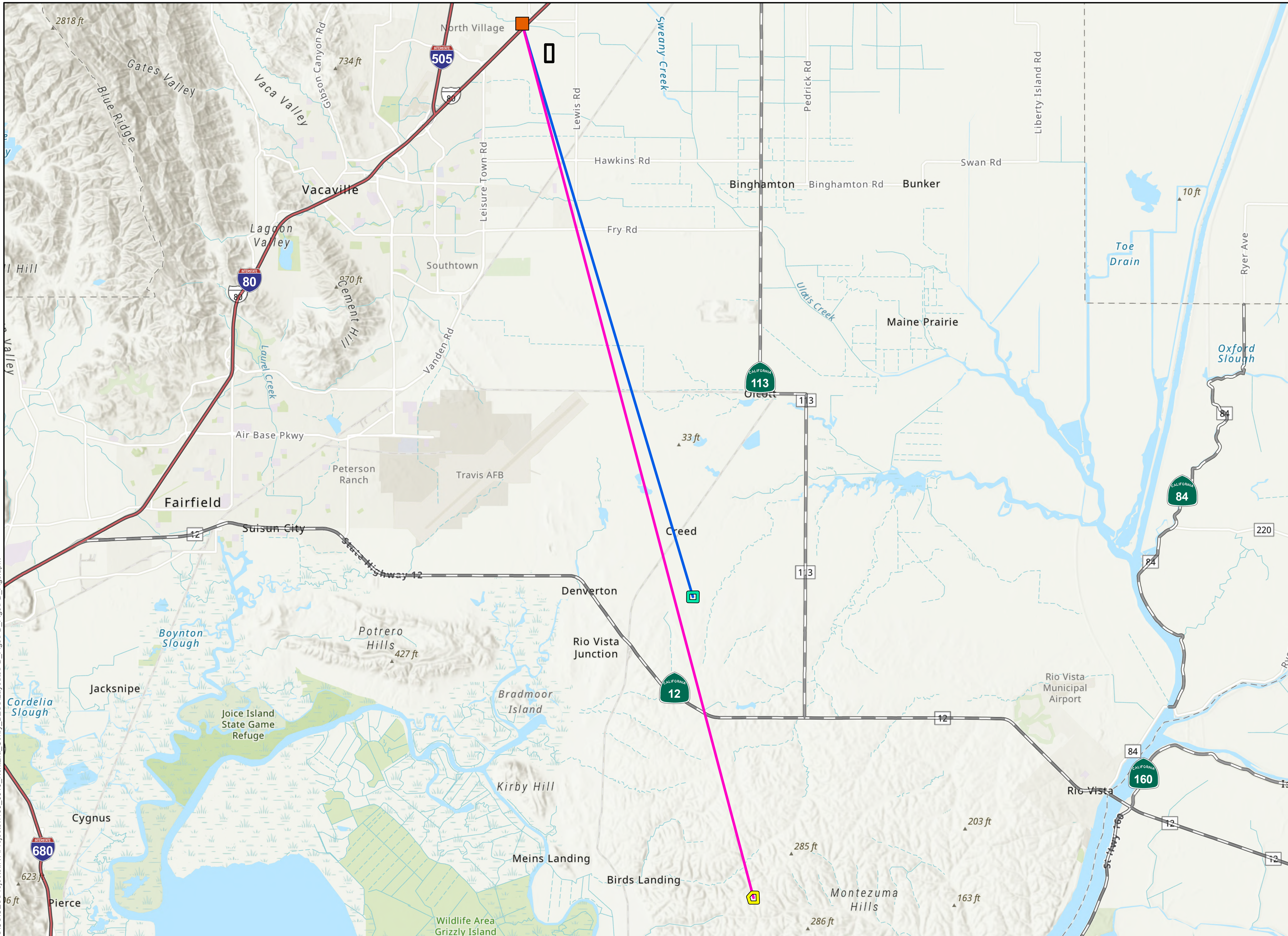
Overall, the Montezuma Wind Energy Center Alternative site is less suitable due to the significantly increased distance from the PG&E Vaca-Dixon Substation, uncertain site control potential, increased grading/site preparation and construction schedule, and higher potential to impact sensitive and protected biological resources.

[7] https://www.wildlife.ca.gov/data/cnddb

NextEra Energy
Corby Battery Energy Storage System Project

Figure 2-1: Alternative Sites Location Map

Solano County, CA



Proposed Features

- Vaca-Dixon Substation
- Lambie Alternative Site Gen-tie
- Montezuma Alternative Site Gen-tie
- Project Site
- Lambie Industrial Park Alternative Site
- Montezuma Wind Energy Center Alternative Site

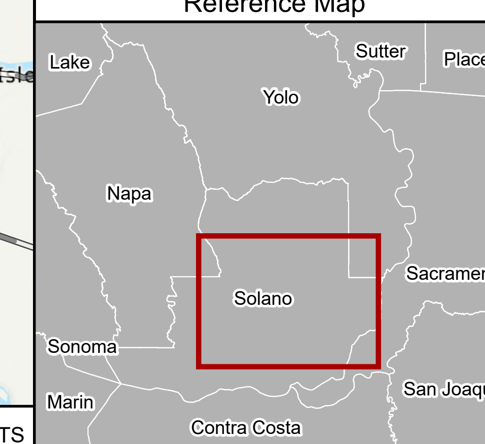
Transportation

- Interstate Highway
- State Highway

TETRA TECH

NOT FOR CONSTRUCTION

Reference Map



1:128,000 NAD 1983 StatePlane California II FIPS 0402 Feet

0 5 10 Miles

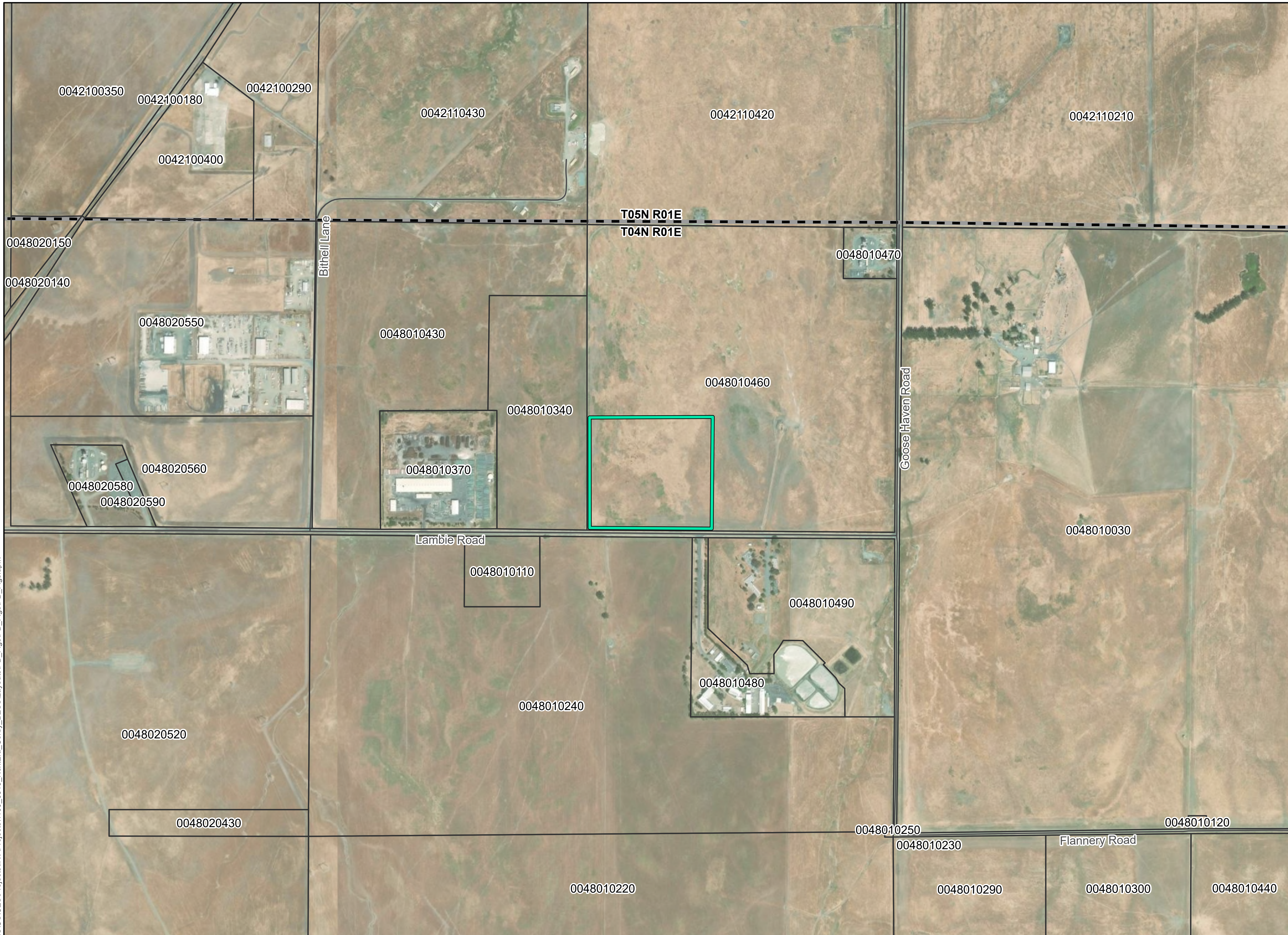
Source: ESRI, USDA NAIP, US CENSUS, BTS

\\tt.local\GIS\US\CES\Projects\IRV\Projects\1109_0319_NextEra_Corby_BESS\Layouts\PD_Figs\PD_Figs.aprx

NextEra Energy
Corby Battery Energy
Storage System Project

Figure 2-2: Lambie Industrial Park Alternative Site

Solano County, CA



Parcels

Township Range

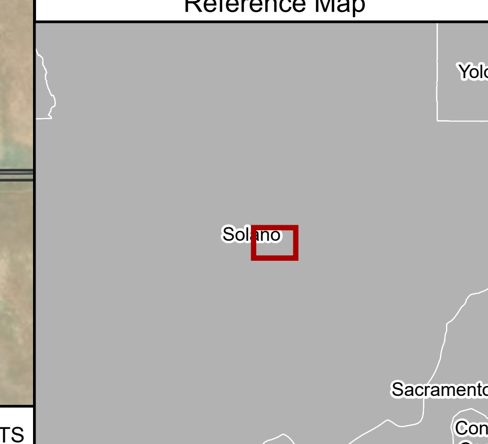
Proposed Features

Lambie Industrial Park Alternative Site

TETRA TECH

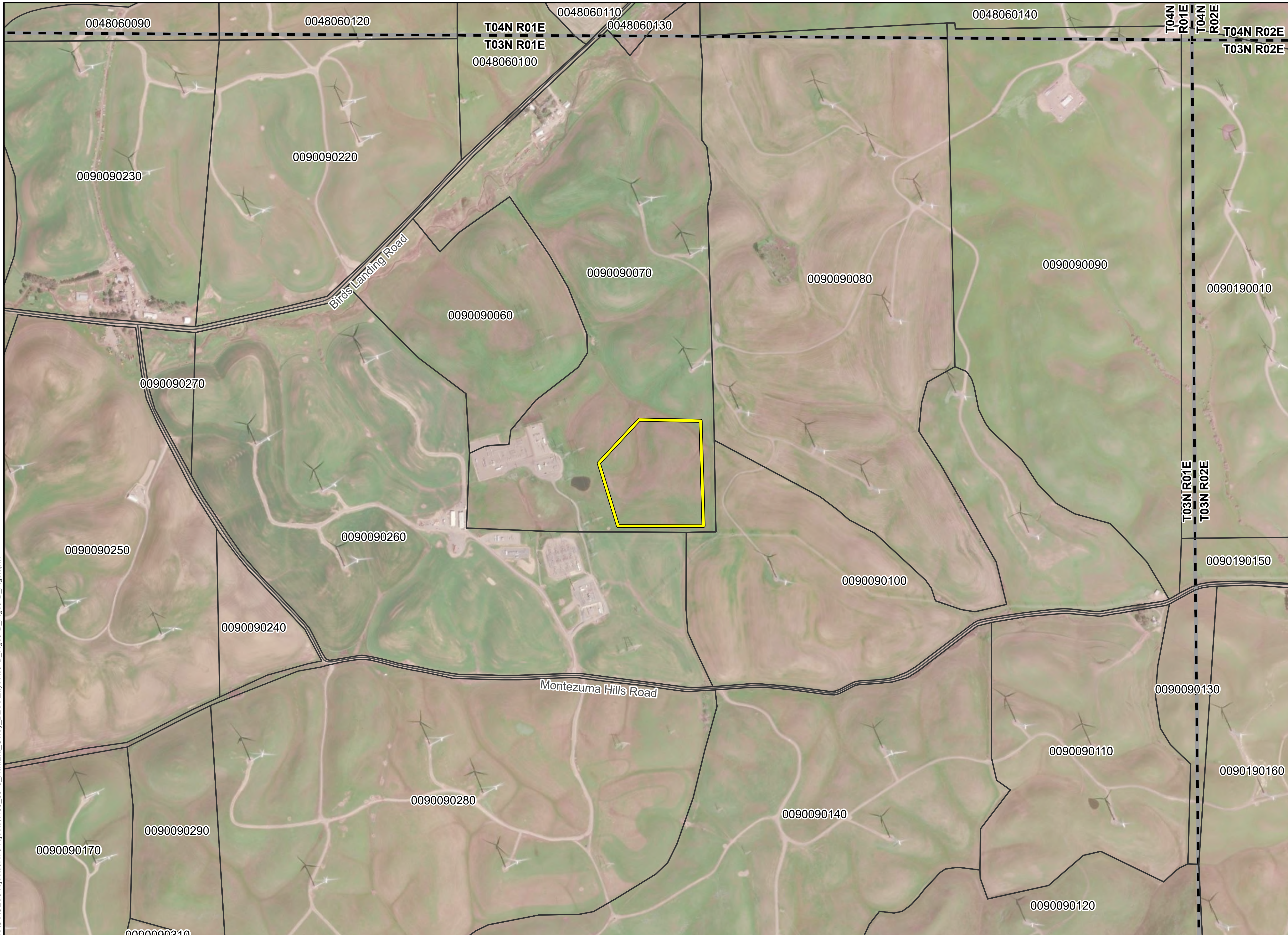
NOT FOR CONSTRUCTION

Reference Map



1:10,000 **NAD 1983 StatePlane California II FIPS 0402 Feet** 0 0.5 1 Miles Source: ESRI, USDA NAIP, US CENSUS, BTS

\\tt.local\GIS\US\CES\Projects\IRV\Projects\1109_0319_NextEra_Corby_BESS\Layouts\PD_Figs\PD_Figs.aprx



NextEra Energy
Corby Battery Energy Storage System Project

Figure 2-3: Montezuma Wind Energy Center Alternative Site

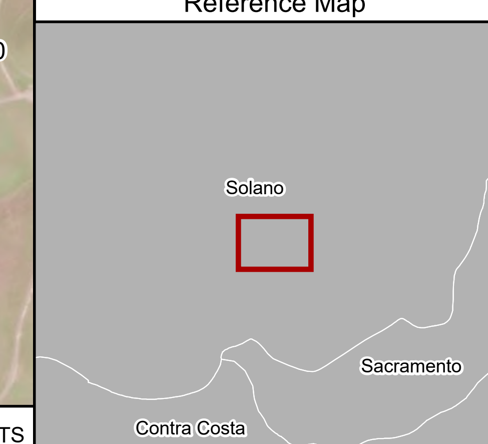
Solano County, CA

Parcels
Township Range
Proposed Features
Montezuma Wind Energy Center Alternative Site

TETRA TECH

NOT FOR CONSTRUCTION

Reference Map



1:12,000 NAD 1983 StatePlane California II FIPS 0402 Feet

0 0.5 1 Miles

Source: ESRI, USDA NAIP, US CENSUS, BTS

3.0 WORKER SAFETY AND FIRE PROTECTION, AIR QUALITY, GREENHOUSE GAS EMISSIONS, AND PUBLIC HEALTH

3.1 Data Request REV 1 DR WS/FP/PH-1

In response to DR WS-3 (TN 263281 and TN 263282), the applicant provided a plume modeling analysis of the impacts during potential BESS thermal runaway events. However, it appears that only carbon monoxide (CO) and carbon dioxide (CO2) were modeled, despite UL9540A testing (provided by the applicant [TN 263281, Appendix 11-A Hazard Mitigation Analysis, Table 3]) indicating the release of a broader range of toxic and flammable compounds during cell and/or module thermal runaway.

These compounds include acetylene, benzene, toluene, dimethyl carbonate, ethyl methyl carbonate, hydrogen, methane, propane, ethylene, and others (TN 259900, Volume 2 App 4-9 Hazards Appendices). In addition, the applicant used the Immediately Dangerous to Life or Health (IDLH) values as the end-point of the plume analysis. However, staff believes that the use of IDLH is inappropriate to determine on-site or off-site human health risks. Staff is requesting an estimate of the worst-case maximum impacts for the project at the nearest sensitive receptors. To further assist the CEC staff analyzing the air quality and public health impacts of the batteries during thermal runaway/fires, we request the following supplemental information:

REV 1 DR WS/FP/PH-1. Please provide the exact locations (latitude and longitude or UTM coordinates) and dimensions of the BESS enclosures for modeling purposes. Please provide the following input parameters for a dispersion modeling analysis of all potential criteria air pollutants, greenhouse gases, and toxic air contaminants (TACs) that could be generated during combustion: emission rates (in grams/second), exhaust temperature, pressure, and exhaust gas velocity resulting from battery damage or thermal runaway/fires. Please also provide detailed calculations and justification for parameters used in the calculation of the air pollutant density values. Please include the calculation worksheet if available.

Response: The AERMOD dispersion model input and output file will be supplied to CEC Staff. The modeling input file has the locations of the seven modeled BESS enclosures in Universal Transverse Mercator (UTM), North American Datum 1983 (NAD83), Zone 10 coordinates. The modeling file was used to support the technical report that is included in Appendix 3-A. Additionally, the emission rates and exhaust parameters are included in the technical report and modeling files. Working calculation sheets will also be provided to CEC Staff.

3.2 Data Request REV 1 DR WS/FP/PH-2

REV 1 DR WS/FP/PH-2. Please provide any available data on the potential emissions of particulate matter, metals, hydrogen chloride, hydrogen fluoride, and hydrogen cyanide during BESS thermal runaway/fire events.

Response: Data on potential emissions of hydrogen chloride, hydrogen fluoride, and hydrogen cyanide are included in Appendix 3-A. No information on metals or particulate matter was available in the literature review.

3.3 Data Request REV 1 DR WS/FP/PH-3

REV 1 DR WS/FP/PH-3. Please provide a dispersion modeling analysis of all potential criteria air pollutants and TACs for the thermal runaway/fire scenario using a well-validated model (AERMOD and HARP2 preferred).

Response: AERMOD and HARP2 were utilized to assess criteria pollutants and toxic air contaminants (TACs). These are discussed in detail in Appendix 3-A.

3.4 Data Request REV 1 DR WS/FP/PH-4

REV 1 DR WS/FP/PH-4. Please compare the modeled fire-related TACs concentrations to the Office of Environmental Health Hazard Assessment (OEHHA)/California Air Resources Board (CARB) 1-hour acute Reference Exposure Levels (RELs) and demonstrate whether the acute hazard Index (HI) of TACs would be higher than the significance threshold of 1.0 at sensitive receptors. If an OEHHA 1-hour acute REL is not available, a level 1 U.S. EPA Acute Exposure Guideline Level (AEGL) shall be used as the threshold of significance. Please demonstrate whether the criteria air pollutant impacts would cause or contribute to any exceedance of ambient air quality standards. If exceedances occur, provide a detailed Emergency Response Plan and outline the applicable regulatory notification requirements.

Response: The fire-related TACs were compared to the CARB RELs, and AEGLs when necessary, for calculating the HI at sensitive receptors. Additionally, criteria pollutants (nitrogen dioxide, CO, and sulfur dioxide) were assessed for the 1-hour and 8-hour averaging periods. Details of the complete analyses are found in Appendix 3-A. The conservative analysis demonstrated that no REL, AEGL, or ambient air quality standards would be exceeded under the worst-case scenario evaluated. Regardless, the Applicant has committed to preparing an Emergency Response Plan that will address first responder coordination and nearby residential receptor communication protocols in collaboration with the responding agency, in the unlikely event of fire at the Project facility. The Emergency Response Plan will be submitted to the Dixon Fire Protection District for review and comment and to the CEC for review and approval as required by proposed Condition of Certification WS-2.

APPENDIX 3-A: THERMAL RUNAWAY PLUME MODELING TECHNICAL REPORT

Technical Report in Support of the CEC Response to Comments

Corby Battery Energy Storage System Project

Solano County, California

Submitted to

California Energy Commission

Submitted by

Corby Energy Storage, LLC

NEXTera ENERGY RESOURCES

Prepared by

Atmospheric Dynamics, Inc.

ATMOSPHERIC DYNAMICS, INC
Meteorological & Air Quality Modeling

October 2025

Executive Summary

Data Response Summary

Corby Energy Storage, LLC plans to construct and operate a 300-megawatt (MW) battery energy storage system (BESS) near the intersections of Kilkenny and Byrnes Roads in Solano County, California. This technical report presents the responses to the July 31st, 2025, California Energy Commission (CEC) data requests Rev 1 DR WS/FP/PH-1 through PH-4 which asks for the estimate of the worst-case maximum impacts of thermal runaway/fires at the nearest sensitive receptors.

To derive meaningful modeling results from a potential release scenario, several conservative assumptions were made for the inputs to provide an overprediction of concentrations. The proposed project will utilize battery technology from the Contemporary Amperex Technology Company, Limited (CATL) EnerC+ Lithium-Ion batteries. Emissions test data are based on best estimates of pollutants emitted during the UL 9540A gas composition and release dynamics cell/module/unit levels tests. Because the location of the fire within the facility may affect the concentrations of emissions in immediately adjacent areas, the modeling examined a potential fire at seven (7) different battery locations within Corby BESS. Additional literature on BESS fire incidents were reviewed to provide supplemental information on potential emissions from these events and were applied to this analysis.

The CATL EnerC+ Large Scale Burn Test (DNV, January 2025) indicated that with the manufacturer specified distances between battery enclosures, a thermal runaway event within one enclosure would not propagate to adjacent enclosures, even with complete combustion of all the cells within the enclosure. For purposes of modeling the offsite impacts, the analysis assumed that the maximum credible fire event presented at the proposed BESS is the combustion of one full container (enclosure) of batteries, made up of 4,160 cells, over a 14-hour period based on testing. Seven (7) hypothetical locations were assessed at enclosure locations in close proximity to the project boundary, which typically cause the maximum ambient impacts to surrounding receptors.

The CEC's data request required that the concentrations of toxic air contaminants (TACs) that were determined to be emitted should be compared to the California Office of Environmental Health Hazard Assessment (OEHHA) and the Air Resources Board (ARB) one-hour (1-hr) Reference Exposure Levels (RELs), which are used in facility health risk assessments conducted for the AB2588 Air Toxics "Hot Spots" Program. The data request also requires the calculation that the acute hazard index (HI) of TACs to determine if the significance threshold of 1.0 at sensitive receptors (residences) is exceeded. The data request also asks that for any TAC that did not have an established REL, the comparison was made with the United States Environmental Protection Agency's (EPA) Acute Exposure Guideline Level 1 (AEGL-1). AEGLs were developed by an international coalition of government and non-government scientists and are used worldwide by government and private emergency responders. Thus, the results of the Corby BESS modeling were compared to the following to determine the levels of potential health impacts:

- A Reference Exposure Level (REL) is the concentration level at or below which no adverse non-cancer health effects are anticipated for the specified exposure duration. RELs are based on the most sensitive, relevant, adverse health effects reported in the medical and toxicological literature. RELs are designed to protect the most sensitive individuals in the population by the inclusion of factors that account for uncertainties as well as individual differences in human susceptibility to chemical exposures. The factors used in the calculation of RELs are meant to err on the side of public health protection in order to avoid underestimation of non-cancer hazards. Exceeding the REL does not automatically indicate an adverse health impact. However, increasing concentrations above the REL value increases the likelihood that the health effect will occur.

- AEGL-1 – In areas that exceed AEGL-1, the general population could experience transient and reversible discomfort or irritation. In areas with concentrations below AEGL-1, no members of the general population, including susceptible individuals, are expected to experience any health effects.

The basic premise of the report is the quantification of emissions of criteria pollutants and TACs and the ground level concentrations and acute hazard footprint from a hypothetical fire in one of the battery containers at seven different locations within the BESS.

The results of the HI modeling from any of the seven (7) hypothetical locations of thermal runaway events at the Corby BESS, under the meteorological conditions that can produce the highest ground level concentrations, never equal or exceed a hazard index 1.0 at the sensitive receptors (residences). Additionally, the AEGL-1 thresholds were never exceeded at any receptor or sensitive receptor location. The criteria pollutant impacts were all less than the California Ambient Air Quality Standards (CAAQS) for the 1-hour nitrogen dioxide (NO_2) sulfur dioxide (SO_2) and carbon monoxide (CO) averaging periods and for the 8-hour CO averaging period at the sensitive receptor locations.

Background

Accidental releases of material during a battery storage thermal runaway fire incident have the potential to affect surrounding populated areas. The purpose of this dispersion modeling assessment was to determine the worst-case magnitude and areal extent of potential emissions of hazardous air pollutants under a full range of site representative meteorological conditions at the Corby BESS facility. The modeling assessment and summary report is preliminary and was based on the best estimates of pollutants emitted during laboratory testing of the EnerC+ batteries. The modeling assessment and summary report is preliminary and was based on the best estimates of pollutants emitted during laboratory testing of similarly designed batteries. The modeling results summarized in this report represent the potential worst-case impacts in terms of magnitude and location that are based on five (5) years of representative hourly meteorological data.

The modeled emissions and subsequent public exposure to criteria pollutants and known chemical substances or hazardous air pollutants (HAPs), were converted into potential health risks which were assessed in accordance with guidance established by the California Office of Environmental Health Hazard Assessment (OEHHA 2015) and the California Air Resources Board.

The U.S. EPA AERMOD (**A**merican Meteorological Society/**E**nvironmental Protection Agency **R**egulatory Model Improvement Committee's Dispersion **Mod**el) was used to assess this event in order to calculate the areal extent of the release such that predictive estimates of potential impacts to human health and safety to the general public could be assessed. Model outputs were based on a five (5) year range of site atmospheric conditions, including similar conditions that occurred during the release. The model outputs were then input into the Hotspots Analysis and Reporting Program (HARP), which is based on the 2015 Air Toxics Hotspots Program Guidance Manual for Preparation of Health Risk Assessments. This procedure follows the California Office of Environmental Health Hazard Assessment (OEHAA) which is designed to improve estimates of potential lifetime cancer and noncancer risks from air toxics by refining data for individuals of all ages, and with adjustments based on new science about the increased childhood sensitivity to air toxics.

Uncertainties in the Preliminary Dispersion Modeling Assessment

The results of this analysis, conducted at the request of Corby BESS, were based on a potential release scenario using data from cell-, module-, and unit-level UL9540A thermal runaway fire propagation testing and large-scale burn testing. In order to derive meaningful modeling results about this specific event, several conservative assumptions were made for the inputs in order to provide an overprediction of concentrations. These include the quantification of emissions, the total mass released during the flaming portion of the fire, and the plume characteristics during the active fire portion.

The cell level UL9540A test involved the thermal runaway of a single cell. Gas composition data from the cell test was extrapolated to a module scenario, and then to a unit scenario. The large scale test burn involved a CATL EnerC+ unit comprised of 5 internal racks, with 8 modules per rack, and 104 cells per module.

For the large scale test initiation, heaters were applied to a cell within a module. After approximately 2 hours of heating, the first cell thermal runaways occurred in the initiating module, at which time, the first smoke was seen externally. The emergency gas ventilation system appeared to operate for approximately 14 minutes before ceasing operation. The following hours saw generally lower smoke emission, until approximately 6.25 hours into the test where there was a significant increase in smoke, before once again dropping to a lower amount. At approximately 9.5 hours into the test, a lit road flare was thrown into the low-laying gas cloud surrounding the initiation unit, igniting the gas/smoke to ensure full worst case burn of the initiating unit and causing the initiating unit to catch on fire and burn completely. The fire continued to burn for several hours, eventually reducing in intensity. The fire burned at a generally reducing intensity until 16.5 hours into the test where it was no longer visible from the exterior of the initiating unit.

During the test, no fire propagation from unit-to-unit was observed and the internal cells of adjacent units did not reach thermal runaway temperature of 181^{o} C. Post test examination confirmed that all battery modules in the initiating unit burned completely, and no significant damage was seen in the interior of the adjacent units. This analysis represents one of the first steps to identify and assess the necessary data required to create an emissions profile and subsequent dispersion pattern for a BESS thermal runaway event at the Corby facility.

An integral part of this analysis is the review of literature data as well as available thermal runaway testing data on cells, modules, and complete units. Typically, uncontrolled fire events do not burn as a steady state process. Uncertainties in the fluctuations in temperature and mass burn rates can produce differences in plume rise and mass emissions. The available test data did contain information on a number of these variables, which were utilized in the dispersion and health risk models. The CEC requested the use of the air quality model, AERMOD, which is a steady-state Gaussian dispersion model. The use of this model requires the use of 1-hour steady state assumptions on meteorology, plume temperature and the mass emission rates.

Lastly, the modeled emissions and resultant concentrations in this assessment are based on estimates and assumptions from the data available at the time this report was generated. The AERMOD and HARP models are considered conservative in that they are designed to overpredict impacts. It is important to recognize that our ability to judge the accuracy of dispersion models is limited by data scarcity: Because only a few field experiments have been conducted in which hazardous gases were released and their concentrations measured, we have few data to measure our models against. Other factors affect our ability to make accurate predictions for any particular release:

- The real world is enormously complex, and many events happen randomly. This complexity and randomness can't be completely captured in any computer program.

- Because the emission estimates and dispersion model make simplifying assumptions about the circumstances of a release, the model results are likely to be more accurate when those assumptions are met than when they are not. For example, the large scale test burn actively burned for approximately fourteen (14) hours with an estimated loss of mass which resulted in the emission estimates. The modeling results presented in this report then reflect this particular release scenario and these results are more likely to reflect accurate predictions for this release than for a release that has a much shorter or longer duration or involves more than one CATL EnerC+ unit.

In summary, due to the inherent uncertainties in both the cell and large scale burn tests, the modeling analysis accommodated these uncertainties by employing and utilizing conservative assumptions regarding emissions, meteorology, and plume characteristics in order to calculate the ground-based concentrations.

AERMOD Model Description

To estimate ambient air concentrations, the latest version of the AERMOD (Version 24142) dispersion model was used. AERMOD is the preferred U.S. EPA's and California Air Resources Board (CARB) dispersion model for use in assessing health risk when air is the predominant pathway. The California Office of Environmental Health Hazard Assessment (OEHHA) has also adopted the AERMOD model as the preferred model for assessing health risk impacts from sources of toxic emissions. AERMOD is a steady-state dispersion model that uses planetary boundary layer (PBL) theory to model air pollutant concentrations. The planetary boundary layer is the breathable portion of the atmosphere that is influenced by contact with the ground surfaces or friction. AERMOD was chosen for this assessment as it's a regulatory method for providing conservative (overestimates) of ground-based concentrations from combustion source types. AERMOD requires the pre-processing of surface characteristics in order to then calculate the effects of meteorology and terrain on air pollutant concentrations. Surface characteristics and meteorological data such as wind speed/direction, temperature, cloud cover, etc. are combined with upper air data to compute planetary boundary parameters used by AERMOD to estimate vertical and horizontal pollutant dispersion. Terrain data is also processed to allow the influence of terrain on modeled concentrations. AERMOD currently contains improved algorithms for:

- Dispersion in both the convective and stable boundary layers,
- Plume rise and buoyancy,
- Plume penetration into elevated inversions, such that can occur during foggy conditions,
- Treatment of elevated, near-surface, and surface level sources,
- Computation of vertical profiles of wind, turbulence, and temperature,
- Treatment of receptors on all types of terrain (from the surface up to and above the plume height) and complex terrain modeling computations, and
- Incorporation of the Plume Rise Model Enhancements (PRIME) building downwash algorithms

The AERMOD modeling system consists of two pre-processors and the dispersion model. The meteorological preprocessor (AERMET) provides AERMOD with the meteorological information it needs to characterize the PBL. The terrain pre-processor (AERMAP) both characterizes the terrain and generates receptor grids for the dispersion model (AERMOD).

Model Input Options

Model options refer to user selections that account for conditions specific to the area being modeled or to the emissions source that needs to be examined. Along with the referenced inputs below, land use type is required as input into the model. In the immediate area surrounding the project site is characterized as "rural". This is based on the land uses within the area circumscribed by a three (3) km radius around the project site, which is greater than 50 percent rural.

Meteorology

Five years of surface meteorological data (2017-2021) collected at the Nut Tree Airport, located 4.3 kilometers (km) west-southwest from the project site along with five years of upper air data from Oakland International Airport were processed in AERMET (version 22112) and provided by the California Air Resources Board (ARB). This is the identical data set that was used to assess the project construction impacts in the CEC application submittal. Figure 1 presents an annual windrose for the meteorological data period.

Receptors and Terrain

Receptor and source base elevations were determined from United States Geological Survey (USGS) National Elevation Dataset (NED) data. The NED data was processed with the EPA-model AERMAP for the receptor locations selected. All coordinates (both sources and receptors) are referenced to UTM North American Datum 1983 (NAD83, Zone 10). AERMAP is capable of interpolating the elevation data in the NED data for both receptor elevations and hill height scales.

The NED data are available in 1/3arc-second (about 10 meter) and 1arc-second (about 30 meter) grid node spacing. Areas that contain receptor grids with 100-meter spacing or less between adjacent receptors will use 10-meter NED data. Other areas that contain only receptor grids of greater than 100-meter spacing utilized 30-meter NED data. For purposes of determining hill height scales, the NED datasets used were extended 5-km past the outside of the coarse receptor grid described below for 30-meter NED data and 2-km past the outside of the close-in receptor grids described below for 10-meter NED data.

Cartesian coordinate receptor grids were used to provide adequate spatial coverage surrounding the project area for assessing ground-level pollution concentrations, to identify the extent of significant impacts, and to identify maximum impact locations. For the full impact analyses, a nested grid was developed to fully represent the initial location and extent of significance area(s) and maximum impact area(s). The nested grid comprises the following and is presented in Figures 2 and 3:

- Receptors were placed along the project fence line with a spacing of about 10 meters between adjacent receptors.
- A high resolution receptor grid with a receptor spacing of 20 meters was extended from the project fence line out to 300 meters from the project in all directions.
- An intermediate receptor grid with 50-meter receptor spacing was extend from the fence line receptor grid out to 1,000 meters from the project in all directions.

- A coarse receptor grid with 200-meter receptor spacing was extended from the intermediate receptor grid outwards to five (5) kilometers (km) from the project in all directions.
- When maximum impacts occur in areas outside any of the existing receptor grids, additional refined receptor grids with 20-meter resolution will be placed around the maximum impacts and extended as necessary to determine maximum impacts.
- Concentrations within the facility fence line were not calculated.

The nearest residence (sensitive receptor) from one of the hypothetical release points is 275 meters towards the north. A second residence is located approximately 400 meters towards the northwest. Other sensitive receptors are located at further distances and were included in the nested grid as described above.

Source Locations

Given that the hypothetical thermal runaway event and resulting fire could occur at any of the battery containers located within the 40-acre project site, seven (7) locations were selected based on the proximity to sensitive receptors and roadways. These locations were selected in part to determine the potential for worst case off-site modeled concentrations. Figure 4 presents these locations.

Procedure to Determine the Emissions

The CATL EnerC+ unit is comprised of five (5) in-line vertical racks, each containing eight (8) modules. Each module contains 104 cells, resulting in 4,160 cells per unit. A single cell weighs approximately 5,500 g, or 12.13 lbs. The total weight of the internal mass potentially subject to thermal runaway, i.e., consumption via combustion, is approximately 50,461 lbs.

The large-scale test (DNV Large Scale Burn Test, January 13, 2025) lasted for approximately 16.5 hours, with combustion occurring for approximately 14.5 hours. Based upon these hourly values, the mass consumed per hour would be approximately 3,480 pounds per hour (lbs/hr). This weight is likely an over estimate since the cells and modules contain numerous non-combustible components.

The early stage of the battery failure is associated with the accumulation of gases, which is the product of the heating and volatilization of the liquid electrolyte. After ignition, the battery will continue to emit substances, which are then subject to thermal oxidation. The final speciation of the vented gases and battery constituents will depend on various factors.

Gas composition data is based on the single cell thermal runaway test as shown in Table 1 below.

Table 1 Gas Composition (Cell basis)		
Gas Name	**Chemical Structure**	**% Measured**
Carbon Monoxide	CO	14.596
Carbon Dioxide	CO2	26.925
Hydrogen	H2	43.066
Methane	CH4	7.051
Acetylene	C2H2	0.119
Ethylene	C2H4	3.289
Ethane	C2H6	1.060
Propylene	C3H6	0.686
Propane	C3H8	0.260
Iso-butane	C4 (total)	0.865
Pentane	C5 (total)	0.399
Hexane	C6 (total)	0.148
1-Heptene	C7H14	0.025
Styrene	C8H8	0.013
Benzene	C6H6	0.082
Toluene	C7H8	0.012
Dimethyl Carbonate	C3H6O3	1.304
Ethyl Methyl Carbonate	C4H8O3	0.101
Total		**100**

The measured volumetric percentages for each compound was converted into a mass emission rate by first utilizing the total gas volume of 204 liters from the test report and then adjusting each compound by the measured percentage. Based on the molecular weight of each substance in Table 1, the gas density in kilograms/liter was calculated. Noting that there was an assumed number of 4,160 battery cells in thermal runaway, the gas density was used to calculate the mass emissions per cell and mass per total cells consumed in the fire for each compound. A source test duration of 14.5 hours in thermal runaway was used in the conversion to pounds per hour. This data is presented in Table 2.A review of the cell, module, and unit tests, as well as the large-scale burn test did not yield any emissions data on a number of other substances clearly identified as "sampled" in the test report. Graphical data for ethane, ethylene, hydrogen chloride (HCl), hydrogen cyanide (HCn), and hydrogen fluoride (HF) was presented for the large-scale test, but this data in its present form (graphical, not numerical) is not useable for purposes of determining emissions rates. Additionally, the sampling methodology did not allow for calculating a volume or flowrate associated with the graphical concentration data, which is required to calculate mass emission rates.

To supplement the test UL data, additional publicly available emissions data from reports on other BESS projects were reviewed and utilized for this analysis. This data included the use of the following sources:

- Vistra MBPP, OCA, Ramboll, 3/2024
- Baseline Environmental, Soda Mtn. Solar AQ Report, 7/2025
- Island Green Power Limited-Cottam Solar Project, Tetra-Tech, 11/2023 (LFP Battery Test)
- Dudek, Viridi Bess Project, 5/2025

- Dudek, Compass Energy Storage Project, May 2025.
- Fisher Engineering, Tesla Megapack 2, Jan 2023.
- Hithium Block 5 LSFT, UL LLC, 2025
- INERIS, 2022 (2) Willstrand et al., 2020 (3) Hynynen, 2023

The emission factors for hydrogen fluoride (HF), hydrogen chloride (HCL), hydrogen cyanide (HCn), hydrogen bromide (HBr), and formaldehyde (FORM) were developed from these sources and are based on the assumed mass of batteries experiencing a thermal event and the duration over which the emission will occur. The data shows that emissions from battery fires are closely related to the mass change from the battery before and after the fire, known as mass loss. While this data is from a variety of battery technologies which may or may not represent the lithium iron phosphate battery type at the Corby BESS, the emissions data from these studies was adjusted for the specific weights and burn time period (14.5 hours) to align with the CATL EnerC+ Large Scale Burn Test (January 2025). Then, averaged across the tests for each compound and then adjusted for the weights and time period of 14.5 hours to match the UL 9540A Cell Level Test (August 2023). The emissions of both criteria pollutants and hazardous air pollutants were modeled using the average across the tests, for each specific substance. The additional data is presented in Table 2.

AERMOD Emission Source Inputs

Reviewing the CATL EnerC+ Large Scale Burn Test Report (January 2025) and the design information with regards to the spacing of the battery enclosures, the source characteristics focused on a single enclosure thermal runaway fire. While the CATL EnerC+ Large Scale Burn Test Report summarized the fire progression throughout the test, the maximum burn rate of materials was during the period when the enclosure was fully engulfed starting with hour nine (9) of the test. Here, the fire and associated combustion gases were emitted through the entire series of side electrical cabinet doors that run the length of the enclosure. Based on this linear release characteristic, a single buoyant line source of approximately 6.06 meters in length (the length of the enclosure) was used to represent the release of combustion gases. AERMOD can simulate concentrations from these types of releases by utilizing the buoyant line source option within the model. Using techniques from the Buoyant Line and Point (BLP) Source Dispersion Model (Schulman and Scire, 1980), AERMOD assesses buoyant line source attributes in the BLP algorithm to define the geometry of one or more linear structures associated with the emission releases. BLP was originally developed to model linear source releases from aluminum smelters. The coordinates of the beginning and ending locations of the line source was used to determine the geometry of the release as well as the orientation of the line source.

To utilize the BLP option in AERMOD, source inputs also include calculating the buoyancy parameter F, which includes identifying an initial vented plume temperature and exit velocity. Since the modeling focused on the maximum one (1) hour active flame portion of the event, the exit temperature was assumed to be approximate to the temperature of an open flame. Based on data provided by in the CATL EnerC+ Large Scale Burn Test Report, the literature noted that vented gases from a battery cell can exceed 600^{o}C prior to ignition and flame temperatures within combustion sources can typically be in the range of 800^{o} to 900^{o}C. The exit temperature was conservatively assumed to be at the lower end at 800^{o}C, which would limit the amount of thermal plume rise which would then tend to increase the ground level concentrations.

The exit velocity was assumed to be one (1) meter per second (m/s) in order to conservatively limit the amount of plume rise due to momentum effects. Burn study testing data did provide some velocity data, but this was typically associated with hot gas ventilation prior to the maximum combustion event, and the gas was vented horizontally. Recognizing that the release of pollutants during the fire portion of the event along the length of open cabinet doors would have minimum vertical mechanical momentum, the focus on plume rise was based upon buoyancy effects. Since limiting momentum rise would cause an increase in the ground level concentrations by restricting the side vented plume rise to a lower elevation, a small exit velocity was used at 1.0 meter per second (m/s).

The buoyancy parameter equation (F) takes the form of the following:

Average Buoyancy Parameter (m^4/s^3)

$$F = [g\ L\ Wm\ w\ (Ts - Ta)]/Ts$$

where:

F = average line source buoyancy parameter (43.229 m^4/s^3)
g = acceleration of gravity (9.81 m/s^2)
L = average line source length (6.06 m)
Wm = average line source width (1.0 m)
w = exit velocity (1.0 m/s)
Ts = exit temperature (1073.15 K)
Ta = ambient air temperature (293.15 K)

Table 1 BESS Fire Emissions Conversions and Calculations (Per cell extrapolated to all modules and cells in the enclosure)

Site Evaluated: Corby Large Scale Test

Volume % Calculation			**Sample**		**Gas**	**Gas**	**Mass per Total Cells Consumed**			**Mass per Cell**			**Modeling**
		Measured	**Volume**	**Gas Molecular**	**Density**	**Density**	**kg**	**lbs**	**lbs/hr**	**kg**	**lbs**	**lbs/hr**	**g/sec**
Substance	**CAS**	**Vol %**	**Gas, L**	**Weight**	**kg/m3 ***	**kg/L**							
Methane	74828	7.051	14.384	16.04	0.667	0.00067	3.990E+01	8.796E+01	6.066E+00	9.591E-03	2.114E-02	1.458E-03	7.650E-01
Acetylene	74862	0.119	0.243	26.04	1.082	0.00108	1.093E+00	2.409E+00	1.662E-01	2.627E-04	5.792E-04	3.994E-05	2.096E-02
Ethylene	74851	3.289	6.710	28.05	1.166	0.00117	3.254E+01	7.173E+01	4.947E+00	7.822E-03	1.724E-02	1.189E-03	6.239E-01
Ethane	74840	1.060	2.162	30.07	1.250	0.00125	1.124E+01	2.478E+01	1.709E+00	2.702E-03	5.958E-03	4.109E-04	2.156E-01
Propadiene	463490	0.000	0.000	40.06	1.665	0.00167	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Propene (Propylene)	115071	0.686	1.399	42.08	1.749	0.00175	1.018E+01	2.245E+01	1.548E+00	2.447E-03	5.396E-03	3.721E-04	1.952E-01
Propane	74986	0.260	0.530	44.10	1.833	0.00183	4.044E+00	8.915E+00	6.148E-01	9.720E-04	2.143E-03	1.478E-04	7.753E-02
Butane (C4 total)	106978	0.865	1.765	58.12	2.415	0.00242	1.773E+01	3.909E+01	2.696E+00	4.262E-03	9.397E-03	6.481E-04	3.400E-01
Pentane (C5 total)	109660	0.399	0.814	72.15	2.999	0.00300	1.015E+01	2.238E+01	1.544E+00	2.441E-03	5.381E-03	3.711E-04	1.947E-01
Hexane (C6 total)	110543	0.148	0.302	86.18	3.582	0.00358	4.499E+00	9.917E+00	6.840E-01	1.081E-03	2.384E-03	1.644E-04	8.625E-02
Heptene	592767	0.025	0.051	98.19	4.081	0.00408	8.658E-01	1.909E+00	1.316E-01	2.081E-04	4.588E-04	3.164E-05	1.660E-02
CO	630080	14.596	29.776	28.00	1.164	0.00116	1.441E+02	3.178E+02	2.192E+01	3.465E-02	7.639E-02	5.268E-03	2.764E+00
CO2	124389	26.925	54.927	44.01	1.829	0.00183	4.179E+02	9.214E+02	6.354E+01	1.005E-01	2.215E-01	1.527E-02	8.013E+00
Hydrogen	1333740	43.066	87.855	2.02	0.084	0.00008	3.062E+01	6.751E+01	4.656E+00	7.361E-03	1.623E-02	1.119E-03	5.871E-01
Benzene	71432	0.082	0.167	78.11	3.246	0.00325	2.259E+00	4.980E+00	3.435E-01	5.430E-04	1.197E-03	8.256E-05	4.331E-02
Toluene	108883	0.012	0.024	92.14	3.829	0.00383	3.900E-01	8.597E-01	5.929E-02	9.374E-05	2.067E-04	1.425E-05	7.477E-03
Styrene	100425	0.013	0.027	104.15	4.328	0.00433	4.775E-01	1.053E+00	7.260E-02	1.148E-04	2.531E-04	1.745E-05	9.156E-03
Dimethyl Carbonate	616386	1.304	2.660	90.08	3.744	0.00374	4.143E+01	9.134E+01	6.299E+00	9.959E-03	2.196E-02	1.514E-03	7.944E-01
Ethylmethyl Carbonate	623530	0.101	0.206	104.10	4.326	0.00433	3.708E+00	8.175E+00	5.638E-01	8.914E-04	1.965E-03	1.355E-04	7.110E-02
	Check Sums	*100.0*	*204.0*										

	Total Gas Vol, L	204	*from test report*	
# of Racks in Enclosure	5			
# of Modules per Rack	8			
# of Cells per Module	104		* based on the ratio of molecular weights to Air and the Specific Wt of Air	
Test Duration, hours	14.5		Mol Wt. AIR= 28.97	
# Cells in Thermal Runaway	4160		Specific Wt of Air at 20C = 1.204	kg/m3

Ref: Module Test Report, UL 9540A , 9/2023

Table 2 BESS Fire Emissions Conversions and Calculations											
							Site Evaluated:		Corby BESS		
mg/kg to lb/lb battery weight											
	Substance >>>>		**Hydrogen Fluoride**	**Hydrogen Chloride**	**Formaldehyde**	**Hydrogen Cyanide**	**Hydrogen Bromide**	**NH3**	**NOx**	**SOx**	**THC**
Enter mg/kg value:			2460	1188.7	500	170	367	20	1426	2375	9800
mg/lb =			1115.84	539.19	226.80	77.11	166.47	9.07	646.82	1077.28	4445.20
lb/lb =			**0.00246**	**0.00119**	**0.00050**	**0.00017**	**0.00037**	**0.00002**	**0.00143**	**0.00238**	**0.00980**
Total Emissions, lbs			**124.1553**	**59.9932**	**25.2348**	**8.5798**	**18.5224**	**1.0094**	**71.9697**	**119.8654**	**494.6024**
Total Emissions, lbs/hr			**8.5624**	**4.1375**	**1.7403**	**0.5917**	**1.2774**	**0.0696**	**4.9634**	**8.2666**	**34.1105**
Modeling, g/sec			**1.07981**	**0.52178**	**0.21947**	**0.07462**	**0.16109**	**0.00878**	**0.62594**	**1.04250**	**4.30168**
Conversion Factors											
1 mg =	0.000002205	lbs									
1 kg =	2.204623	lbs									
Total Battery Weight Consumed, lbs =			50461								
Total Sampling Period, min =			870								
Total Sampling Period, hrs =			14.5								

References

Ref: Vistra MBPP, OCA, Ramboll, 3/2024

Ref: Baseline Environmental, Soda Mtn. Solar AQ Report, 7/2025

Ref: Island Green Power Limited-Cottam Solar Project, Tetra-Tech, 11/2023. (LFP Battery Test)

Ref: Dudek, Viridi Bess Project, 5/2025

Ref: Dudek, Compass Energy Storage Project, May 2025.

Ref: Fisher Engineering, Tesla Megapack 2, Jan 2023.

Ref: Hithium Block 5 LSFT, UL LLC, 2025

Ref: CATL EnerC+ LSFT, 1/2025, DNV Energy USA, Inc.

Ref: (1) INERIS, 2022 (2) Willstrand et al., 2020 (3) Hynynen, 2023

Significance Criteria and Short-Term (Acute) Health Effects

As per the CEC Data Requests, the modeling results were compared with both the acute California Reference Exposure Levels (RELs), and where there are no RELs for specific TACs, to the United States Environmental Protection Agency Acute Exposure Guideline Level-1 for Airborne Chemicals (AEGL-1).

Non-cancer health effects can be either chronic or acute. In determining potential non-cancer health risks (chronic and acute) from air toxics, it is assumed there is a dose of the chemical of concern below which there would be no impact on human health. The air concentration corresponding to this dose is called the REL. Non-cancer health risks can be measured in terms of a hazard quotient, which is the calculated exposure of each contaminant divided by its REL. Hazard quotients for pollutants affecting the same target organ are typically summed with the resulting totals expressed as hazard indices for each organ system. A hazard index of less than 1.0 is considered to be an insignificant health risk. For this assessment, the maximum hazard quotient was presented, regardless of target organ. This method leads to a conservative (upper bound) assessment. RELs used in the hazard index calculations were those published in the CARB/OEHHA listings dated January 2025.

Acute toxicity is defined as adverse health effects caused by a brief chemical exposure of no more than 24 hours. For most chemicals, the air concentration required to produce acute effects is higher than the level required to produce chronic effects because the duration of exposure is shorter. Because acute toxicity is predominantly manifested in the upper respiratory system at threshold exposures, all hazard quotients are typically summed to calculate the acute hazard index. One-hour average concentrations are divided by acute RELs to obtain a hazard index for health effects caused by relatively high, short-term exposure to air toxics.

In addition to RELs, the United States Environmental Protection Agency (EPA) developed AEGLs for airborne chemicals. AEGLs represent threshold exposure limits for the general public and are applicable to emergency exposures ranging from 10 min to 8 hours. Three levels—AEGL-1, AEGL-2, and AEGL-3—are developed for each of five exposure periods (10 min, 30 min, 1-hour, 4-hourh, and 8-hour) and are distinguished by varying degrees of severity of toxic effects. While the request for use of AEGL's are for Level 1, the three levels are presented below for comparison:

- AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

- AEGL-2 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

- AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Airborne concentrations below AEGL-1 represent exposure levels that can produce mild and progressively increasing but transient and nondisabling odor, taste, and sensory irritation or certain asymptomatic, nonsensory effects. With increasing airborne concentrations above each AEGL, there is a progressive increase in the likelihood of occurrence and the severity of effects described for each corresponding AEGL. Although the AEGL values represent threshold levels for the general public, including susceptible subpopulations, such as infants, children, the elderly, persons with asthma, and those with other illnesses, it is recognized that individuals, subject to unique or idiosyncratic responses, could experience the effects described at concentrations below the corresponding AEGL. AEGL's were assessed for the Level 1 (AEGL-1) 1, 4 and 8-hour averaging periods based on the limits of the AERMOD model which limits the averaging period to no less than 1-hour. In the modeling results summary section, any concentrations exceeding AEGL-2 or AEGL-3 were noted.

Table 3 presents a REL's and AEGL's (Level 1, 2 and 3) 1-hour concentration significance criteria in micrograms per cubic meter (ug/m^3). Note that some of the TACs presented in Table 1 and Table 2 do not have either an REL or AEGL but are presented in Table 3 for completeness.

Table 3
CARB OEHHA RELs and EPA AEGLs Significance Criteria (1-Hour Average)

Substance	CAS	REL[1], ug/m^3	AEGL 1[2], ug/m^3	AEGL 2, ug/m^3	AEGL 3, ug/m^3
Hydrogen Chloride	7647010	2100	2684	32807	149121
Hydrogen Fluoride	7664393	240	818	19462	36010
Hydrogen Cyanide	74908	340	2210	7848	16580
Hydrogen Bromide	10035106	-	3309	132369	426889
Methane	74828	-	-	-	-
Acetylene	74862	-	-	-	-
Ethylene	74851	-	-	-	-
Ethane	74840	-	-	-	-
Propadiene	463490	-	-	-	-
Propene (Propylene)	115071	-	-	-	-
Propane	74986	-	9920	-	-
Butane (C4 total)	106978	-	13074	-	-
Pentane (C5 total)	109660	-	-	-	-
Hexane (C6 total)	110543	-	10222	10000000	-
Heptene	592767	-	-	-	-
Ammonia	7664417	3200	20,859	111,248	764,830
Carbon Dioxide	124389	-	-	-	-
Hydrogen	1333740	-	-	-	-
Formaldehyde	50000	55	1105	17,195	68,781
Benzene	71432	27	170000	2600000	-

Toluene	108883	5000	250000	2100000	-
Styrene	100425	21000	85000	550000	-
Dimethyl Carbonate	616386	-	-	-	-
Nitrogen Dioxide	10102440	470	941	22581	37620
Carbon Monoxide	630080	23000	-	95450	379500
Sulfur Dioxide	7446095	660	524	1965	78600
1.Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values (CARB, 08/2025) 2. EPA Access Acute Exposure Guideline Levels Values (EPA August 2025)					

For each acute OEHHA REL, Table 4 lists the target organs that would be affected by exposure to a particular TAC or criteria pollutant. When multiple TACs affect the same target organ or system, their hazard quotients are summed to estimate combined risks for that organ system.

Table 4
OEHHA Acute REL Target Organ Summary

Pollutant	Acute Cardiovascular Effects	Acute Respiratory Effects	Acute Eye Effects	Developmental, Immune, Hematologic
Hydrogen Fluoride		Y	Y	
Hydrogen Chloride		Y	Y	
Formaldehyde			Y	
Nitrogen Dioxide		Y		
Ammonia		Y		
Benzene				Y
Toluene		Y		
Styrene		Y	Y	
Carbon Monoxide	Y			
Nitrogen Dioxide		Y		
Sulfur Dioxide		Y		

Concentrations of these pollutants in air associated with the emissions were calculated using the AERMOD dispersion model with the results input into the HARP2 Risk Assessment (Version 22118) program to calculate the HI. The AERMOD output was also compared with the AEGL-1 for those TACS that do not have RELs. This included:

- Hydrogen Bromide
- Propane
- Butane
- Hexane

Given the short duration of the 14.5-hour event, long term chronic and cancer (annual) exposure estimates were not assessed as the exposure periods for this event were less than a single day.

Chronic exposure is typically based on annual average concentrations which would be negligible for this event based on the single day's duration of exposure. For cancer, the increased risk periods are based on 30 years of exposure which for the single day's short duration of exposure, would also be negligible when prorated over a 30-year exposure period.

Model Results and Summary of Impacts

Table 5 presents the results of the acute exposure concentrations (RELs, AEGL-1) and the HI at the maximum impacted sensitive receptor (residence) for the thermal runaway scenario as defined earlier.

Table 5
Acute 1-Hour Risk Results

Pollutant	REL (ug/m3)	AEGL-1 (ug/m3)	Acute Hazard Quotient (HI)	Sensitive Receptor x,y (meters)
Hydrogen Chloride*	51.525	-	0.0245	595420.0, 4250270.0
Hydrogen Fluoride*	106.535	-	0.444	595420.0, 4250270.0
Hydrogen Cyanide	7.368	-	0.0217	595420.0, 4250270.0
Ammonia	0.866	-	0.000271	595420.0, 4250270.0
Formaldehyde*	21.656	-	0.394	595420.0, 4250270.0
Benzene	4.28	-	0.159	595420.0, 4250270.0
Toluene	0.738	-	0.000148	595420.0, 4250270.0
Styrene*	0.904	-	0.000043	595420.0, 4250270.0
Hydrogen Bromide	-	15.911	-	
Propane	-	7.66	-	
Butane	-	35.58	-	
Hexane	-	8.519	-	
		Hazard Index	**0.8625***	595420.0, 4250270.0

*** The total HI is based on the target organ "eyes" and represents the sum of HI hazard quotients for hydrogen chloride, hydrogen fluoride, formaldehyde, and styrene.**

The results of the HI modeling were plotted on a map to identify any areas that may result modeled hazard indexes above 1.0 and aid emergency responders in quickly identifying areas where exposed individuals may experience health impacts. The results of this are depicted in Figure 5 and represent the maximum distance of the HI equaling or exceeding 1.0 from any of the seven (7) hypothetical locations of unexpected thermal runaways at the BESS under meteorological conditions that can produce the highest ground level concentrations. The HI of 1.0 was not exceeded at any sensitive receptor while the AEGL-1 thresholds were never exceeded at any receptor.

Table 6 presents the results of the criteria pollutant modeling at the location of the maximum impacted sensitive receptor.

Table 6
Modeled Concentrations and Ambient Air Quality Standards

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Back-ground (µg/m^3)	Total (µg/m^3)	Ambient Air Quality Standards (µg/m^3) CAAQS
NO_2	1-hour maximum	61.83	50.81	112.64	339
CO	1-hour maximum	273.01	13,225	13,498.01	23,000
	8-hour maximum	211.87	2070	2281.87	10,000
SO_2	1-hour maximum	102.97	296.32	399.29	655

The criteria pollutant impacts were under the California Ambient Air Quality Standards (CAAQS) for all modeled criteria pollutants.

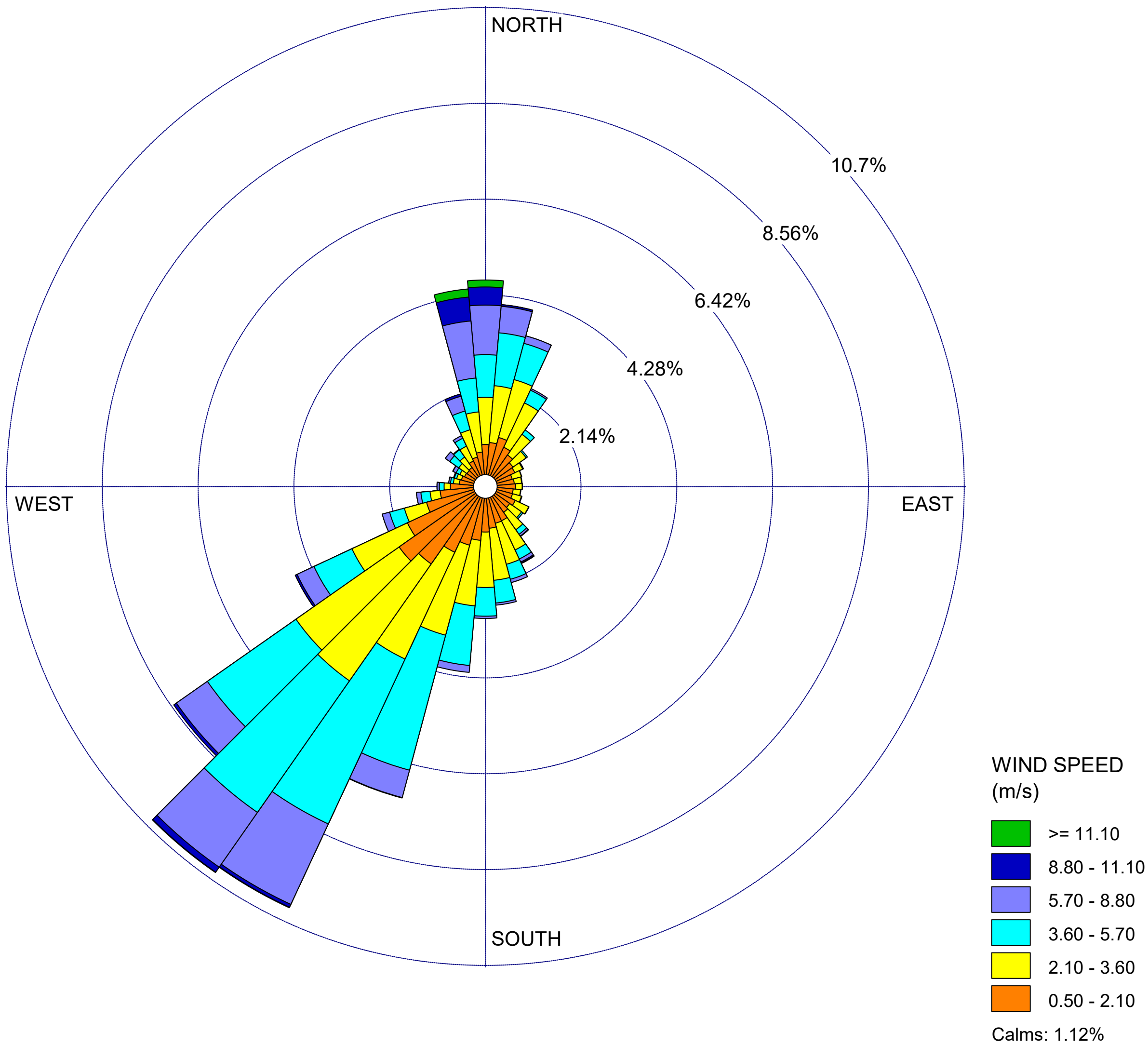
Conclusion

The results of the HI modeling demonstrate that the maximum distance to any receptor equaling or exceeding the HI of 1.0 is less than the distances to the two nearest sensitive receptors. The distance from the closest hypothetical source to the nearest sensitive receptor towards the north is 290 meters while the distance to the sensitive receptor towards the northwest is 407 meters. The maximum extent of any of the seven (7) HI 1.0 isopleths never exceeds 265 meters from the point of release. Thus, no sensitive receptors would be exposed to hazard indexes equal to or greater than 1.0.

WIND ROSE PLOT:

Figure 1
5-Year Nut Tree Airport Wind Rose (2017-2021)

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/2017 - 00:00 **End Date: 12/31/2021 - 23:59**	**Atmospheric Dynamics, Inc.**	
		MODELER: **Alfred E. Neuman**	
	CALM WINDS: **1.12%**	TOTAL COUNT: **43535 hrs.**	
	AVG. WIND SPEED: **3.25 m/s**	DATE: **9/29/2025**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Figure 2
Corby BESS Nested Receptor Grids

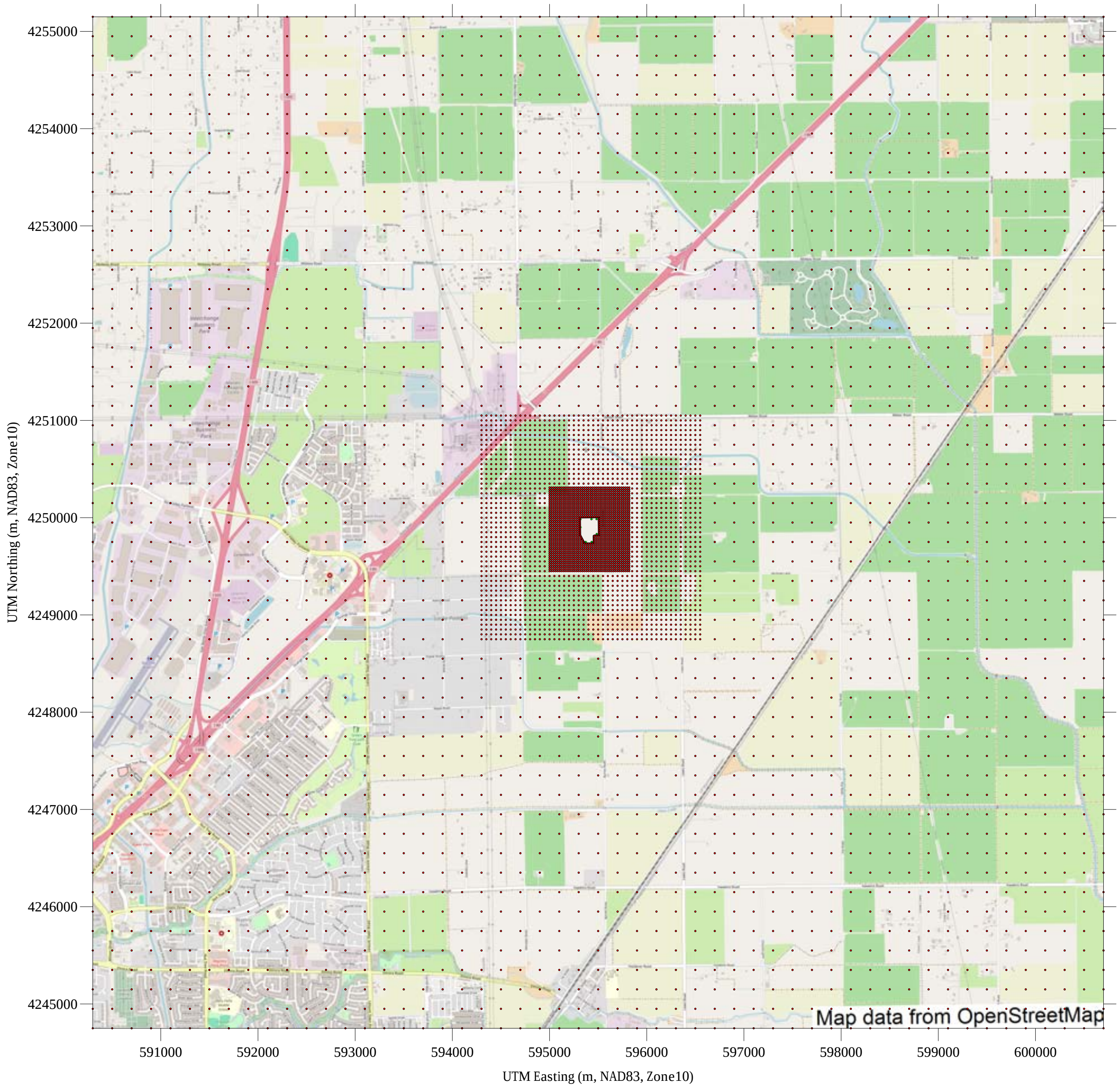


Figure 3
Corby BESS High Resolution Receptor Grids

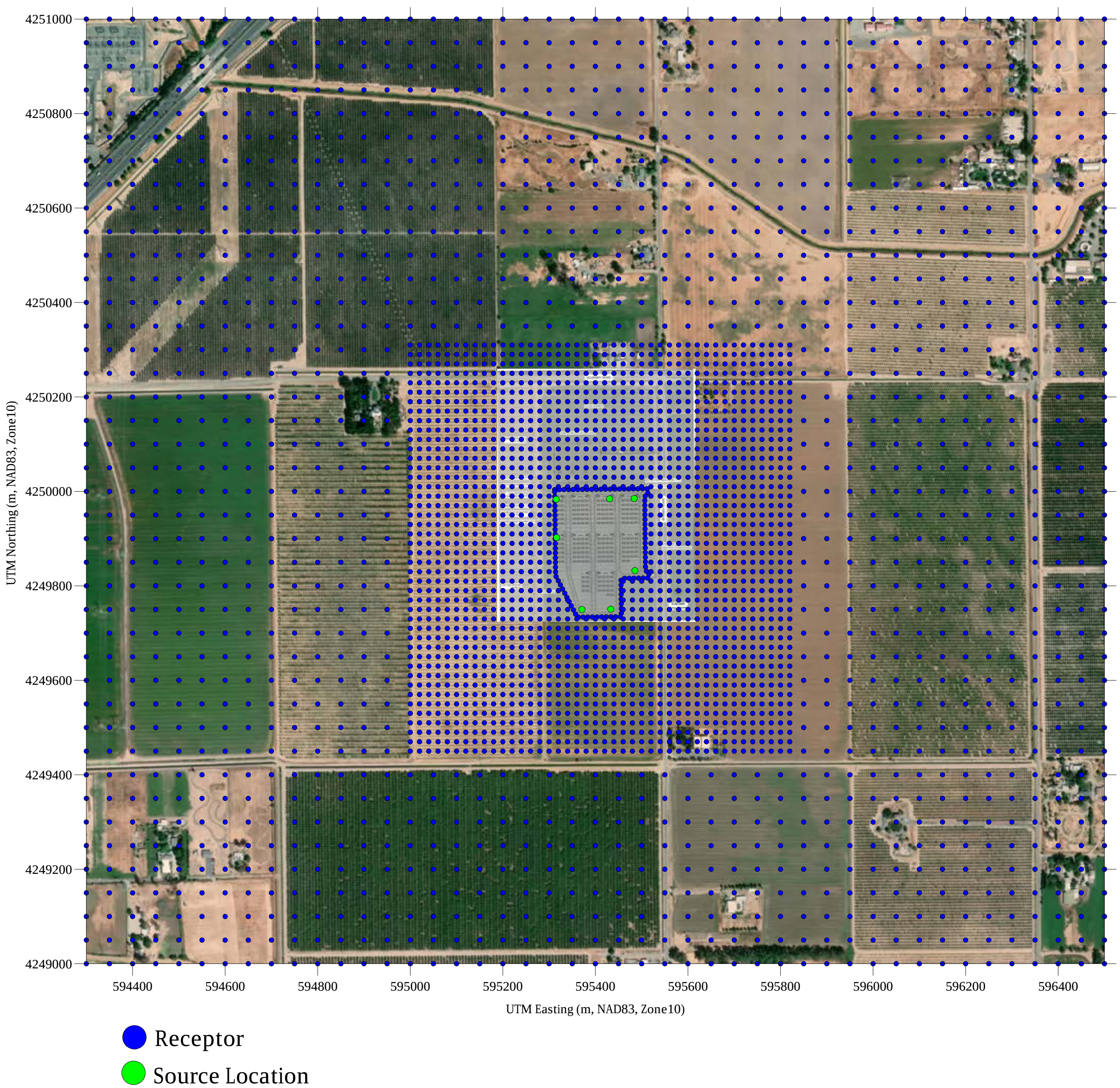


Figure 4
Corby BESS Thermal Runaway Source Locations

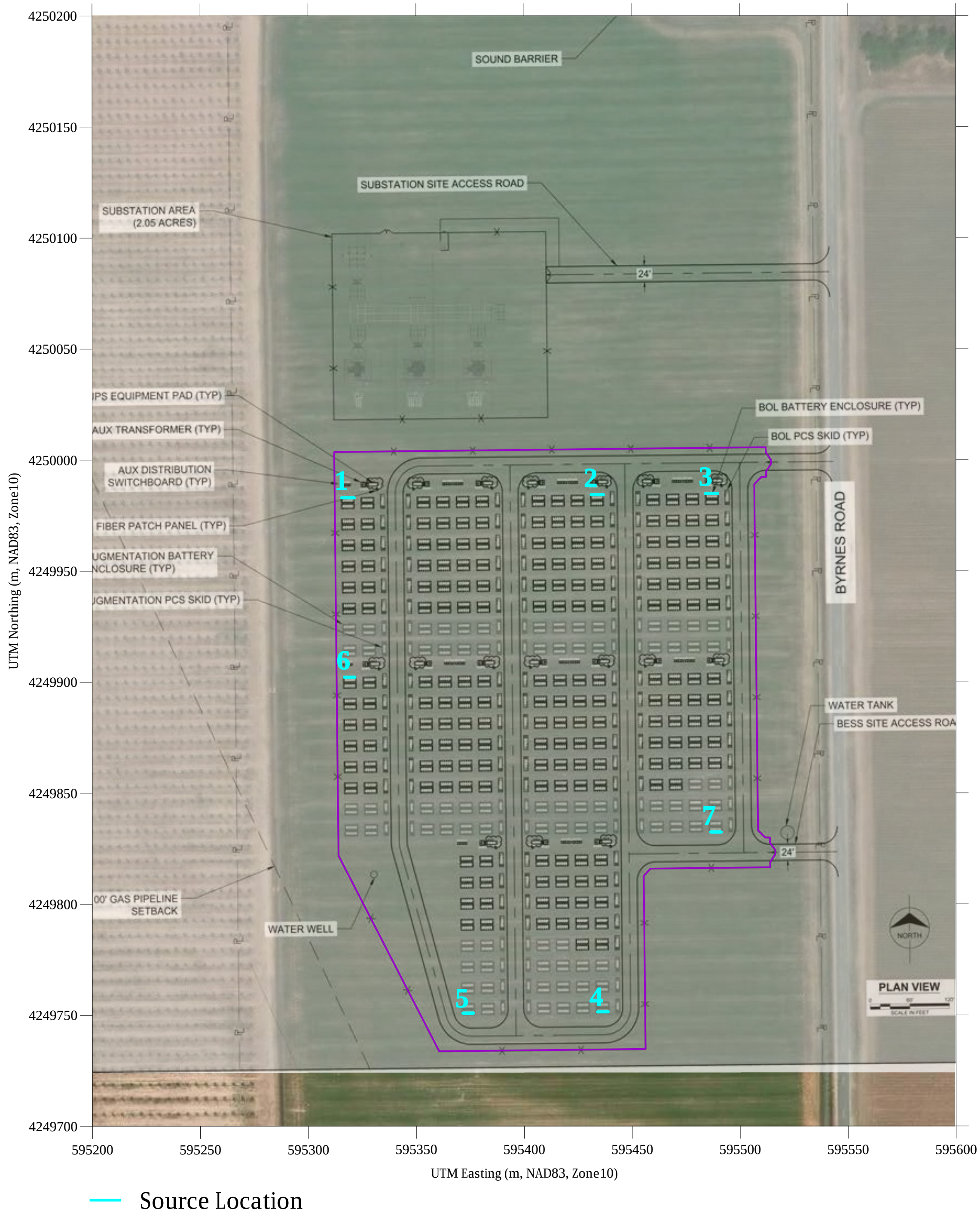


Figure 5
Corby BESS Acute HI