Joint Project to Evaluate and Protect Movement of People and Wildlife across Connecticut

FY 2023 Wildlife Crossing Pilot Program Grant Application

August 1, 2023

Submitted to:

Federal Highway Administration, US DOT

Submitted by:

Connecticut Department of Transportation

Joint Project to Evaluate & Protect Movement of People & Wildlife across Connecticut

Wildlife Crossing Pilot Program
Project Narrative

The Connecticut Department of Transportation (CTDOT) is pleased to submit a grant application for consideration under the Federal Highway Administration's (FHWA) Wildlife Crossings Pilot Program (WCPP) grant program.

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I. Basic Project Information

I.I Project Background

Wildlife-vehicle collisions (WVCs) in the United States are an ongoing significant threat to human safety, resulting in injuries, death, and an estimated $11 billion in property damage and other costs annually. Each year, between one and two million collisions occur between cars and large animals, resulting in more than 200 human fatalities and over 26,000 injuries each year, and the number of WVCs is steadily increasing.[1]

Wildlife-vehicle collisions also have enormous consequences for wildlife populations. The estimated 1-2 million large animal-vehicle collisions represent only a small fraction of the total wildlife struck by vehicles each year. For example, an estimated 89 to 340 million birds die annually in the U.S. from vehicle collisions.[2] Moreover, road mortality is reported as a major threat to survival for more than 20 Federally listed threatened or endangered species.

In addition to the challenges posed by WVC's, transportation infrastructure and roads are considered one of the primary causes of habitat fragmentation as they are long, linear features commonly found throughout the landscape. With this habitat fragmentation comes reduced gene flow between populations, altered behavior, a reduction in foraging opportunities, and a restriction on species' ability to move to adapt to the effects of climate change. These challenges are also extremely prevalent in aquatic systems, where roadways with inadequate culverts or other barriers, block species movement through a stream system. With migratory fish species populations declining worldwide approximately 76%, there is a critical need to connect both aquatic and land habitats.[3]

Reducing the number of WVCs and improving habitat connectivity across transportation infrastructure is a multifaceted challenge: most animal collisions are isolated, single-vehicle incidents that occur on two-lane, low-volume roads; the data, required to understand the magnitude of the problem and identify WVC hotspots and important wildlife crossings in Connecticut either do not exist, are insufficient, or are not well-integrated; and to maximize possible future investment in mitigation, the scale of analyses should be regional or statewide, requiring the collaboration of multiple agencies and partners. Because the issue is complex and cannot be solved by any one entity working alone, a comprehensive and multidimensional approach is required. The proposed project is a collaboration between State agencies and non-profit entities that will combine scientific analyses of existing and new data with improved data collections efforts to better understand WVCs in Connecticut. Ultimately, the results of the project will allow decision-makers to develop a strategic approach to reduce WVCs and increase habitat connectivity when planning for transportation projects. Wildlife crossings have the added benefit of connecting wildlife populations and their habitats which helps prevent listing of species at the federal or state level

[1] Reducing-Wildlife-Vehicle-Collisions-by-Building-Crossings
[2] Loss, S. R., Will, T., & Marra, P. P. 2014. Estimation of bird-vehicle collision mortality on US roads. The Journal of Wildlife Management, 78(5), 763-771.
[3] Deinet, S., Scott-Gatty, K., Rotton, H., Twardek, W. M., Marconi, V., McRae, L., Baumgartner, L. J., Brink, K., Claussen, J. E., Cooke, S. J., Darwall, W., Eriksson, B. K., Garcia de Leaniz, C., Hogan, Z., Royte, J., Silva, L. G. M., Thieme, M. L., Tickner, D., Waldman, J., Wanningen, H., Weyl, O. L. F., & Berkhuysen, A. 2020. The Living Planet Index (LPI) for migratory freshwater fish - Technical Report. World Fish Migration Foundation, The Netherlands.

thus ultimately reducing the regulatory burden associated with the Endangered Species Act and corresponding State level listings. These connections also help advance climate adaptation initiatives.

I.I.I Wildlife-Vehicle Collisions in Connecticut

Currently, there is limited systematic data collection for WVCs in Connecticut. Data associated with deer and other animal collisions that result in injury or property damage and generate a police report are included in the CT Crash Data Repository.[4] According to the repository, there have been 8,359 recorded deer-vehicle incidents resulting in injury or property damage since January 2015, averaging 1,028 incidents annually (Fig. 1). Of these incidents, over 500 resulted in injuries, including three fatalities. In 2023 alone, Connecticut had instances of multiple moose crossing local roads and interstates near some of the state's largest municipalities such as Waterbury, Hartford, Bloomfield, and Windsor.

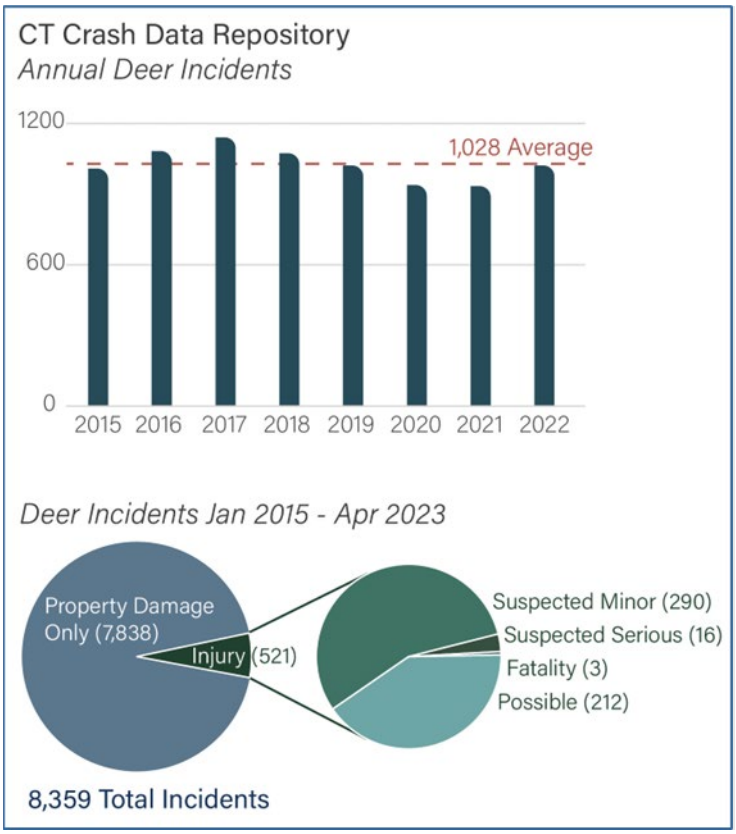

Figure 1. CT Crash Data Repository records for annual deer-vehicle collisions (upper panel) and categorization of injury and property damage related to those deer-vehicle incidents.

A study by Virginia DOT found that Deer-Vehicle Collisions (DVCs) represent a considerable safety hazard in Virginia, but the magnitude of this problem is not apparent from the data that are

[4] Connecticut Crash Data Repository https://www.ctcrash.uconn.edu/

currently available.[5] According to deer carcass removal records, the number of DVCs in the evaluated areas was up to 8.5 times greater than what was documented in police crash reports, and DVCs were the most frequent type of collision in the areas evaluated. The underrepresentation of DVCs understates the costs of these collisions. DVCs were estimated to be 6 times costlier on average than what was indicated from police crash report data. The situation is most likely very similar in Connecticut, where large deer populations and a developed landscape come together.

I.I.II Habitat Connectivity and Fragmentation in Connecticut

Connecticut is a unique landscape of habitats, with connections between the estuarine and riverine environments, and the forest, grassland, and wetland landscapes that surround them. Additionally, Connecticut can be considered the "gateway" to many other New England states in terms of both wildlife and human movement. Connecticut is home to the southern – and northern-most extent of species' ranges and will play an important role as species continue to move through the landscape to adapt to climate change.[6]

All the varied landscapes in Connecticut contribute to a diversity of wildlife. Connecticut supports 84 species of mammals, 335 species of birds, 50 species of reptiles and amphibians, 169 species of fish and an estimated 20,000 species of invertebrates. Of these species, the 2015 State Wildlife Action Plan (SWAP) identified 26 mammals, 95 birds, 31 reptiles and amphibians, 73 fish, 242 invertebrates, and 100 plants as Species of Greatest Conservation Need (GCN).

According to CT Department of Energy and Environmental Protection's (CTDEEP) 2015 SWAP, habitat fragmentation and loss continue to be the greatest threat to Connecticut's biota. Historically, habitat destruction has had a severe impact on Connecticut's wildlife habitat. Almost all of Connecticut was forested prior to European settlement, but by the early 1800's only 25% of forestland remained as it was cleared for agriculture or development.[7] Over time, deforestation has dwindled and today Connecticut is approximately 60% forested. However, much of that forest is secondary growth and only 53% of that is considered core forest.[8] Other important habitat types in Connecticut that have undergone fragmentation due to development and/or transportation infrastructure include coastal and island forests, grasslands, wetlands and marshes, and riverine migratory corridors.[9]

Specific populations of species that may be most vulnerable to habitat fragmentation caused by road-infrastructure include small, medium, and large mammals, reptiles and amphibians (particularly those that have seasonal vernal pool migration), ground birds, birds that are attracted to road-kill, migrating aquatic fish and invertebrates, and invertebrates attracted to roadway plants. Species range in Connecticut can vary from state-wide coverage to restricted portions of the state

[5] Donaldson, B. 2017. Improving Animal-Vehicle Collision Data for the Strategic Application of Mitigation. Virginia Transportation Research Council. https://www.virginiadot.org/vtrc/main/online_reports/pdf/18-r16.pdf
[6] Connecticut Department of Energy and Environmental Protection. 2015. State Wildlife Action Plan. https://portal.ct.gov/DEEP/Wildlife/CT-Wildlife-Action-Plan/Connecticut-Wildlife-Action-Plan
[7] Connecticut Department of Energy and Environmental Protection. 2013. The History of Connecticut's Forestlands. https://portal.ct.gov/-/media/DEEP/forestry/forest_resource_plan/fplanallpdf.pdf
[8] Connecticut Department of Energy and Environmental Protection. 2020. Connecticut's 2020 Forest Action Plan. https://portal.ct.gov/-/media/DEEP/forestry/2020-Approved-CT-Forest-Action-Plan.pdf
[9] Connecticut Department of Energy and Environmental Protection. Coastal Habitat Restoration Approaches. https://portal.ct.gov/-/media/DEEP/coastal-resources/coastal_management/Habitat_Restoration/HR_Approaches.pdf

where their desired habitat exists, and their distribution is projected to further shift as a result of climate change impacts.

I.II Project Description

Understanding how roads affect wildlife in Connecticut and reducing WVCs has been and continues to be a priority for state agencies. In the SWAP, habitat fragmentation from transportation infrastructure was identified as a major threat.[10] The highest priority action to mitigate this threat was for CTDEEP to collaborate with the Connecticut Department of Transportation (CTDOT) to provide input on ways to minimize fragmentation. CTDEEP has worked with local partners on local species-specific road crossing projects; for example, one project focused on the diamondback terrapin, a State Species of Special Concern. Conducting a statewide spatial analysis of the intersections of key habitat blocks and roadways and scaling up data collection efforts are the logical next steps to accomplish state transportation and wildlife goals. The WCPP funding announcement was well-timed as prior efforts and new partnerships have enabled agencies and partners to be well-prepared for the opportunity.

The proposed project is based on the recommendations presented in the Federal Highway Administration's (FHWA) Report to Congress *Wildlife–vehicle Collision Reduction Study: Best Practices Manual.*[11] The report emphasizes that large scale statewide or regional planning is the best foundation to substantially reduce WVCs. The proposed project originated from collaboration between state agencies (CTDOT and CTDEEP) and The Nature Conservancy‘s (TNC) Connecticut Chapter. The partners’ shared statewide goals ultimately are to 1) reduce WVCs and 2) improve habitat connectivity. Large scale planning to reduce WVCs requires a systematic approach with results that identify opportunities to maximize investments in mitigations. The Report to Congress describes a broad overview of the needs and requirements for such an approach. Step 1 is “Collect Statewide Data”, and the project will accomplish this by compiling and leveraging existing datasets and enhancing existing WVC and wildlife crossing data collection systems. Step 2 in the report is “Identify and Prioritize Road Mortality and Crossing Locations.” Step 2 will be performed by conducting a spatial analysis to identify priority wildlife-transportation intersections. Moreover, as recommended by the report WVC data and habitat linkage zones will be incorporated into the analysis as this provides better insight into animal movements (e.g., identify areas where animals may be crossing successfully, areas with high aborted crossings, or areas where future range shifts may increase crossing attempts).

This project will also look to past and current efforts that are assessing wildlife movement across a similar scale. Assessing the data and methodology of those similar efforts, will improve and enrich our own critical habitat and wildlife corridor analysis. Other local and regional scale efforts include but are not limited to TNC’s effort to Reconnect the Appalachians, TNC’s Connect the Coast project in New Hampshire, Housatonic Valley Association’s Follow the Forest initiative, and the North Atlantic Aquatic Connectivity Collaborative’s habitat connectivity toolsets.

[10] Connecticut Department of Energy and Environmental Protection. 2015. State Wildlife Action Plan. https://portal.ct.gov/DEEP/Wildlife/CT-Wildlife-Action-Plan/Connecticut-Wildlife-Action-Plan

[11] Huijser, Marcel P., P. McGowan, A. Hardy, Al Kociolek, A. P. Clevenger, D. Smith, & R. Ament. Wildlife-vehicle collision reduction study: Report to congress. 2017. https://www.fhwa.dot.gov/publications/research/safety/08034/03.cfm

I.II.III Project Scope

This project proposes to reduce wildlife-vehicle collisions and improve habitat connectivity in the state of Connecticut by conducting a spatial analysis that identifies critical habitat blocks, wildlife corridors, and priority road-segments where wildlife are most vulnerable to collisions or in need of movement between habitats (Fig. 2 depicts the main steps of the spatial analysis). The results of the spatial analysis will be included in a mapping toolset that will be housed within CTDOT's existing Open Data platform and be available for public and practitioner use.[12] Additionally, as the project is compiling data and information, CTDOT will evaluate opportunities to enhance its current public facing roadkill reporting tool to better understand if it can be adjusted to allow for the collection of more species level information, which can provide more specific and comprehensive data to the mapping platform during this process and into the future.[13] This type of field verified data that elicits a response and action from DOT personnel, could fill an important gap between data collected as the result of an MVC resulting in a crash report and those that otherwise go unreported by the involved vehicle.

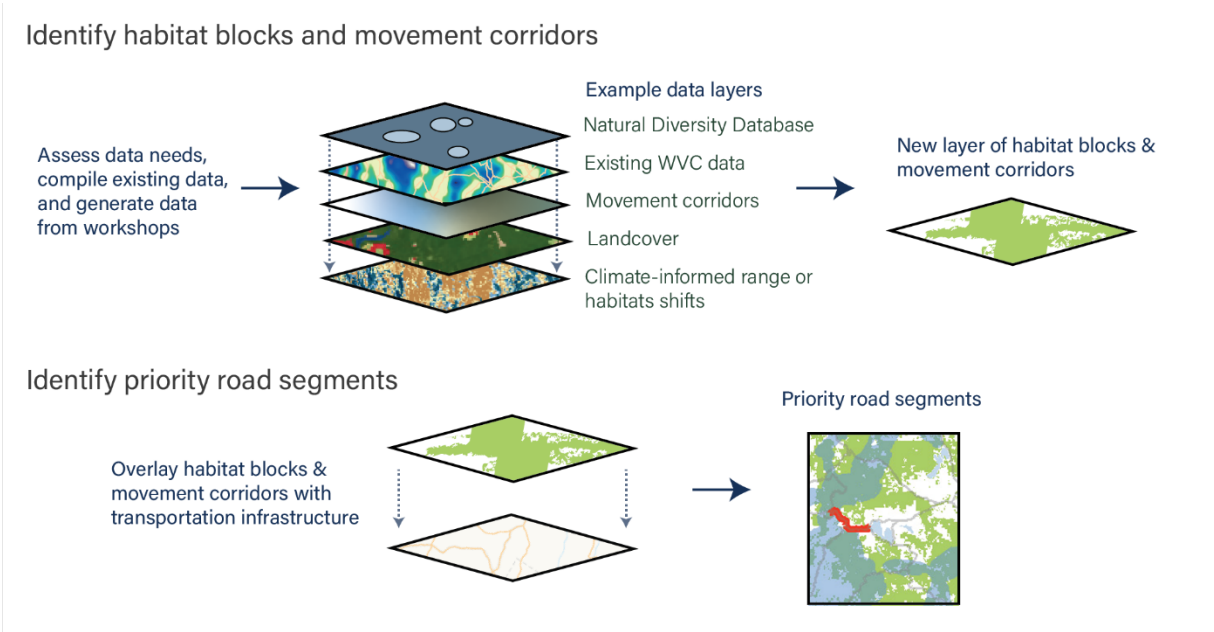

Figure 2. The spatial analysis will use several sources of spatial data to identify habitat blocks and corridors, and ultimately identify priority road segments.

In addition to the mapping toolset, a final set of documentation will provide an understanding of metadata, project methodology, and guidance on how to use the new tool. Results will be utilized by CTDOT Planners and Engineers as a consideration for future infrastructure projects. CTDOT will work closely with CTDEEP's Wildlife Division to identify and analyze opportunities to enhance wildlife crossings and reduce WVC's and will use this initial mapping as a base to incorporate additional data sources as they become available.

[12] CTDOT Open Data https://connecticut-ctdot.opendata.arcgis.com/
[13] CTDOT Roadkill Contact Us (arcgis.com)

Project success is demonstrated by the completion of the following deliverables: 1) a final report of the spatial analysis including an inventory of priority intersections of transportation infrastructure and habitat blocks and corridors; 2) data analysis output layers that can be utilized by Transportation Planners, Engineers, and other stakeholders in the project planning process; 3) and a public-facing interactive mapping web application that supports a user's ability to gain insight into the supporting analysis data.

Two groups will manage and guide this project:

- *Project Team*: The project team will be made up of staff from CTDOT, CTDEEP, and TNC. This internal team will work together to shepherd the project through its various phases. The team will meet approximately bi-monthly, or as needed, to move the project forward.

- *Advisory Work Group*: The project team would assemble an Advisory Work Group of technical experts from CTDOT and CTDEEP agency staff, environmental NGOs, academia, and local/regional municipalities or governing groups. The Advisory Work Group would provide their expertise in Connecticut habitat types, species and their movement, climate change, landscape level conservation, data analysis, geospatial tool development, and transportation use. This collective expertise is essential to guide the development of transportation/wildlife hot-spots, and the mapping platform. Depending on the engagement needed, the Advisory Work Group will meet throughout the project period with webinars and/or in-person workshops.

Project Tasks and Timeline

Below is Table 1, a proposed timeline and set of tasks that will assist in the completion of the data compilation, analysis, and mapping. As demonstrated in the detailed project schedule below, the project is reasonably expected to begin in a timely manner.

Table 1. Proposed project tasks and potential timeline

Tasks		Description	Potential Timeline
Project Collaboration	Internal Project Team Collaboration	CTDOT, CTDEEP, and TNC will collaborate to move project forward.	Jan 2024 – Dec 2025
	Assemble Project Advisory Work Group	Project Team will assemble a group of experts in environmental and transportation data.	Jan – Feb 2024
	Advisory Work Group Collaboration	Advisory Work Group will provide insight and guidance throughout the project and potentially could meet periodically after project period to make sure data and mapping tool are up-to-date.	March 2024 – Ongoing after Project Completion
Wildlife Crossing & Habitat Connectivity Mapping	Consultant Solicitation & Selection	Project Team will develop a Request for Proposals and select a GIS consultant to compile data, manage the analysis, and develop final map.	Jan – April 2024
	Data Compilation	With guidance from the project team and Advisory Work Group, Consultant will compile relevant environmental and transportation data.	May 2024 – December 2025
	Assess Data Needs	Consultant will assess any data gaps or needs and determine if it is possible to fill gaps. Consultant will also work with project team to assess if CTDOT's current data collection systems can be adjusted to include the collection of species-level information.	
	Advisory Work Group Facilitation & Data Prioritization	Consultant will work with Advisory Work Group and Project Team to determine what data and information needs to be included and prioritized in the spatial analysis.	
	Spatial Analysis	With guidance from Advisory Work Group and Project Team, Consultant will conduct a spatial analysis to identify critical habitat blocks and wildlife movement corridors. Road infrastructure data will be overlayed and integrated to understand road segments that are most vulnerable to WVC's or species movement.	
	Mapping Toolset Development	Working within CTDOT's existing structure and with CTDOT staff, the consultant will develop a mapping web application that will be housed in CT DOT's Open Data platform.	
	Data & Guidance Documentation	Working within CTDOT's existing structure and with CTDOT staff, the consultant will help develop documentation on project methodology, metadata, and data use.	
	Engaging Stakeholders around Mapping Toolset	The Project Team and Advisory Work Group will assess how this data and mapping tool can be used to inform efforts to reduce WVC's and improve habitat connectivity outside of CTDOT.	Sept – Dec 2025

I.II.I Project Location

The project will take place within the boundaries of the state of Connecticut, located in the northeast United States (Fig. 3). The state is bordered by New York to its west, Massachusetts to its north, Rhode Island to its east, and Long Island Sound to its south (from 40° 58' N to 42° 3' N and 71° 47' W to 73° 44' W). Despite its location between two major metropolitan areas (New York City, NY and Boston, MA), Connecticut is ~54% rural, as defined by the FHWA.

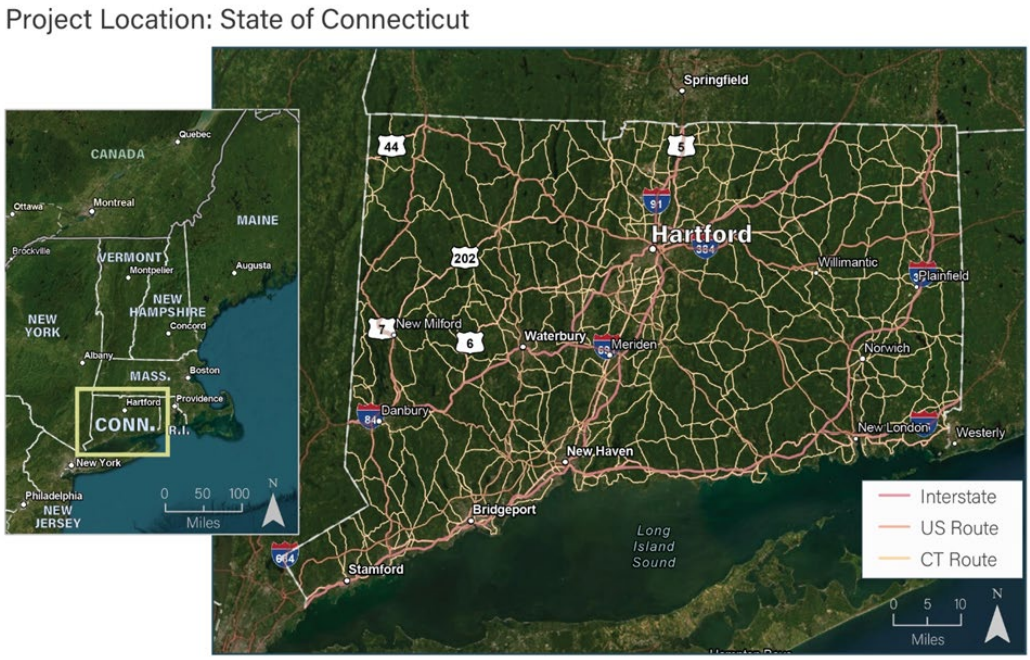

Figure 3. The project will take place within the boundaries of the state of Connecticut.

According to the Roadway Information Systems within the Bureau of Policy and Planning, Connecticut has 45,610 total lane miles of road including three primary interstate highways, five auxiliary interstate highways, and numerous state and town roads. There are 4,158 centerline miles of State roads and ramps, 1,423 miles of which are on the National Highway System, and 17,446 centerline miles of town roads, 55 of which are on the National Highway System. The annual vehicle miles traveled (VMT) per vehicle is 10,973, totaling 86.6 million daily VMT and 31.6 billion VMT annually.

Traffic volumes (which have rebounded to pre - COVID levels) and the density of highways and State roadways within Connecticut, coupled with our wildlife populations, pose a particular challenge. The arrival of moose and other large mammals in urban landscapes reflects the mix of rural, suburban and urban landscapes within Connecticut's 5,018 square miles, posing a serious threat to both motorists and wildlife. This proposed project will be a significant step in moving forward planning efforts to identify "hot spot" locations, which can then be taken into consideration for transportation projects moving forward.

With a population of 3.5 million people, Connecticut is the fourth most densely populated state in the nation. There are 17 Adjusted Urban Areas within the project boundaries, five of which are multistate. These include Bridgeport—Stamford, CT—NY; Colchester, CT; Danbury, CT—NY; Hartford, CT; Jewett City, CT, Lake Pocotopaug—East Hampton, CT; Litchfield, CT; Moodus, CT; New Haven, CT; New York—Newark, NY—NJ—CT; Norwich—New London, CT – RI; Springfield, MA – CT; Stafford Springs, CT; Torrington, CT; Waterbury, CT; Willimantic, CT; and Worcester, MA – CT.

Within the project boundaries are several federally designated community development zones (Fig. 4). Connecticut has 72 Opportunity Zones, two Choice Neighborhoods (Meriden and Norwalk), one Promise Zone (north Hartford), and parts of New Haven have been designated an Empowerment Zone. Additionally, Connecticut's has designated 25 "distressed municipalities" and over 60 towns with designated environmental justice block groups.[14] Connecticut law also recognizes five Indian tribes: (1) Golden Hill Paugussett, (2) Mashantucket Pequot, (3) Mohegan, (4) Paucatuck Eastern Pequot, and (5) Schaghticoke. These five tribes have six reservations in the state. Both the Mashantucket Pequot and Mohegan tribes are recognized by the federal government and their reservations are federal reservations.[15]

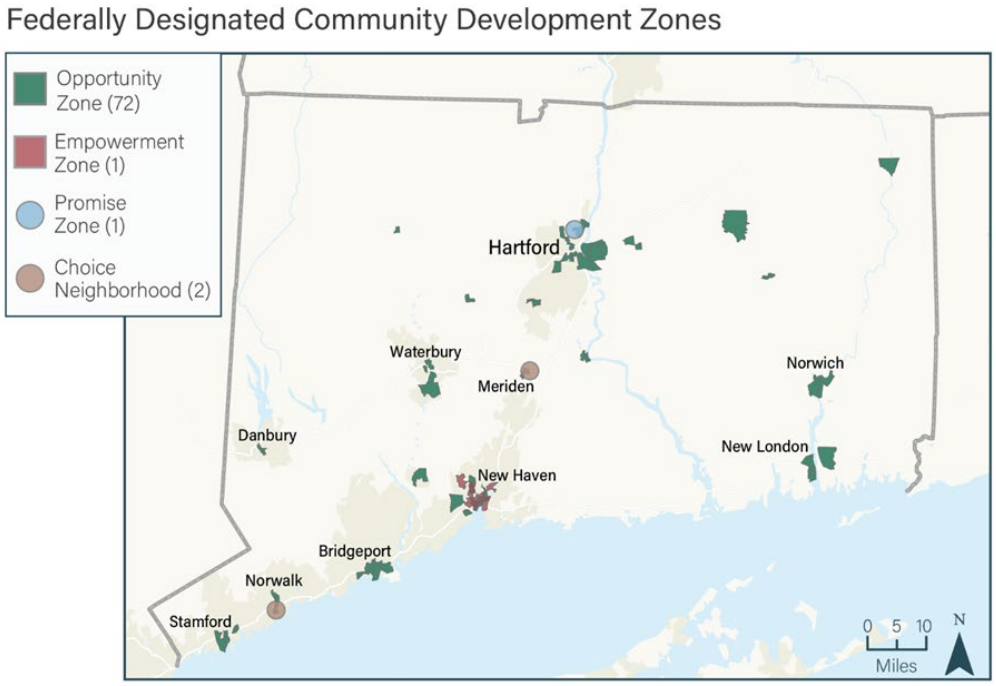

Figure 4. Location of federally designated community development zones within the project boundaries.

Since the proposed project is statewide, the project is located within Congressional Districts CT-1, CT-02, CT-03, CT-04 and CT-05.

[14] Connecticut Department of Energy and Environmental Protection. https://portal.ct.gov/DEEP/Environmental-Justice/05-Learn-More-About-Environmental-Justice-Communities

[15] Questions about State Recognition of Indian Tribes https://www.cga.ct.gov/2002/rpt/2002-R-0072.htm

I.II.II Project Applicant and Partners

Roles of Project Applicant and Partners

This is a joint project; CTDOT is partnering with the CTDEEP and TNC to evaluate and protect the movement of people and wildlife across Connecticut. The Nature Conservancy will act as the project manager, assembling an Advisory Work Group, soliciting a project consultant, and overseeing the development of the mapping toolset and other deliverables. CTDOT, the project applicant, will be responsible for managing the overall logistics of the grant and offering guidance and expertise throughout the project. CTDEEP will be responsible for offering guidance and expertise throughout the project as well.

Project Applicant: Connecticut Department of Transportation

CTDOT is the project applicant and would be the designated recipient entering into an agreement with FHWA if awarded funds under the WCPP grant program. CTDOT is a fully multi-modal statewide transportation agency that develops and maintains the State's various transportation systems. The mission of the CTDOT is to provide a safe and efficient intermodal transportation network that improves the quality of life and promotes economic vitality for the State and the region. The vision of the CTDOT is to lead, inspire and motivate a progressive, responsive team, striving to exceed customer expectations. CTDOT's Values include measurable results, Customer Service, Quality of Life, Accountability & Integrity, and Excellence. As one of a few states that owns and operates multiple modes of transit throughout the state, Connecticut is uniquely positioned to deploy solutions to address the problems of first and last mile connectivity, congestion and emissions, and access to economic opportunity.

CTDOT oversees a multi-billion-dollar, five-year capital program. In federal FY 2022, CTDOT committed approximately $2.2 billion across all modes, including $800 million for bus and rail transportation. CTDOT has demonstrated experience successfully working with federal agencies, including FHWA and the Federal Transit Administration (FTA). CTDOT, as a past recipient of Transportation Investment Generating Economic Recovery (TIGER) and Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant awards, has extensive experience with administering federal funds. CTDOT has developed effective management practices and recently created a new Capital Program Management unit that develops and maintains uniform processes for planning and executing projects statewide.

As the applicant and designated recipient of WCPP grant funds (if awarded), CTDOT will be responsible for administering the WCPP grant funds. Any programmed expenses eligible for reimbursement under the WCPP grant program will be encumbered by an entity under contract, invoiced by the sub-recipients and submitted to CTDOT for review. Upon review and approval, CTDOT will execute payment to sub-recipients to pay vendors, etc.

If awarded, CTDOT will promptly include this project in the Statewide Transportation Improvement Program (STIP) and coordinate with effected Regional Planning Agencies and Council of Governments (COGs) to include it on their Transportation Improvement Programs (TIP) as well.

As demonstrated, CTDOT has several decades of experience administering Federal grants and dollars requiring a state or local match. CTDOT will manage this vital WCPP grant project no differently.

Project Partner: Connecticut Department of Energy and Environmental Protection

CTDEEP is charged with conserving, improving and protecting the natural resources and the environment of the state of Connecticut as well as making cheaper, cleaner and more reliable energy available for the people and businesses of the state. The agency is also committed to playing a positive role in rebuilding Connecticut's economy and creating jobs – and to fostering a sustainable and prosperous economic future for the state.

CTDEEP's Bureau of Natural Resources is tasked with managing the state's natural resources (particularly fish, wildlife, and forests) through a program of research, management, public education, and regulation. The Wildlife Division is part of the Bureau of Natural Resources with a mission to advance the conservation, use, and appreciation of Connecticut's wildlife resources. The Wildlife Division is comprised of several important programs that work together to conserve and manage wildlife. Guiding many of these conservation actions is Connecticut's Wildlife Action Plan, a federally approved plan that describes species of greatest conservation need and the threats they face. Road mortality ranks among the highest threats many wildlife species face in our state, and in much of the northeast region. Implementing conservation actions that help identify locations where crossings would be beneficial for creating movement corridors and reducing wildlife-vehicle collisions helps reduce risk and prevent species from becoming state or federally listed which in turn helps provide regulatory certainty for transportation infrastructure projects.

Project Partner: The Nature Conservancy

TNC's mission is to conserve the land and waters on which all life depends. Increasing and safeguarding habitat connectivity is part of this mission and TNC has a wealth of organizational experience working with partners to better understanding connectivity, inform transportation planning, and implement wildlife crossings. TNC worked closely with New Jersey Endangered and Non-Game Species Program to implement Connecting Habitat Across New Jersey (CHANJ), a project to improve conditions for animals as they move around their home ranges and navigate around the dense road network in the state.[16] A similar effort was led by TNC in New Hampshire with the Connect the Coast project.[17] Large-scale assessments such as these, and the one currently proposed for Connecticut, enable practitioners to identify wildlife crossing infrastructure funding priorities to address connectivity barriers (see a recent TNC example from California[18]). When important wildlife crossings are identified, TNC is well prepared to implement mitigation measures. For example, a partnership between TNC and the New York State Department of Transportation resulted in a new structure engineered to allow wildlife to move between Tug Hill

[16] Connecting Habitat Across New Jersey (CHANJ) https://dep.nj.gov/njfw/conservation/connecting-habitat-across-new-jersey-chanj/
[17] Steckler, P., & Brickner-Wood, D. 2019. Connect The Coast. The Nature Conservancy and the Great Bay Resource Protection Partnership. Concord, NH. https://www.nature.org/content/dam/tnc/nature/en/documents/nh-connect-the-coast-report.pdf
[18] https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_2Pager_WildlifeConnectivity_Final9.pdf

and the Adirondack Park.[19] TNC is a lead partner in the Staying Connected Initiative,[20] an international public-private partnership that works to maintain landscape connectivity across the Northern Appalachian – Acadian Region of the U.S. and Canada. A main area of focus of the initiative is to make roadways safer for wildlife and people by identifying road segments that are critical for wildlife connectivity. Finally, there is a current effort led by TNC to address transportation barriers to species movement in the northern Appalachians region (from Maine to New Jersey) by increasing knowledge of regionally important road segments and building capacity within state agencies.

I.II.IV Assessment of Project Risks and Mitigation Strategies

As this proposed project is for planning and assessment, there are not any anticipated significant risks in terms of finances, project scheduling, lack of stakeholder support, or environmental uncertainties. Additionally, the proposed project will not require environmental review, permitting, or right-of-way acquisition. The proposed project may have some risk in regard to proper use and understanding of the data presented. To mitigate this risk, the project team will work with the hired consultant to ensure proper data documentation, guidance on how to use data and application, and posting of disclaimers where needed in acordance with the standards developed and utilized by CTDOT on its Open Data platform.

[19] https://www.nature.org/en-us/about-us/where-we-work/united-states/new-york/stories-in-new-york/critter-crossings/
[20] Staying Connected Initiative https://stayingconnectedinitiative.org/

II. Budget Narrative

Table 2. Budget Narrative

WCPP Grant Request Amount	$363,104.00	78.86% of project cost
Estimated Total of Other Federal Funding (excluding WCPP Requested Amount)	$0	
Estimated Other Federal Funding (excluding WCPP Requested Amount)	$0	
Estimated Non-Federal Funding: -Non-Federal Funding from TNC -Non-Federal Funding for State (CTDOT & CTDEEP)	$97,338.00	21.14% of project cost
-Non-Federal Funding from TNC	$77,338.00	16% of project costs
-Non-Federal Funding for State (CTDOT & CTDEEP)	$10,000/agency total of $20,000	4% of project costs
Future Eligible Project Cost (Sum of WCPP Requested Amount, Estimated Total of Other Federal Funding, and Estimated Non-Federal Funding, above	$460,442.00	
Previously Incurred Project Costs (including any expenses expected to be incurred between the applicant being selected for award and obligation of WCPP funds)	$0	
Total Project Cost (Sum of 'Previously Incurred Project Costs' and 'Future Eligible Project Cost')	$460,442.00	

TNC will manage the proposed project, including soliciting contractors, organizing, facilitating, and contributing to technical, Project Team, and Advisory Committee meetings, and managing TNC-generated spatial data contributions. This cost is anticipated to be $177,018 based on salary and fringe benefits for project staff time.

In coordination with CTDOT and CTDEEP, TNC will retain a qualified contractor to facilitate technical discussions, conduct the spatial analysis, deliver a report, and develop the mapping webtool with associated metadata and guidance documentation (estimated cost $200,000, based on similar contracts and scopes of work). The mapping toolset will be integrated into CT DOT's existing website and the agency. CTDOT will finance any future maintenance costs

CTDOT and CTDEEP will each contribute $10,000 (a total of $20,000, 4% of the of project costs). These funds present a complete funding package. There are no restrictions on funds for this project.

Table 3. Budget Items and Tasks

Direct Expenses					
Task	**Activities**	**Responsibility**	**Total Cost**	**TNC Match**	**Agency Match**
Project Management	Project Management, Consultant Solicitation, Meeting Facilitation, Project Team and Advisory Committee Meeting Management, TNC GIS/Spatial Contributions	TNC	**$181,018** Salary & benefits: $177,018 Travel: $2,000 Supplies: $2,000	**$63,392** Salary & Benefits: $59,392 Travel: $2,000 Supplies: $2,000	
Spatial Analysis and Products	Spatial Analysis, Integration of Mapping toolset in existing DOT Infrastructure, Assistance with any project specific documentation needed, Facilitation of Technical Discussions	Consultant - GIS analyst	**$200,000**		**$20,000**
Indirect Expenses					
Indirect Expenses (TNC)			**$65,478**		
Indirect Expenses (TNC) on Match Funds			**$13,946**	**$13,946**	
TOTALS					
Total			**$460,442**	**$77,338**	**$20,000**
Federal Funding Request			**$363,104**		

III. Project Merit Criteria

III.I Primary Merit Criteria

III.I.I Criteria #1.1: Reduction of Wildlife Vehicle Collisions

Wildlife-vehicle collisions in Connecticut are a threat to human safety, causing injuries, death, and millions of dollars of related costs annually. The major crash data repository for the state reports over 1,000 deer-vehicle collisions annually, though it is widely known that this type of data severely underrepresents the actual number of WVCs. The proposed analysis will fill critical knowledge gaps that are essential for transportation planners and conservation practitioners to identify and prioritize road segments for mitigation. Without this information, decision-makers are unable to calculate the magnitude of the issue, determine hotspots, or identify pressing conservation issues. Nor can they strategically plan for transportation or infrastructure modifications or optimize investments that effectively reduce WVCs or increase habitat connectivity. The proposed project will provide the foundational information described as the first steps in the FHWA's *Wildlife–vehicle Collision Reduction Study: Best Practices Manual.*

Data associated with deer and other animal collisions that result in injury or property damage and generating a police report is included in the CT Crash Data Repository.[21] However, species level data are not collected, and the categories for WVCs are "deer" and "animal other than deer." Because of this, it is not possible to determine which incidents in the "other" category involve wildlife, as domestic animals would also be included in these reports. The state of Maryland has a similar major accident database populated by information from Maryland Police agencies' accident reports, and in 2002 they compared this information with a new Large Animal Removal Reporting System. Results indicated that the major accident database only captured a very small portion (~14%) of the deer-vehicle collisions that were collected by the carcass removal system.[22] The incidence of deer-vehicle collisions was much more prevalent than the records in the accident database suggested, and the extent of this disparity was unknown prior to the implementation of the new system.

According to the CT Crash Data Repository (CT CDR), there have been 8,359 recorded deer-vehicle incidents resulting in injury or property damage since January 2015, averaging 1,028 incidents annually (Fig. 1). These incidents occur throughout the state, and hotspots are associated with major roadways (Fig. 5). Deer are most commonly involved in collisions between October and December and the frequency can be as high as one deer-vehicle collision every six hours during this period.

[21] Connecticut Crash Data Repository https://www.ctcrash.uconn.edu/

[22] Henke M.B., Cibor J., & Dayton B.J. 2002. Assessment of Deer-Vehicle Collisions in MD Using GIS, Report MD-02-SP107B4H, Earthspan, Inc., Baltimore, MD. https://www.roads.maryland.gov/OPR_Research/MD-02-SP107B4H-Deer-Vehicle-Collision-Data-Using-GIS-Report.pdf

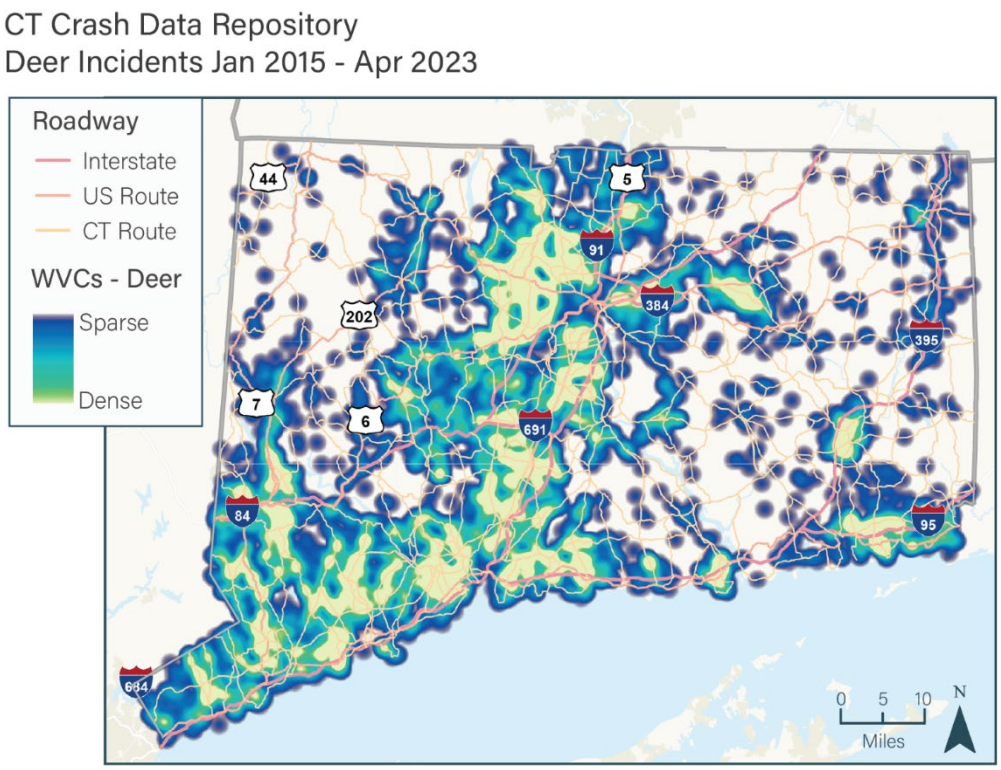

Figure 5. CT Crash Data Repository deer-vehicle collision location across the state from Jan 2015-Apr 2023.

As of 2008, the average estimated cost of each WVC is $8,854 (dollar amounts shown are 2023 dollars), which is based on estimated costs from incidents ranging from the lowest cost, property damage (~$3,600), to the highest, fatalities ($4.7M), and their frequency.[23] Using these figures as a guide combined with the limited CT CDR information for 8.5 years of deer-vehicle collisions, these incidents have an average cost of ~$8.4M per year.

Connecticut is approximately 60% forested, and there are many multi-thousand-acre core forest blocks that are bisected by road infrastructure.[24] Forested landscapes provide habitat for many large animals in the state, including deer, moose, and black bear. In a Nature Conservancy analysis of resilient lands and movement corridors across Eastern North America, sizable portions of the forested areas in Litchfield, Tolland, and Windham counties were identified as having both significant present-day and climate-informed species flow.[25] Integrating climate impact considerations into infrastructure planning will result in a modernized and cost-effective transportation network that saves human and animal lives.[26] Unfenced forested and mowed

[23] Huijser, Marcel P., P. McGowan, A. Hardy, Al Kociolek, A. P. Clevenger, D. Smith, & R. Ament. Wildlife-vehicle collision reduction study: Report to congress. 2017. https://www.fhwa.dot.gov/publications/research/safety/08034/03.cfm
[24] Housatonic Valley Association. Follow the Forest. https://hvatoday.maps.arcgis.com/apps/webappviewer/index.html?id=289e7ea807574c1ea9a40346097b3467&extent=-8565759.9965%2C4989120.7519%2C-7587366.0345%2C5476483.2443%2C102100
[25] Anderson, M.G., Barnett, A., Clark, M., Prince, J., Olivero Sheldon, A. and Vickery B. 2016. Resilient and Connected Landscapes for Terrestrial Conservation. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office. Boston, MA
[26] Joint Statement Regarding Climate-Informed Wildlife Crossings https://arc-solutions.org/wp-content/uploads/2023/02/Climate-and-Crossings-Consensus-Statement-232023-1.pdf

roadside habitat is common across the state and likely attracts animals and encourages their crossing.

The results of the proposed project will give decision-makers the tools to make strategic WVC mitigation implementations. It is anticipated that deliverables from the project will be available two years after the project begins and immediately be integrated into state transportation planning. It is expected that any implementation action will reduce the number of WVCs, and in doing so, decrease collisions, injuries, and death, and increase habitat connectivity. The data gathered from the data collection portal will be ongoing and contribute to the understanding of WVCs and wildlife crossings. The initial data collected and compiled will document baseline conditions of an area prior to any wildlife crossing interventions and can be compared with records after intervention to estimate the total reduction of WVCs.

III.I.II Criteria #1.2: Improvement of Terrestrial and Aquatic Habitat Connectivity

This project will improve terrestrial and aquatic habitat connectivity by identifying critical habitat blocks, linkage corridors between those blocks, and the roads that intersect the habitat blocks and/or migratory corridors. By identifying those important features for wildlife movement, practitioners can 1) deploy best practices to allow safer movement of wildlife between habitat blocks, 2) further protect or manage land in critical habitat blocks or migratory corridors to improve habitat connectivity, and 3) inform existing and future planning efforts.

Connecticut is a unique landscape of habitats, with connections between the estuarine and riverine environments, and the forest, grassland, and wetland landscapes that surround them. Additionally, Connecticut can be considered the "gateway" to many other New England states in terms of both wildlife and human centered movement. Connecticut is home to the southern – and northern-most extent of a number of species' ranges and will play an important role as species continue to move through the landscape to adapt to climate change.[27]

Through the 2015 State Wildlife Action Plan (SWAP) CTDEEP, identified 10 key habitats and association sub-habitats across the state. These habitats include upland forest, upland woodland and shrub, upland herbaceous, forest inland wetland, shrub inland wetland, herbaceous inland wetland, tidal wetland, freshwater aquatic, tidal aquatic, and unique, natural, or man-made features.[28]

All these varied landscapes in Connecticut contribute to a diversity of wildlife across the state. Connecticut boasts 84 species of mammals, 335 species of birds, 50 species of reptiles and amphibians, 169 species of fish and an estimated 20,000 species of invertebrates. Of these species, the 2015 SWAP identified 26 mammals, 95 birds, 31 reptiles and amphibians, 73 fish, 242 invertebrates, and 100 plants as Species of Greatest Conservation Need (GCN).

According to CTDEEP's 2015 SWAP, habitat fragmentation and loss continue to be the greatest threat to Connecticut's biota. Historically, habitat destruction has had a severe impact on

[27] Connecticut Department of Energy and Environmental Protection. 2015. State Wildlife Action Plan. https://portal.ct.gov/DEEP/Wildlife/CT-Wildlife-Action-Plan/Connecticut-Wildlife-Action-Plan
[28] Connecticut Department of Energy and Environmental Protection. 2015. State Wildlife Action Plan. https://portal.ct.gov/DEEP/Wildlife/CT-Wildlife-Action-Plan/Connecticut-Wildlife-Action-Plan

Connecticut's wildlife habitat. Almost all of Connecticut was forested prior to European settlement, but by the early 1800's only 25% of forestland remained as it was cleared for agriculture or development.[29] Over time, deforestation has dwindled and today Connecticut is approximately 60% forested. However, much of that forest is secondary growth and only 53% of that is considered core forest.[30] Core forests, areas 300 feet away from non-forested areas, provide essential ecosystem functions and high-quality habitat, especially to species sensitive to disturbance. As forests are fragmented, by roads or clearings, they lose some of their function and provide substandard wildlife habitat. Core forests in particular have declined about 15% in the last 35 years.[27] Other important habitat types in Connecticut that have undergone fragmentation due to development and/or transportation infrastructure include coastal and island forests, grasslands, wetlands and marshes, and riverine migratory corridors.[31]

Roads and transportation infrastructure can constrain wildlife mobility between habitat blocks, either through direct mortality or acting as a barrier.[32] In addition to the millions of animals that are killed each year due to wildlife-vehicle mortality, road infrastructure that fragments habitats can cause other detrimental impacts to entire populations of wildlife by altering behavior, isolating gene flow and genetic diversity, and not allowing migration due to seasonal or climatic changes.

Species range in Connecticut can vary from state-wide coverage to small portions of the state where there is their desired habitat, and ranges may be significantly altered in the future due to the effects of climate change.

To strategize around and prioritize the threats imposed to habitat connectivity and wildlife, the proposed project will convene an Advisory Work Group of experts on Connecticut's habitats, species, and species movement, taking into special consideration how habitats and species will shift with climate change[33]. The Advisory Work Group will prioritize habitat types, habitat features, and specific species to incorporate into the critical habitat blocks and wildlife corridors. Transportation infrastructure will then overlay the identified habitat blocks and wildlife corridors to highlight road-segments where intervention is most needed and/or where habitat connectivity is most crucial.

By identifying critical habitat blocks and wildlife corridors, practitioners like CTDEEP, regional COGs, land trusts, environmental NGOs, and others, will be better able to prioritize landscapes most in need of protection or better management. Additionally, as climate change shifts species ranges, it will become even more crucial to protect high quality, resilient habitat and the avenues to get to them.

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[29] Connecticut Department of Energy and Environmental Protection. 2020. Connecticut's 2020 Forest Action Plan. https://portal.ct.gov/-/media/DEEP/forestry/2020-Approved-CT-Forest-Action-Plan.pdf

[30] Connecticut State Council on Environmental Quality. 2022. 2022 CEQ Annual Report. https://portal.ct.gov/CEQ/AR-22-Gold/2022-CEQ-Annual-Report-eBook

[31] Connecticut Department of Energy and Environmental Protection. Coastal Habitat Restoration Approaches. https://portal.ct.gov/-/media/DEEP/coastal-resources/coastal_management/Habitat_Restoration/HR_Approaches.pdf

[32] Trombulak, S.C., & Frissell, C.A. 2000. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. Conservation Biology 18-30.

[33] Joint Statement Regarding Climate-Informed Wildlife Crossings https://arc-solutions.org/wp-content/uploads/2023/02/Climate-and-Crossings-Consensus-Statement-232023-1.pdf

By identifying segments of transportation infrastructure that are potentially the most likely to present wildlife crossing challenges, CTDOT will be better able to consider and integrate roadway and habitat connectivity aspects into planned projects. CTDOT will work collaboratively to assess and analyze this data and take the data into account when considering future actions.

Also, there are several state-wide or regional planning efforts for which the information and mapping toolsets created as part of this proposed project would provide additional insight and guidance on habitat connectivity. These planning efforts may include, CTDEEP's State Wildlife Action Plan, CTDEEP's Forest Action Plan, CTDEEP's Comprehensive Open Space Acquisition Strategy (Green Plan), Long Island Sound Study's Comprehensive Conservation and Management Plan and CTDOT's Long Range Transportation Plan.

III.II Secondary Merit Criteria

III.II.I Criteria #2.1 Leveraging Investments

The proposed project will leverage expertise, information, and resources from previous and current efforts that look to understand wildlife movement across the state and region. TNC is currently working on a project to address barriers to species movement for a resilient and connected Appalachians. The proposed project will look to this regional scale effort for lessons learned in cataloging data, conducting a mapping analysis at scale, and identifying connectivity needs.

Other state planning efforts which may offer insight and resources to this project include CTDEEP's State Wildlife Action Plan, CTDEEP's Forest Action Plan, CTDEEP's Comprehensive Open Space Acquisition Strategy (Green Plan) and Long Island Sound Study's Comprehensive Conservation and Management Plan. A number of these state planning efforts are also going to be updated in the next few years, so the proposed project is very timely in aligning with their development. This project will also leverage funds and match through in-kind contributions. TNC will contribute to this project by acting as the lead project manager, soliciting project consultants, and overseeing the development of the mapping toolset. The Nature Conservancy will provide an in-kind contribution (non-Federal match) up to $78,000. The in-kind contribution/match will be provided by the contribution of time, personnel costs, and travel.

CTDOT will contribute $10,000 and CTDEEP will contribute an additional $10,000 for a total of $20,000 towards the state portion of the non-federal funding match. If awarded, CTDOT will administer the grant. CTDOT will host and maintain the map and data long-term.

III.II.II Criteria #2.2 Economic Development and Visitation Opportunities

Collisions between large mammals and vehicles cause expensive damage, creating significant economic and safety problems. This project will help prevent economic loss due to property damage and loss of life. The maps and mapping toolset produced in this project will also identify "hot-spots" of wildlife movement or habitat that intersect with transportation infrastructure and roadways. By identifying those road segments, practitioners like state agencies, COGs, and local municipalities will be able to deploy best practices around those sites that can reduce wildlife-vehicle collisions. Those best practices may include strategic fencing, wildlife tunnels, or retrofitting or upgrading culverts. Wildlife-friendly infrastructure has proven to be effective at

reducing wildlife vehicle collisions and cost effective as they reduce the cost associated with property damage, human injury, and wildlife mortality.[34]

Moreover, this project will contribute to Economic Development and Visitation by advancing land protection efforts and wildlife-friendly road infrastructure which can contribute to job growth and access to open space. The set of maps, data, and mapping toolset developed through this project will highlight critical habitat blocks and wildlife corridors for movement between those blocks. By identifying areas critical for movement now and in the future as climate changes and habitats shift, they emphasize which land parcels should be protected. Practitioners like land trusts, Connecticut COGs, state agencies, etc. can use these new resources to support grant efforts or funding for improved land management, conservation easements, or purchasing parcels. Growth in land conservation can lead to an increase in jobs in varying fields like real estate, forestry, surveying and engineering, and recreation and tourism. More conserved land throughout the state can also offer more recreational and visitation opportunities for the public, and with those opportunities comes economic development for the surrounding community as people visit restaurants, stores, and take advantage of other local amenities. According to a 2016 U.S. Fish and Wildlife Service report, wildlife-related recreation contributed more than $150 billion nationwide to local economies, while forest-based recreation contributes $1.2 billion annually to Connecticut's economy.[35,36] Another local study of protected parcels in New England found that there is a positive and statistically significant relationship between land protected and the number of people employed in the labor force.[37]

The conservation of land also can provide many ecosystem services such as protection from flooding and erosion, clean water, and air pollution reduction. These ecosystem services provide a community economic benefit because the community doesn't have to be burdened with the cost of those services.

III.II.III Criteria #2.3 Innovation

Several important aspects of the proposed project are unique and innovative. First, as part of the project, innovative partnerships will be formed to draw on resources and knowledge from a diverse team of agency staff, university wildlife experts, TNC scientists, and community members. Second, climate and resiliency datasets will be integrated into the analysis that will allow the project team to assess the intersections of transportation infrastructure with habitat blocks and corridors under current and future scenarios as species respond to climate change. Third, WVC knowledge gaps will be filled by modifying a platform for the public to input roadkill and other observations of wildlife in roadways.

[34] Steward, K. 2015. Effectiveness of Wildlife Crossing Structures to Minimize Traffic Collisions with Mule Deer and other Wildlife in Nevada. Nevada Department of Transportation.
[35] U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2016. National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. https://www.census.gov/content/dam/Census/library/publications/2018/demo/fhw16-nat.pdf
[36] The Economic Importance of Connecticut's Forest Based Economy. 2015. https://portal.ct.gov/-/media/DEEP/forestry/CTForestBasedEconomypdf.pdf
[37] Sims, K., Thompson, J., Meyer, S., Nolte, C., & Plisinski, J. 2019. Assessing the local economic impacts of. Conservation Biology 1-10.

As the climate changes, some species are responding by shifting their ranges (for example, by latitude or elevation); thus, where a species exists today is not necessarily where it may be found in the future and the presence or higher abundance of a species may be recorded in previously un- or underoccupied areas.[38] TNC's Resilient and Connected Network (RCN) is the first comprehensive map of resilient lands and significant climate corridors across Eastern North America.[39] A product of this work was the identification of "climate corridors" and "climate flow zones"; these were identified by determining the natural flows and pathways that allow species populations to shift over time, and then identifying representative resilient sites situated within those pathways. The RCN is distributed across Connecticut, providing a foundational layer for an assessment of habitat connectivity. By incorporating climate corridors and flow zones into the analysis, only WVC hotspots can be identified that may be exacerbated in the future with shifting species' ranges but also potential areas of concern that may emerge as the climate changes. The RCN identifies ten areas in Connecticut where major roads form potential barriers to range shifts and species movements. The project was conducted at the continental scale with parameters that reflected eastern North America; and while it is planned to incorporate these ten areas into the analysis, it is anticipated that with Connecticut-specific parameters new, locally relevant, locations will be revealed.

One goal of the proposed project is to explore restructuring of an existing CTDOT web application to allow more robust data gathering of WVC reports from the general public. There is no systematic collection of, or current repository for, these data in Connecticut, just a component of an overall larger system maintained by the CTDOT. The insight gained by centralizing access to relevant data and analysis tools has the potential to produce multiple benefits at the state and local scale. For example, a new system will enable decision-makers to access real-time data, assess the scale and patterns of WVCs, calculate the impacts of WVCs on wildlife populations, and allocate resources effectively while prioritizing road safety and conservation.

III.II.IV Criteria #2.4 Education and Outreach

This project will contribute to education and outreach through public facing mapping tools and practitioner engagement in data collection and tool development.

As this tool is developed and deployed, the project team will work with experts and various stakeholders to gather information and insight on wildlife movement and transportation across the state, and how best to develop the mapping toolset so that it is accessible. The proposed project will look to the USDOT's Promising Practices for Meaningful Public Involvement in Transportation Decision-Making report, for strategies and tools to have a representative Advisory Work Group and set of stakeholders to develop and pilot this tool.[40] Leveraging existing partnerships such as the Long Island Sound Study, Connecticut's National Estuarine Research

[38] Lenoir, J., & Svenning, J.C. 2015. Climate-related range shifts–a global multidimensional synthesis and new research directions. Ecography 38: 15-28.
[39] Anderson, M.G., Barnett, A., Clark, M., Prince, J., Olivero Sheldon, A. & Vickery B. 2016. Resilient and Connected Landscapes for Terrestrial Conservation. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office. Boston, MA
[40] USDOT. Promising Practices for Meaningful Public Involvement in Transportation Decision-Making. 2022. https://www.transportation.gov/sites/dot.gov/files/2022-10/Promising%20Practices%20for%20Meaningful%20Public%20Involvement%20in%20Transportation%20Decision-making.pdf

Reserve, University of Connecticut, and the COGs will be prioritized to spread the project's goals, messages, and tools throughout their networks.

Additionally, as the consultant is working with the project team to compile data and information relevant to this project, CTDOT will also evaluate their current public facing roadkill reporting tool to better understand if it can be enhanced to allow for the collection of more species level information. The project team will assess whether the reporting tool, existing web information around the tool, and the new mapping toolset can be enhanced to illustrate to the public the dangers of wildlife-vehicle collisions and importance of safe movement for all.

III.II.V Criteria #2.5 Monitoring and Research

Repurposing CTDOT's existing data collection system will take approximately 6-12 months for stakeholder input, redevelopment, programing, and thorough testing. This application is critical for recording locations of WVCs. The current major crash repository only captures data from a presumed small percentage of WVCs, and only deer are identified at the species level. The revised system will provide state agencies with information that is currently not recorded in a manner that would support specific countermeasure selection and planning activities. These data will be essential in analyses to identify WVC patterns and hotspots and can contribute information critical to the understanding and management of species of conservation concern (e.g., mortality data for population viability analyses). Data can capture baseline conditions of an area prior to any wildlife crossing interventions and can be compared with records after intervention to estimate the total reduction of WVCs.

Project success is demonstrated by the completion of the following deliverables: 1) a final report of the spatial analysis including an inventory of priority intersections of transportation infrastructure and habitat blocks and corridors; 2) a public-facing interactive web mapping application to provide centralized access to an analysis toolset for transportation professionals and stakeholders; and 3) compiled component datasets available for download through Open Data.

The data generated by and the results of the proposed project will be made publicly available in multiple formats. The results of the spatial analysis will be disseminated in 1) a downloadable report made available on state agency websites and 2) an interactive mapping web application. In the application, users can display layers of selected spatial information to explore their own interests. The mapping application is expected to be used by state and municipal employees, private and non-profit organizations, students, and the public. Moreover, geospatial information will be made available for download for others to explore, use, and build off these data. Data collected and compiled by the wildlife observation portal will be ongoing and available to agency staff. Summary data will be viewable on a public-facing mapping portal and downloadable data will be available by request. It is expected that the data made available from this project will empower local communities and municipalities to raise awareness and address connectivity issues in their neighborhoods, especially for priority road segments on roadways not maintained by the State.

III.II.VI Criteria #2.6 Survival of Species

There are 12 Federally-listed, 1 Proposed, and 1 Candidate species with their current range believed to or known to occur in Connecticut.[41] For some of these species, like bog turtle (*Glyptemys muhlenbergii*; Threatened), roads are a major threat to populations. Roads act as barriers to dispersal, increase habitat disturbance, and result in direct mortality

Roads are a major threat to turtle populations as they act as barriers to dispersal, increase habitat disturbance, and result in direct mortality. Bog turtles are long-lived species that rely on subadult and adult survivorship and persist in small, isolated populations; these characteristics make bog turtles vulnerable to the impacts of roads.[42] In a study estimating the effects of road mortality on turtles, results indicated semi-terrestrial populations – such as bog turtle – may lose >5% of individuals every year to road mortality in the northeastern region of the United States.[43] This figure is troubling as long-term demographic studies of turtle populations indicate that as little as 2-3% annual mortality may tip populations towards negative growth. The USFWS Bog Turtle Conservation Plan, recognizes the need to research the effects of roads on the species and identify locations where roads intersect habitat.[44]

Although small animal collisions are not a chief public safety concern or the main focus of the spatial analysis, it is possible that priority road segments identified in this study may include key habitats also used by small animals. Thus, any future mitigation actions targeted towards large animals may indirectly increase habitat connectivity for a host of smaller species.

IV. USDOT Administration Priorities

The proposed project will meet USDOT's Administrative Priorities of safety, climate change, sustainability, equity and workforce development as outlined in the WCPP Notice of Funding Opportunity (NOFO).

By identifying road-segments that are most vulnerable to wildlife movement, the proposed project can improve transportation safety by offering better insight into where mitigation measures are needed most and move toward implementation to improve road safety. It is expected that any implementation action to reduce the number of WVCs, will in turn decrease collisions, injuries, and death. By identifying priority road segments of wildlife movement, practitioners like state agencies, Councils of Government, and local municipalities will be able to deploy some best practices around those sites that can reduce wildlife-vehicle collisions. Those best practices may include strategic fencing, wildlife tunnels, or retrofitting or upgrading culverts.

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[41] U.S. Fish and Wildlife Service. Environmental Conservation Online System. https://ecos.fws.gov/ecp/report/species-listings-by-state?stateAbbrev=CT&stateName=Connecticut&statusCategory=Listed

[42] Howell, H. J., & Seigel, R. A. 2019. The effects of road mortality on small, isolated turtle populations. Journal of Herpetology, 53: 39-46.

[43] Gibbs, J. P., & Shriver, W. G. 2002. Estimating the effects of road mortality on turtle populations. Conservation Biology 16: 1647-1652.

[44] Erb, L. 2019. Bog turtle conservation plan for the Northern population. A report to the Pennsylvania Division of Fisheries & Wildlife and the U.S. Fish and Wildlife Service. 102 pp.

As mentioned in Criteria 2.3, the proposed project will take an innovative approach by integrating climate and resiliency datasets into the analysis that will allow assessment of the intersections of transportation infrastructure with habitat blocks and corridors under current and future scenarios as species respond to climate change. By incorporating climate corridors and flow zones into the analysis, WVC hotspots that may be exacerbated in the future with shifting species' ranges will be identified as well as potential areas of concern that may emerge as the climate changes.

The proposed project will also take equity into consideration when assessing and understanding the movement of people and wildlife throughout the state. As the proposed project will occur on a state-wide scale, it will be looking at movement in Connecticut's urban, suburban, and rural landscapes. As mentioned in the Project Location, Connecticut is approximately 54% rural with 72 Opportunity Zones, two Choice Neighborhoods (Meriden and Norwalk), one Promise Zone (north Hartford), and parts of New Haven have been designated an Empowerment Zone. Additionally, Connecticut's has designated a list of "Distressed Municipalities" and "Environmental Justice Block Groups," both of which could be overlayed with the proposed project mapping toolset to better understand and prioritize mitigation measures in those areas.

As mentioned in Criteria 2.2, the proposed project could lead to advancing land protection efforts and wildlife-friendly road infrastructure, which can contribute to job growth and access to open space. Growth in land conservation can lead to an increase in jobs in varying fields like real estate, forestry, and recreation and tourism. More conserved land throughout the state can also offer more recreational and visitation opportunities for the public, and with those opportunities comes economic development for the surrounding community as people visit restaurants, stores, and take advantage of other local amenities.

The deliverables from the project are anticipated to be available two years after the project begins and immediately be available for use in state transportation planning. A two-year detailed project schedule demonstrates technical feasibility and project readiness.

VI. Appendixes

VI.I Letters of Support

The proposed project is well supported by state agencies, local governments, nonprofit organizations, and academia. The letters of support found in the Appendix represent broad public support for the project.