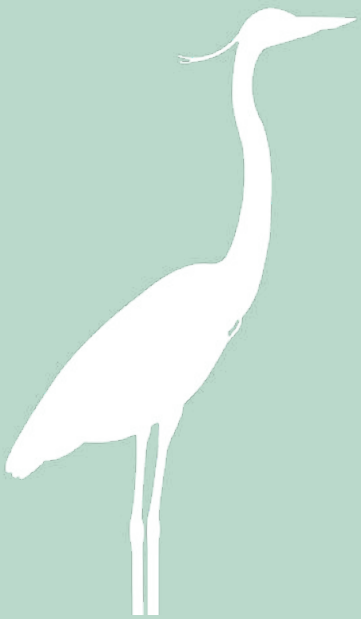
The Corte Madera

Climate Adaptation Assessment

A Roadmap to Resilience

May 2021



THE TOWN OF
CORTE MADERA

MARIN COUNTY CALIFORNIA

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Report Availability

The report is available and can be downloaded from cortemaderaadapts.org.

Acknowledgements

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Town of Corte Madera Council Members

- Eli Beckman (Mayor)
- David Kunhardt (Vice Mayor)
- Fred Casissa
- Charles Lee
- Bob Ravasio

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- Julian Skinner (City of Larkspur)
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The Town of Corte Madera
Marin County California

NELSON NYGAARD

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GLOSSARY

Most glossary terms shown rely on descriptions from either the National Climate Assessment (2018) or the California Adaptation Planning Guide (2020).

Adaptation - An adjustment in natural or human systems to a new or changing environment. Adaptation to climate change includes proactive planning and preparation to reduce risk, utilize new opportunities and enhance resilience.

Adaptation action - A specific activity, act, project, program or effort that the community can take to support the Town's efforts to increase climate resilience. Example action: Inventory all homes and structures in the WUI and assess if they comply with the Town's WUI regulations, policies, and codes using the JPA "Collector App."

Adaptive capacity - The ability to adjust to potential impacts, take advantage of opportunities, and respond to extreme weather events and changing climate conditions.

Adaptation pathway - A visual representation that supports local governments in planning for multiple potential futures with differing environmental, social, and economic conditions by developing strategies that can be modified or adjusted at key junctures in the future depending on future "triggers" and "thresholds."

Adaptation strategy - A general area of action that can help enhance the climate resilience of the community. Adaptation Strategies bring together sets of actions that have a similar purpose. Example strategy: Enhance the Town's vegetation management, defensible space, and building hardening efforts in the Wildland Urban Interface.

Adaptation goal - A broad objective identified by the Town of Corte Madera and broader community to support the Town's vision ("One Town, One Region, Resilient Together") for a resilient future. The Adaptation Assessment contains four key goals. Example goal: Protect the health, safety, and wellbeing of all Town residents, visitors, and workers by focusing on preparedness and prevention.

Climate change - Changes in average weather conditions that persist over multiple decades or longer. Climate change encompasses both increases and decreases in temperature, as well as shifts in precipitation, changing risk of certain types of severe weather events, and changes to other features of the climate system.

Climate exposure - An extreme weather event or changing climate condition that can adversely affect people, livelihoods, species, ecosystems, environmental functions, services, resources, infrastructure and economic, social, and cultural assets.

Drought - A period with little or no rain. Whether a dry spell becomes a drought depends on how long it lasts, expectations based on historical data and perceptions, and the water needs of people and natural systems.

Equity - Just and fair inclusion into a society in which all can participate, prosper, and reach their full potential. The central equity challenges for climate change policy involve several core issues: addressing the impacts of climate change, which are felt unequally; identifying who is responsible for causing climate change and for actions to limit its effects; and understanding the ways in which climate policy intersects with other dimensions of human development, both globally and domestically.

Emissions scenarios - Quantitative illustrations of how the release of different amounts of climate altering gases and particles into the atmosphere from human and natural sources will produce different future climate conditions. Scenarios are developed using a wide range of assumptions about population growth, economic and technological development, and other factors.

Extreme precipitation event - An episode of abnormally high rain or snow. The definition of "extreme" is a statistical concept that varies depending on location, season, and length of the historical record.

Extreme storm event - Relatively infrequent water level events that are a result of relatively high astronomical tides coupled with a storm surge event. The absolute elevation reached during these events are due to short-term meteorological processes (such as low atmospheric pressure due to storms) and large-scale oceanographic conditions (such as king tides). The extreme storm events discussed in this analysis do not include the full reach of wind-driven waves.

Fire Hazard Severity Zone (FHSZ) - A mapped area designated by CalFire where wildfire hazards are likely to be more severe (based on factors such as fuel, slope, and fire weather) using varying degrees of fire hazard (i.e., moderate, high, and very high). CalFire uses the FHSV designations to dictate its responsibilities for fire protection and/or mitigation work across the State.

Frontline communities - Historically disadvantaged and underserved members of the community who experience the first and disproportionately worst impacts of climate change. These frontline community members may include older adults in the community, those with disabilities, low-income residents, BIPOC (Black, Indigenous and people of color), LGBTQ individuals, English as a Second Language (ESL) communities, the unhoused, those who lack transportation, and those who lack access to television, radio, internet and/or phone service.

Fuel hazard reduction - The act of reducing surface and ladder fuels that exacerbate wildfire growth and severity in order to reduce the threat to public safety, firefighter safety, and damage to property and life. Generally, fuel hazard reduction activities include a variety of treatments like thinning and limbing trees, removing underbrush, conducting prescribed burns, grazing, etc.

Greenhouse gas (GHG) - Any gaseous compound in the atmosphere that is capable of absorbing infrared radiation, thereby trapping and holding heat in the atmosphere. Greenhouse gases include carbon dioxide, methane, nitrous oxide, and other compounds.

Green infrastructure - An approach to water management that protects, restores, or mimics the natural water cycle.

Groundwater - Water found in the spaces between soil particles and cracks in rocks underground.

Hazard - An event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural losses, damage to the environment, interruption of business, or other types of harm or loss.

Hazard mitigation - Sustained action taken to reduce or eliminate the long-term risk to human life and property through actions that reduce hazard, exposure, and vulnerability. Hazard mitigation can be one component of climate change adaptation.

Home hardening - Altering the building materials, design features, and landscaping of a home to reduce its susceptibility to wildfire embers, flames, or radiant heat.

Inundation - The submergence of land by water.

Invasive species - A non-native organism whose introduction within a particular ecosystem causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health.

King tide - An especially high tide caused by alignment of gravitational pull between the sun and the moon. King Tides are the highest high tides of the year, about a foot or two higher than average tides, occur naturally and regularly (about 5-6 times each year), and are predictable and expected. When King Tides occur during floods or storms, water levels can rise higher and have the potential to cause great damage to the coastline and coastal property.

LGBTQIA+ - A common abbreviation for the Lesbian, Gay, Bisexual, Pansexual, Transgender, Genderqueer, Queer, Intersex, Agender, Asexual and other queer-identifying community.

Managed retreat - The purposeful, coordinated movement of people and buildings away from risks. This may involve the movement of people, infrastructure, or a community.

Mean Higher High Water - Average height of the higher high tides of each day during the current National Tidal Datum Epoch, which is a specific 19-year period (1983-2001) adopted by the National Oceanic and Atmospheric Administration (NOAA) to perform tidal computations. This is generally what is considered the high tide line.

Mitigation (Climate) - Measures to reduce the amount and speed of future climate change by reducing emissions of heat-trapping gases or removing carbon dioxide from the atmosphere.

Nature-based solutions - Physical landscape features that are created and evolve over time through the actions of environmental processes or features that mimic characteristics of natural features but are created by engineering and construction (in concert with natural processes) to provide coastal protection and other ecosystem services.

Resilience (Climate) - The capacity of a community to withstand, survive, and thrive by maintaining and adhering to essential cultural functions, identities, and structures, while co-existing with and managing for changing conditions.

Public Safety Power Shutoffs (PSPS) - A power shut off event initiated by a utility company (e.g., PG&E) as a precautionary safety measure during severe weather or extreme fire conditions (e.g., drought and/or high winds) to prevent fire ignitions from utility equipment.

Sea Level Rise (SLR) - Increase in the mean level of the ocean. Relative sea level rise occurs where there is a net increase in the level of the ocean relative to local land and is a combination of thermal expansion of ocean water, increases in water volume due to the melting of land based ice, and vertical land movement or subsidence.

Sensitivity (Climate) - The degree to which community function, structures, and populations are affected by a climate exposure.

Storm surge - A rise or piling up of water generated by high winds and low atmospheric pressure in the presence of a storm that is over and above the predicted astronomical tide. The magnitude of a storm surge and the height of an astronomical tide are additive: when the sum of the two is unusually large, an extreme storm event occurs.

Temporary flooding - Temporary flooding caused by storm events or extreme tides is generally short in duration (hours to days) but can have long lasting consequences.

Threshold/Trigger - A trigger point at which a particular asset (or group of assets) is compromised so that it no longer functions as intended, or a change of circumstances (e.g., funding opportunity) arises that prompts decision makers to adjust or implement adaptation measures.

Urban heat island effect - The tendency for higher air temperatures to persist in urban areas as a result of heat absorbed and emitted by buildings and asphalt, tending to make cities warmer than the surrounding countryside.

Vulnerability (Climate) - The degree to which something is susceptible to adverse effects of climate change as determined by climate exposure, sensitivity, and adaptive capacity. Vulnerability can increase or decrease because of physical (built and environmental), social, political, and/or economic factor(s).

Wildland Urban Interface (WUI) - Area between wildland vegetation and the constructed areas that cause significant exposure to structures in the event of a wildland fire.

A LETTER FROM THE MAYOR

The global climate is changing and we are feeling the impacts right here in Corte Madera. The ever present risk of wildfire looms over our community and smoke from regional wildfires makes our air unhealthy to breathe. Meanwhile, king tides and storm events flood our streets and backyards, with scientific studies of sea level rise forecasting much worse flooding in the years ahead. These changes are affecting our community, homes, businesses, infrastructure, and way of life, and demand that we act now.

To address this emergency, the Town of Corte Madera embarked on a two year process to develop a Climate Adaptation Assessment, which synthesizes new ideas and concepts with conclusions from prior regional reports and studies. The Assessment is essentially a roadmap, or a framework, to inform Town decisions relating to how our community adapts to climate change. Critically, it is a "living" document that will continue to be updated in collaboration with the community as we gain new information and as conditions change.

Each adaptation action or project identified in the Assessment is essentially an idea that has been analyzed by planners, scientists, and engineers at a "planning level," to begin to evaluate feasibility, effectiveness, costs, and benefits. It provides initial guidance to questions such as: How would a given action protect the town? How long would that protection last? How much would it likely cost? Is the action flexible and can it be modified or updated over time? This analysis will assist with informing next steps, priorities, and the choices that we make as a community. This Assessment is the first step toward protecting Corte Madera's future as a vibrant place to live and work.

The strategies discussed in this document are ideas, not shovel-ready projects, and this Climate Adaptation Assessment does not provide any "shortcuts" or "loopholes" on ideas that future Town Councils may wish to pursue. If implemented, actions discussed in this Assessment would still go through the full public process, such as including additional public notices, public hearings, public workshops, community discussions, public review by various boards and commissions, and compliance with the California Environmental Quality Act. Future Councils may also decide to not pursue certain ideas outlined in this assessment.

Our town is already on the front line of climate change. The issues we face are not new—from the devastating wildfires of the 19th century to the severe flooding of the '80's—but as climate change advances, our situation is growing markedly more dire. The scale of the challenge is monumental, but today, we still have the opportunity to take decisive and proactive measures that will help protect our beloved town. Now is the time for Corte Madera to be a leader in the region, through the development and implementation of meaningful, effective, robust, and equitable solutions to the climate emergency. Taking this first step on the road to resilience will not only help guide our efforts to protect the health and safety of our community, but will ultimately enhance everyday quality of life in our community.

We look forward to working collaboratively with all residents and relevant partners to further explore, develop, analyze, refine, and implement actions that will ensure a safe and prosperous future for Corte Madera. We all know that Corte Madera is a special place; that's why we choose to make it our home. The actions we take now, and over the coming years, will help ensure the long-term health, vitality, and resilience of our community.

Yours truly,

Eli Beckman
Mayor
Town of Corte Madera

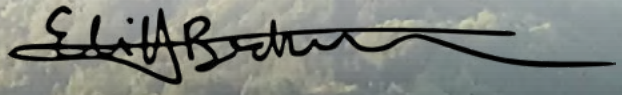
UNA CARTA DEL ALCADE

El clima global está cambiando y nosotros estamos sintiendo su impacto aquí mismo en Corte Madera. El riesgo permanente de incendios forestales sin control amenaza nuestras comunidades y el humo de incendios regionales hace que el aire que respiramos sea dañino. Asimismo, nuestras calles y jardines son inundados por tormentas y mareas de gran tamaño; estudios científicos sobre el aumento del nivel del mar indican que tendremos inundaciones más graves en los próximos años. Estos cambios afectan a nuestra comunidad, nuestros hogares, nuestros negocios, así como la infraestructura y nuestra forma de vida, lo que demanda que actuemos ya. Para atender esta emergencia, la Ciudad de Corte Madera se ha embarcado en un proceso de dos años para desarrollar un Evaluación de Adaptación Climática, que combina ideas y conceptos nuevos con reportes y estudios regionales anteriores. El evaluación es básicamente una hoja de ruta o un marco, para informar acerca de las decisiones de la Ciudad sobre cómo se adapta nuestra comunidad al cambio climático. Analizándolo, es un documento "vivo" que seguirá siendo actualizado en colaboración con la comunidad conforme vayamos obteniendo nueva información y conforme vayan cambiando las condiciones.

Cada acción o proyecto de adaptación identificado en el Evaluación es esencialmente una idea que ha sido analizada en su "etapa de planeación" por científicos, ingenieros y organizadores para empezar a evaluar su viabilidad, su eficacia, su costo y sus ventajas. Proporciona una guía inicial para preguntas como: ¿En qué forma protegería a la ciudad una determinada acción? ¿Cuánto duraría esa protección? ¿Cuál sería el costo aproximado? ¿Es flexible la acción y puede ser modificada o actualizada más adelante? Este análisis ayudará a informar sobre los siguientes pasos a seguir, las prioridades y las decisiones que tomamos como comunidad. Este evaluación es el primer paso para proteger el futuro de Corte Madera como un lugar dinámico en donde vivir y trabajar. Las estrategias analizadas en este documento son ideas, no proyectos inmediatos y este Evaluación de Adaptación Climática no ofrece ningún "atajo" o "vacío" sobre las ideas que próximos ayuntamientos quisieran seguir. De ser implementadas, las acciones incluidas en este Evaluación tendrían que seguir todo el proceso público, por ejemplo incluyendo avisos públicos adicionales, audiencias públicas, talleres públicos, debates comunitarios, revisión pública por diferentes juntas directivas y comisiones, y cumplir con la Ley de Calidad Ambiental de California (California Environmental Quality Act). Asimismo, futuros ayuntamientos podrían decidir no seguir algunas de las ideas esbozadas en este evaluación.

Nuestra ciudad se encuentra ya en la primera línea del cambio climático. Los retos que enfrentamos no son nuevos -desde los devastadores incendios forestales del siglo 19 hasta las graves inundaciones de la década de los años 80- pero conforme avanza el cambio climático, nuestra situación se está volviendo notoriamente más alarmante cada vez. La magnitud del reto es enorme, pero al día de hoy, todavía tenemos la oportunidad de tomar medidas decisivas, preventivas, que ayudarán a proteger a nuestra querida ciudad. Este es el momento de que Corte Madera se convierta en un líder en la región, mediante el desarrollo y la implementación de soluciones significativas, efectivas, sólidas y equitativas a la emergencia climática. Dar el primer paso en el camino a la resiliencia no sólo nos ayudará a guiar nuestros esfuerzos para proteger la salud de nuestra comunidad y su seguridad, sino que en última instancia ampliará la calidad de la vida diaria en nuestra comunidad. Estamos ansiosos por trabajar en colaboración con todos los residentes y socios relevantes para explorar, desarrollar, analizar, mejorar e implementar más a fondo acciones que aseguren un futuro seguro y próspero para Corte Madera. Todos sabemos que Corte Madera es un lugar especial: por eso lo escogimos como nuestro hogar. Las acciones que tomemos ahora y en los siguientes años nos ayudarán a asegurar a largo plazo la fortaleza, vitalidad y resiliencia de nuestra comunidad.

Sinceramente,



Eli Beckman
Alcalde
Ciudad de Corte Madera

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1855 watercolor painting of Mount Tamalpais by William McMurtrie.

1 planning for climate

change

The Town of Corte Madera offers its residents both scenic beauty and a high quality of life; however, like many California communities, the Town is already (and will continue to be) affected by climate change. To serve its residents, the Town must look forward and proactively explore options to build resilience for the whole community and diminish threats to Town residents' lives, property, and quality of life. This document advances that goal by describing the Town's vulnerabilities, describing potential tools to reduce those vulnerabilities, and providing a roadmap that can guide the Town's future investments over time. As new information about our changing climate and its local implications becomes available in the future, this document and the vulnerabilities, adaptation actions, and roadmap within it, must change and adapt as well. For more information on the Assessment, see Figure 1.2.

This Climate Adaptation Assessment is an essential next step in highlighting the real and present challenges facing the Town and laying out potential actions that can be taken to address these challenges and adapt to a changing climate.

There are many ways to complete the adaptation planning process. The California Governor's Office of Emergency Services recently updated the State's Adaptation Planning Guide and defines four key phases of adaptation planning[1] (*see Figure 1.1*): Phase 1 - Explore, Define, and Initiate; Phase 2 - Assess Vulnerability; Phase 3 - Define Adaptation Framework and Strategies; Phase 4 - Implement, Monitor, Evaluate, and Adjust.

Figure 1.1. The four phases of adaptation planning (Source: California Adaptation Planning Guide, 2020).

The Climate Adaptation Assessment is the core of Phase 3 in the adaptation planning process, building on and refining previous vulnerability assessment work across the Bay Area and identifying actions that could be further developed, evaluated, and eventually implemented. The Assessment was completed over two and a half years (January 2019 – May 2021); over the course of those months, Town leadership, Town staff, the Resilience Advisory Group (RAC), and hundreds of community members worked together to identify, refine, and customize the actions highlighted in this assessment.

What is the Corte Madera Climate Adaptation Assessment?		
This Assessment is...	**This Assessment isn't...**	**Details**
A Roadmap for Action	An Ordinance or Policy	This assessment is the next step on the journey to plan for climate change and enhance the resilience of our community. It lays out options the community can further consider and invest in overtime to help protect and prepare the community and the Town's infrastructure for the future.
A Toolbox of Potential Actions	A Commitment to Implement Individual Actions	This assessment contains a broad suite of potential actions from outreach and education to infrastructure projects and policies. No individual action, or set of actions, has been selected for implementation and the approval of this assessment does NOT constitute a commitment to implement any of the actions identified in the Assessment. Each action can be considered over time and will follow the Town's usual and customary approach to designing, developing, refining, and implementing actions as appropriate to the type of action.
An Initial Screening of Actions	Detailed Final Analysis of Alternatives	All evaluation of actions described in the Assessment, including any initial costs provided, were completed at a planning level only. The associated analysis of potential actions was designed to explore the effectiveness, efficiency, and feasibility in addressing the climate change challenges facing the community. Additional community engagement, technical, and policy analysis will be required before implementing any of the actions.
A Commitment to the Health, Safety, and Wellbeing of All Residents	Selective Investment in Individual Sectors or Neighborhoods	The Assessment reaffirms the Town's commitment to being stewards of public funds and working to support and enhance the wellbeing and quality of life of all residents. It provides information on the relative urgency of addressing different climate change challenges. Future actions by the community and Town leadership will help determine how best to invest funds, staff time, and resources to achieve the goals of the Town and help the community thrive for decades to come.

Figure 1.2. A visual chart highlighting what the Assessment is and is not.

The adaptation actions identified in this assessment are not final and require further analysis and additional community discussion.

These actions build on work happening across the Bay Area, the State of California, and the country and showcase a range of potential ideas for the Town that have been analyzed by the project team, Town staff, scientists, and engineers at the planning level. These actions are customized to Corte Madera and have been screened for effectiveness, efficiency, and feasibility (based on current conditions and best available science). In some cases, more detailed initial assessment of feasibility and costs were completed to better understand the potential alternatives and provide baseline information to build on in future stages of the planning process.

There will be many more steps to take over the next few years and coming decades, as the Town and the region continue to respond to an ever-changing physical, social, and political climate and as new and innovative ideas come to light. Before moving into the implementation phase in the adaptation planning process, most actions will require additional feasibility studies, environmental review, cost-benefit analyses, and/or customization and refinement. The Assessment does not provide any "shortcuts" or "loop-holes" in the public process, which, depending on the scale of each individual project, could include additional public notices, public hearings, public workshops and discussions with the community, public review by various boards and commissions, and compliance with the California Environmental Quality Act. Future Town Councils may also decide to not pursue certain ideas outlined in this assessment. Additional coordination with regional and state agencies and Town departments (in some cases over the next few years) will help determine the appropriateness, priority, and also the timing for implementing individual actions and various projects.

The actions highlighted in the plan are also not an exhaustive list of all potential options, nor are they a prescriptive list of final actions the Town has decided to implement. Instead, they represent a suite of actions the Town can use to address the climate crisis and move forward in its goal to adapt and become more resilient to future climate changes.

After final adoption of this assessment, aspects of this report may be referenced and incorporated into the Safety Element of the next General Plan update to embed climate adaptation planning into the Town's guiding planning document and meet California requirements to consider adaptation and resilience strategies in general plans.

The Town understands the urgency for action and adheres to the California Adaptation Planning Guide's principle that it is critical to:

> "Take immediate actions to reduce present and near future (within 20 years) climate change risks…while also thinking in the long term and responding to continual changes in climate, ecology, and economics using adaptive management that incorporates regular monitoring." (pg. 9)

The Town will determine the exact approach for implementation, evaluation, and monitoring individual actions as they are selected from this assessment and implemented. Actions can be taken through outreach and education, adjustments to the capital improvement plan, modifications to the Town Municipal Code, and integration into operational and maintenance policies and procedures. As the Town moves into the implementation phase, it is critical to: monitor and evaluate the success of the actions; continue to adapt, refine, and remain flexible; and ensure that community input and guidance remains a central component in the Town's efforts to reduce risk and enhance resilience. The Assessment is focused on near-term actions and strategies, but also identifies potential longer-term investments that could be further explored and lays out a common path to a resilient future.


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CORTE MADERA IN CONTEXT

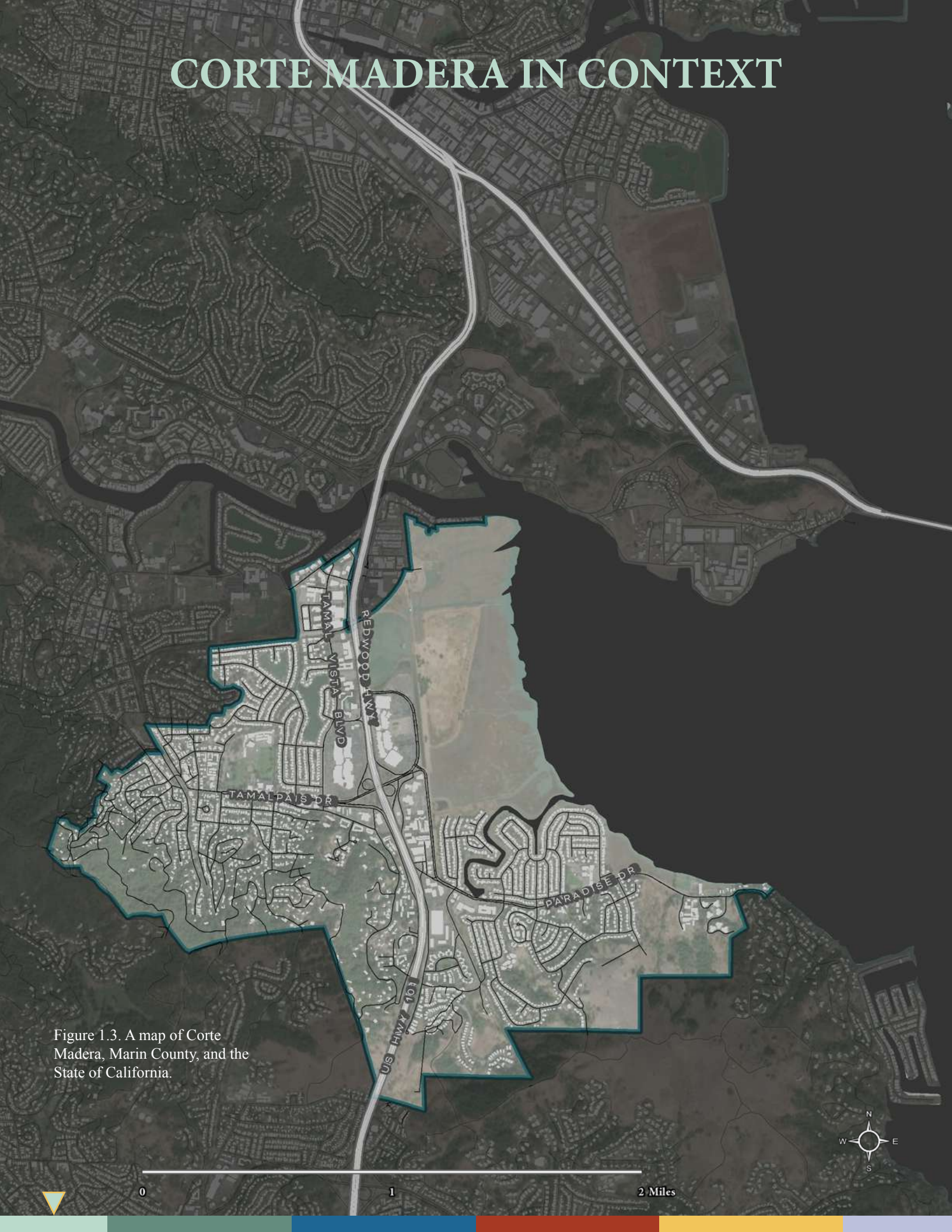
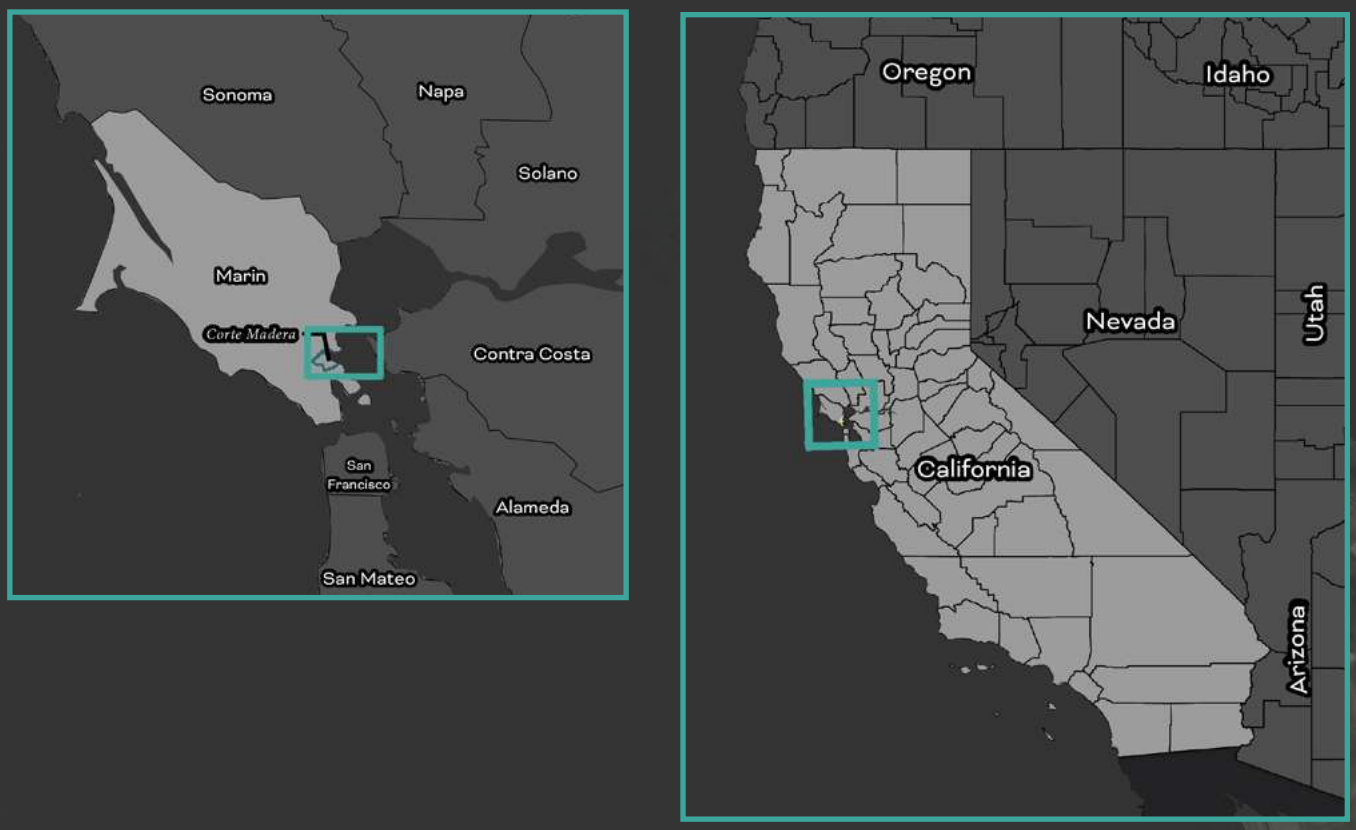


Figure 1.3. A map of Corte Madera, Marin County, and the State of California.



The Town of Corte Madera is a small community of 3,800 households and just under 10,000 residents in Marin County, California, located on the San Francisco Bay just north of San Francisco. The community is surrounded by similar small communities, including Larkspur, Mill Valley, and Tiburon. The residents are well-educated, with approximately 85% of adults with at least some college education, and the median household income is $134,000 a year.[2] While primarily a residential community, Corte Madera has a vibrant shopping and retail sector with two large, high-end retail shopping centers, as well as significant commercial office uses congregated along the Hwy 101 corridor.

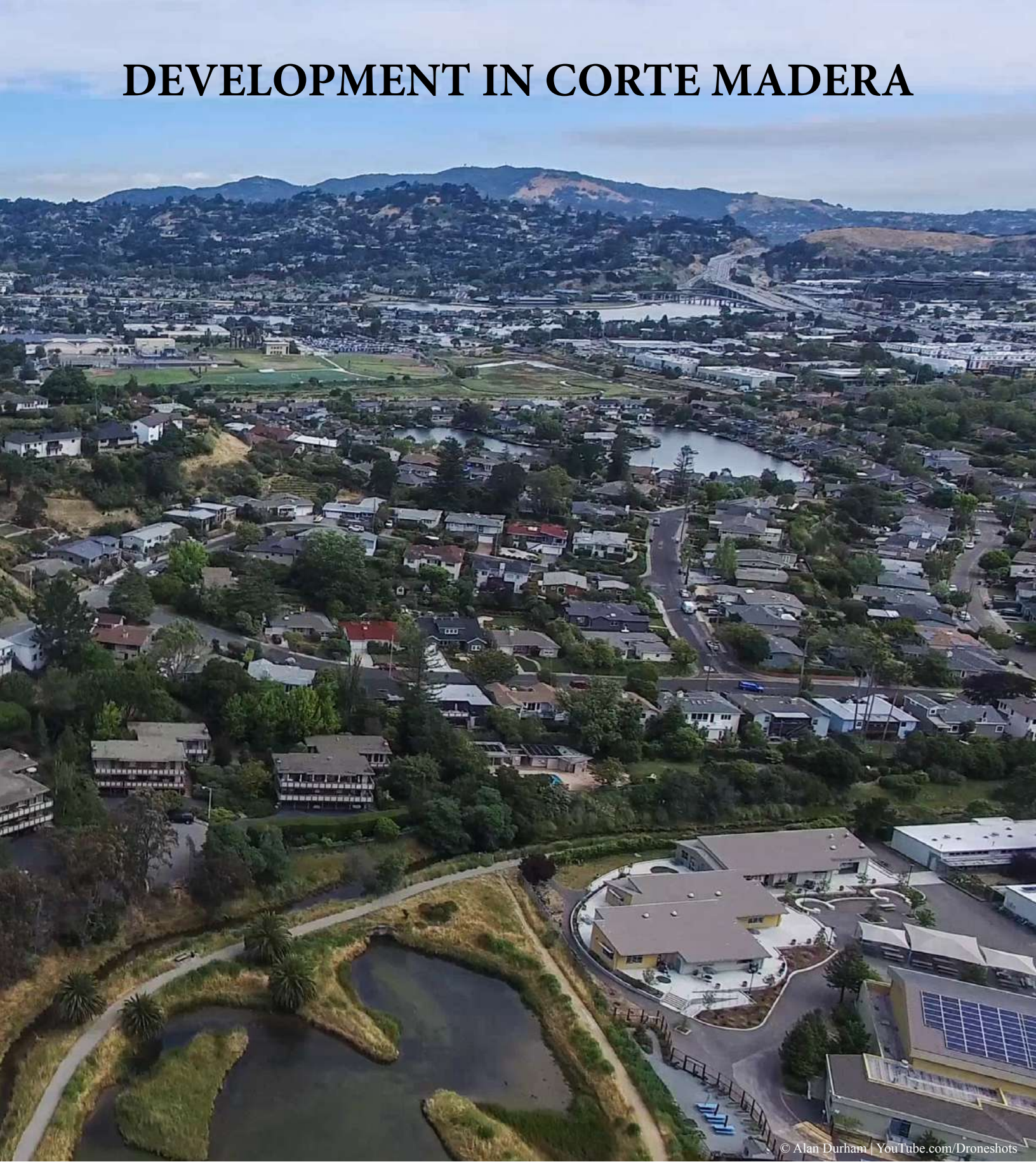
Residents have a strong sense of place and community and enjoy the “small town feel” that provides ample natural environments - woodlands to the west and the Bay to the east. Homes on the bay enjoy immediate access to kayaking, wildlife, and scenic views. Those in the hills have immediate access to hiking trails, urban pathways, and lush canopies of mixed oak, bay, and redwood trees. The town as a whole is connected by a regional bike trail and recreational areas that can be used most of the year.

Figure 1.4. Early development in Corte Madera in 1926. © Corte Madera Memories.

The history of development within the town is also a story of increasing climate vulnerability. Early development in the area occurred at the base of the hills on the drier, upland edges of the marsh. The railroad at the time roughly corresponds to what is now Highway 101, crossing the marshes and Corte Madera Creek. With the development of the Golden Gate Bridge and the post-WWII housing boom, there was a dramatic increase in homes and businesses in Corte Madera within the next few decades. Without strategic planning or strong policies in place to address this increased level of development, homes were built in the hillsides to accommodate the town's growth. As Mariner Cove and Marina Village were developed east of the railroad, levees were constructed to protect low-lying areas from flooding, and in other areas, fill was placed to raise the ground elevation under homes (*see Figure 1.5*).

Figure 1.5. Low-fill (A) and high-level fill development (B) progression from the 1960's in Corte Madera. © Corte Madera Memories.

DEVELOPMENT IN CORTE MADERA



Today, Corte Madera has a mix of neighborhoods both built up and into the hillsides and out along the bay. A legacy of preserved marshland is a significant asset for the community. Highway 101 passes through the center of the town, making it a key piece in the regional transportation network and providing easy access to the two shopping centers.

WHAT IS THE ASSESSMENT?

The Town received a grant from Caltrans in June 2018 to develop a Climate Adaptation Assessment. The Assessment was developed over two and a half years (January 2019 - May 2021). Over the course of the project, Town staff, the Resilience Advisory Committee (RAC), and community members worked together to develop the adaptation roadmap and list of potential actions in this assessment. The 22 members of the RAC included representatives from the Town Council, Town staff, the county, neighboring towns, non-profit organizations, state and regional entities, local businesses, and the school district. They brought a diverse range of technical and policy expertise to help inform the development of the Assessment. For more information about the members of the RAC, see the Acknowledgements section of this assessment.

Assessment Phases

The assessment was developed over five key phases (*see Figure 1.6*): Phase 1 - Laying the Foundation; Phase 2 - Engaging on Adaptation; Phase 3 - Exploring Adaptation Options; Phase 4 - Refining Adaptation Approaches; and, Phase 5 - Developing the Assessment. Each phase included a series of milestones accomplished by the planning team and community engagement was prioritized throughout.

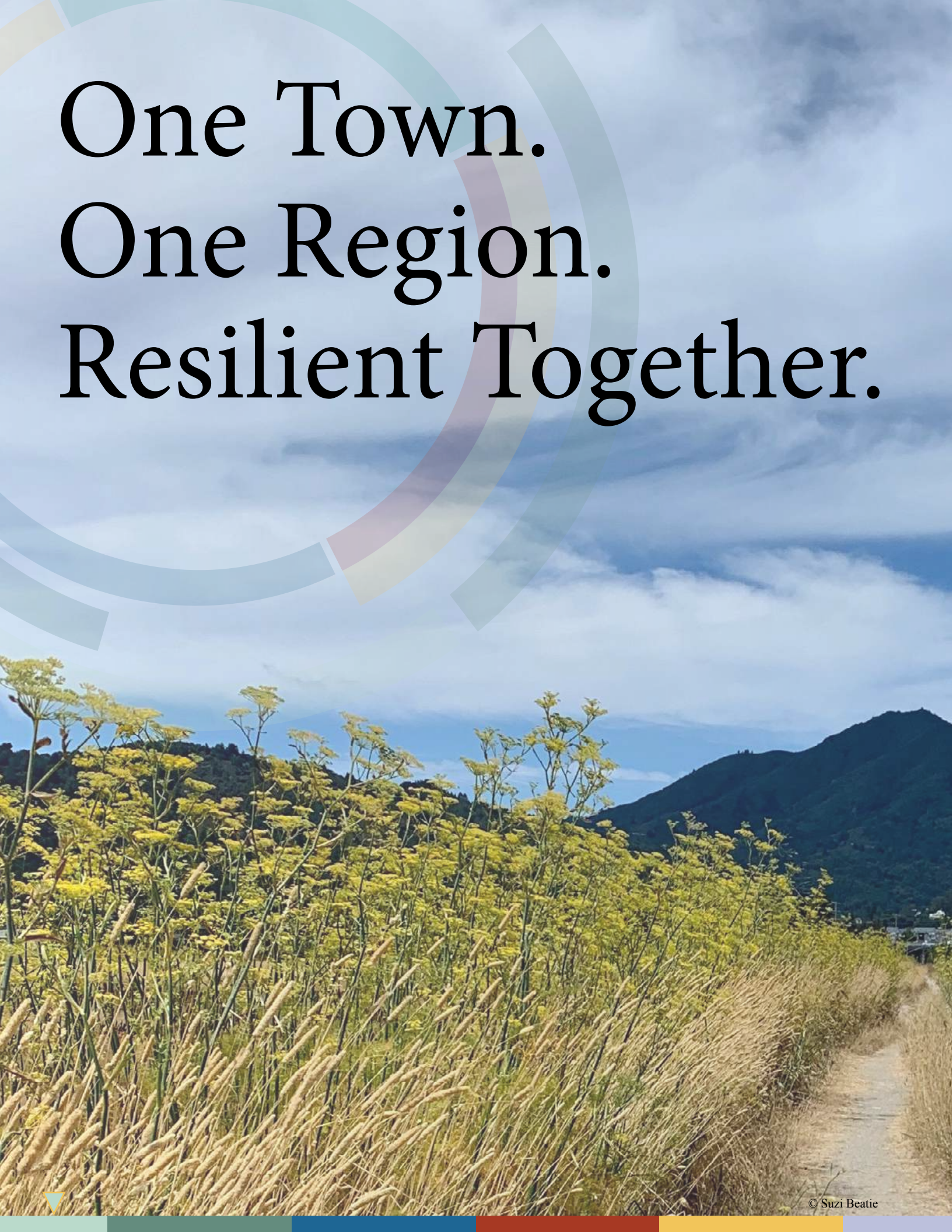
Figure 1.6. The five phases of the Corte Madera Climate Adaptation Assessment.

Guiding Principles

Resilience planning requires a broad-based, holistic, and interdisciplinary perspective that considers people, the environment, and local infrastructure. The health, vitality, and wellbeing of the community depends on all of these components seamlessly working together. Five guiding principles have helped inform the development of this assessment.

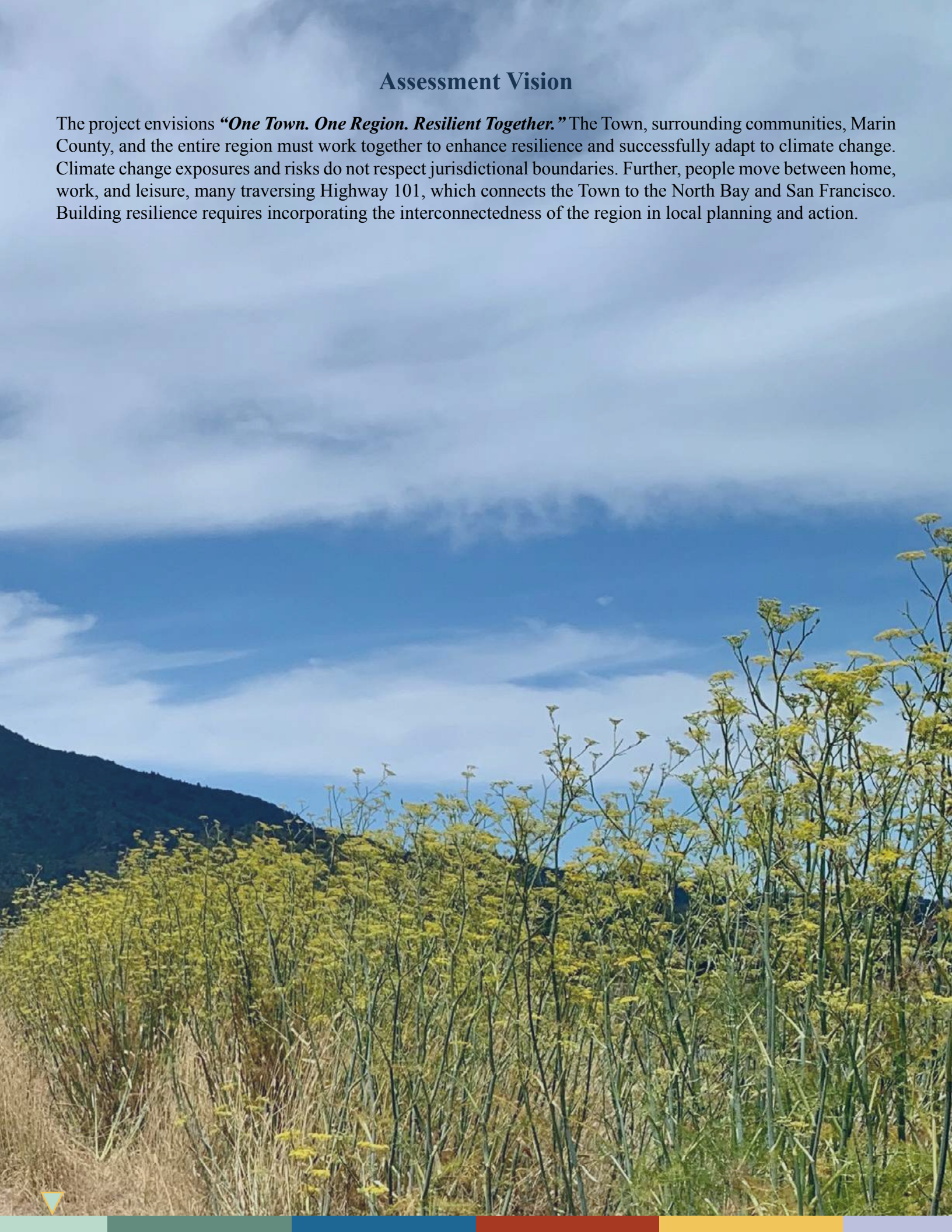
- **Now is the time for action.** While investments likely need to be phased in over time, the Town must move forward with the work required to further review, select, and implement resilience projects now. This assessment provides the details on an adaptation program for the near-term and a roadmap for the next few decades that can be used to guide the Town's actions and investments to support resilience.
- **Collaboration, networking, and learning are critical.** Adaptation is a process, not the outcome of a single project. Bringing together local and regional partners to develop solutions and learn from each other is critical to success. Having the right partners at the table will help design, fund, and implement solutions. This paradigm of collaboration permeates all aspects of this assessment and the work that the Town intends to do over the next three decades.
- **Investments in resilience should be cost effective and provide multiple benefits.** When balancing where and when to make investments, the Town will identify benefits provided by each investment. Ideally, these investments will be cost effective, and the values provided will be commensurate with the scale of the challenge and will enhance the resilience of the community as a whole, especially for those who have been historically marginalized and have fewer resources.
- **Flexible, nature-based solutions are preferred.** It is important to explore nature-based or hybrid adaptation solutions that both provide multiple benefits and can adapt (or be adapted) to changing conditions over time. These flexible solutions can be more cost-effective and scalable over time.
- **Taking the Long View.** Continued investments, attention, and commitment to the vision, goals, and actions of this assessment are needed to achieve success. This assessment should be reviewed and updated regularly, especially when conditions and scientific understanding changes or improves. The Corte Madera of the future may not look like it does today, and decisions made now will determine whether the Town will remain a vibrant and thriving community.

One Town.
One Region.
Resilient Together.



Assessment Vision

The project envisions ***"One Town. One Region. Resilient Together."*** The Town, surrounding communities, Marin County, and the entire region must work together to enhance resilience and successfully adapt to climate change. Climate change exposures and risks do not respect jurisdictional boundaries. Further, people move between home, work, and leisure, many traversing Highway 101, which connects the Town to the North Bay and San Francisco. Building resilience requires incorporating the interconnectedness of the region in local planning and action.



assessment goals

GOAL 1

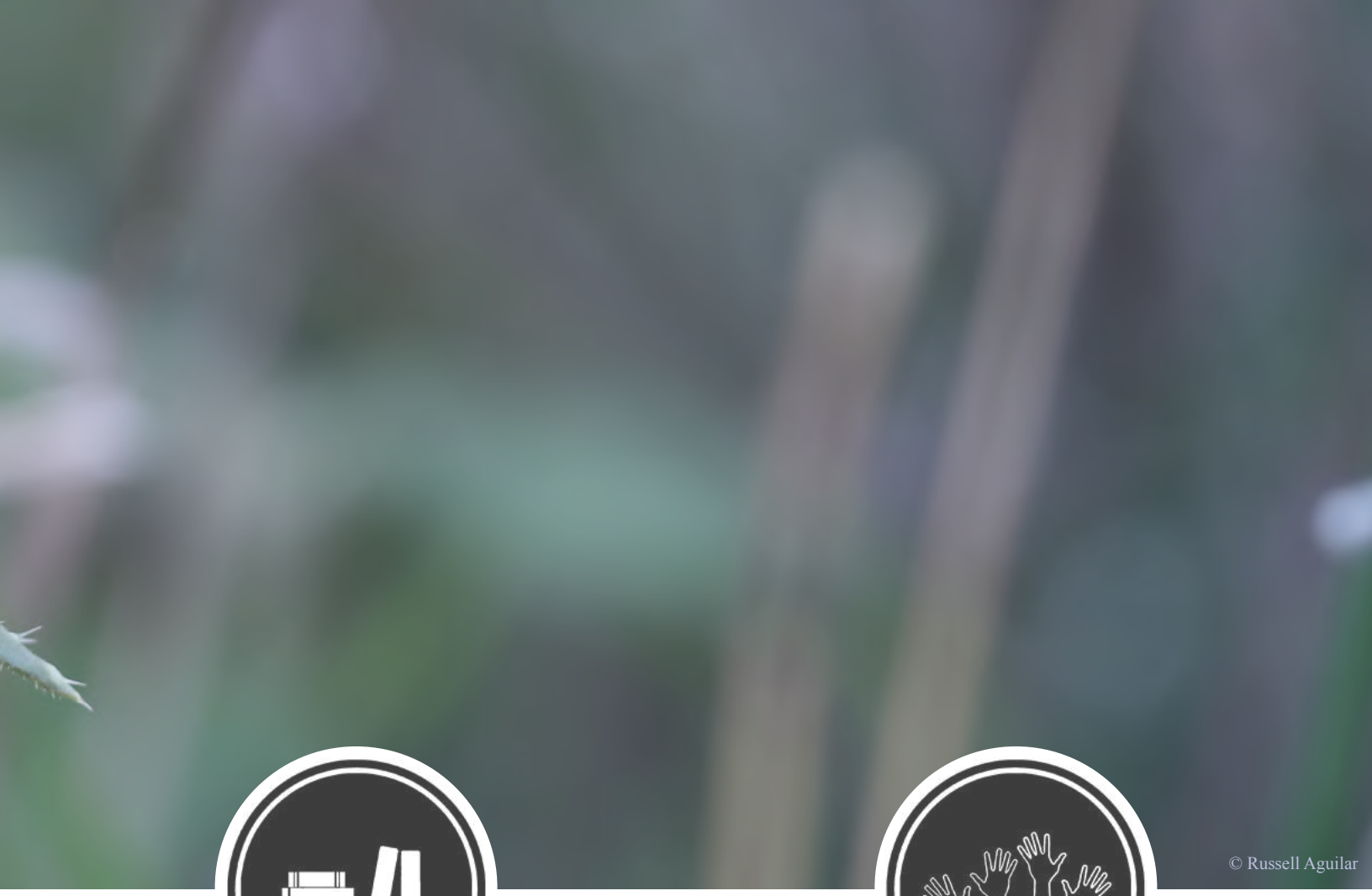
Protect the health, safety, and wellbeing of all Town residents, visitors, and workers by focusing on preparedness and prevention.

Protecting the health and safety of people, both now and in the future, includes supporting risk reduction, emergency preparedness, response, recovery, and improvements to everyday quality of life.

GOAL 2

Incorporate resilience and equity into all of the Town's plans, policies, and projects.

Historically disadvantaged and underserved members of the community experience the first and worst impacts of climate change. To successfully build resilience, actions must meet the needs of community members who face the greatest climate impacts with the least resources. Normalizing consideration of both climate change and equity in Town planning and actions is a crucial component of enhancing resilience.



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GOAL 3

Increase community awareness about the urgent need to take action and prepare for climate change.

An informed community can help create and implement strategic and effective solutions.

GOAL 4

Bring the community, neighboring towns, and the region together to plan and fund actions to build resilience.

Multi-jurisdictional collaboration requires effort and attention. This collaboration is critical to the success of the broader resilience initiatives.

ASSESSMENT APPROACH

Local and State Policy Context

The Town's goals and efforts to address climate change align closely with various state and regional adaptation and resilience policies. First, the Town's Adaptation Assessment follows the requirements for state agencies in California Executive Order (EO) B-30-15, a major backdrop for state and regional climate adaptation planning.[3] EO B-30-15 set new greenhouse gas emission reduction targets, required state agencies to integrate climate change into all planning and investment decisions, including accounting for current and future climate conditions in infrastructure investment.

Second, recent state law requires that each municipality and county include, in the Safety Element of its General Plan, "climate adaptation and resiliency strategies." The Safety Element must include a "vulnerability assessment that identifies the risks that climate change poses to the local jurisdiction," "a set of adaptation and resilience goals, policies, and objectives," and "a set of feasible implementation measures designed to carry out the goals, policies, and objectives."[4,5]

Finally, in order to receive certain types of non-emergency disaster assistance through the federal Hazard Mitigation Assistance Programs, local governments must adopt a hazard mitigation plan. Corte Madera adopted the Marin County Multi-Jurisdictional Local Hazard Mitigation Plan (LHMP), which includes all of the jurisdictions within Marin County, on September 17, 2019. The next update to the County Local Hazard Mitigation Plan, tentatively expected to be completed in early 2023, is also intended to address the state law requirements noted above in relation to the Safety Element of the Town's General Plan. The Town's strategies and actions identified in this Climate Adaptation Assessment will be an important resource in the development of the Marin County Multi-Jurisdictional LHMP update and/or the Town's own update to its Safety Element of the General Plan at a future time. At this time, the Town's adoption of the Adaptation Assessment is not intended to, nor does it, address state law requirements for updating the Safety Element of the Town's General Plan.

The Assessment also builds on the Town's Climate Action Plan, which addresses the effects of climate change by identifying Town actions to reduce greenhouse gas emissions, consistent with the state Sustainable Communities and Climate Protection Act.[6] Finally, this assessment is consistent with the goals of the Planning for Healthy Communities Act[7], which requires each local jurisdiction to adopt an environmental justice element or integrate environmental justice policies, objectives, and goals, through the other elements of the General Plan.

Building on Regional and County Assessments and Planning

This assessment builds on previous county-wide efforts, such as the Marin Bay Waterfront Adaptation Vulnerability Evaluation (BayWAVE).[8] BayWAVE is a major collaborative effort between the Town, County of Marin, cities, special districts, and others to develop a detailed vulnerability assessment that evaluates the extent of assets that could be impacted by sea level rise and coastal flooding. As a part of the BayWAVE project, the Town participated in the drafting of "Adaptation Land Use Planning: Guidance for Marin County Local Governments," which explores cross-jurisdictional sea level rise impacts and appropriate adaptation land use planning approaches that could be considered by multiple local governments and unincorporated areas.[9] BayWAVE informed the update to the Marin County Multi-jurisdictional Local Hazard Mitigation Plan, which as noted above, the Town adopted.

This Assessment's focus on the vulnerability and adaptive capacity of local transportation and infrastructure systems complements the Marin County Department of Public Works' Highway 1 Corridor project that examines adaptation options addressing sea level rise and current flooding at Highway 1 and on the Mill Valley-Sausalito Trail in Southern Marin. It also complements Caltrans and North Bay partner's State Route (SR) 37 Corridor Plan that proactively identifies possible adaptation opportunities for transportation networks and natural ecosystems for the SR 37 corridor.[10,11]

Future Regional Collaboration

The complex nature of land jurisdiction and ownership in and around Corte Madera highlights the need to focus on collaborative approaches to monitoring, implementing, and evaluating any and all adaptation work. Oftentimes, different areas are governed by overlapping regulatory jurisdictions and require coordination for project planning, permitting, and development.

Below is a list of agencies and municipalities who will likely need to be consulted or involved in future adaptation planning:

- City of Larkspur
- City of Mill Valley
- Town of Tiburon
- County of Marin
- Central Marin Fire Department (CMFD)
- Central Marin Police Department (CMPD)
- Marin Wildfire Prevention Authority (MWPA)
- Marin County Open Space District
- Pacific Gas & Electric (PG&E)
- Sonoma-Marin Rail Transit (SMART) District
- San Francisco Bay Conservation and Development Commission (BCDC)
- Transportation Authority of Marin (TAM)
- Golden Gate Bridge, Highway, and Transportation District (GGBHTD)
- Marin Audubon Society
- California Department of Fish and Wildlife (CDFW)
- Association of Bay Area Governments (ABAG)
- Regional Water Quality Control Board, San Francisco Region
- United States Army Corps of Engineers (USACE)
- National Marine Fisheries Service (NMFS)
- Federal Emergency Management Agency (FEMA)

For more detailed information on adaptation projects happening in the Bay area, check out the Bay Area Climate Adaptation Network (BayCAN) website where you can learn about the hundreds of projects and programs being spearheaded by BayCAN members to address sea level rise, wildfires, extreme heat, drought, and other climate impacts.[12]

Stakeholder Engagement Process

Stakeholder engagement was a central component of developing this Assessment. Participants included staff from various Town departments, local and regional organizations, environmental stakeholder groups, businesses, and homeowners. There were three levels of engagement:

- Community-wide activities appropriate for all members of the general public and other stakeholders;
- Partner meetings designed to gather and vet ideas with special interest groups and invested stakeholders such as CalTrans and the County of Marin; and,
- The Resilience Advisory Committee – a Representative community and technical advisory committee with individuals from the Town, businesses, the school district, and county and regional agencies.

The Town developed an outreach and engagement plan to solicit broad participation in the planning process. The Outreach Plan outlined a range of activities and timeframes for stakeholder engagement activities. To help increase engagement, the Town offered multiple methods of feedback and learning opportunities for community members. It should be noted that the COVID-19 pandemic significantly impacted these planned activities, and all engagement activities after March of 2020 were held virtually. The stakeholder engagement graphic on the following page illustrates the general timeline and type of activities that were held.

- **Community-wide activities** included six workshops, four of which were online due to COVID-19, a project website (www.cortemaderaadapts.org), an online survey, newsletter and media outreach, a "storymap" detailing existing plans and projects (700+ views), and a community feedback survey.
- The **Resilience Advisory Committee** met six times throughout the project to review technical information and refine questions and materials designed to collect effective community feedback.
- The **Town Staff and Partners** met at several key junctions to inform the existing social, environmental, economic conditions within the town and provide feedback on, and recommendations for, potential projects and strategies.
- Town Staff presented to the **Marin BayWAVE Steering Committee and the Town of Corte Madera Flood Control Board** multiple times.
- The **Town Council** was updated on progress throughout the process.

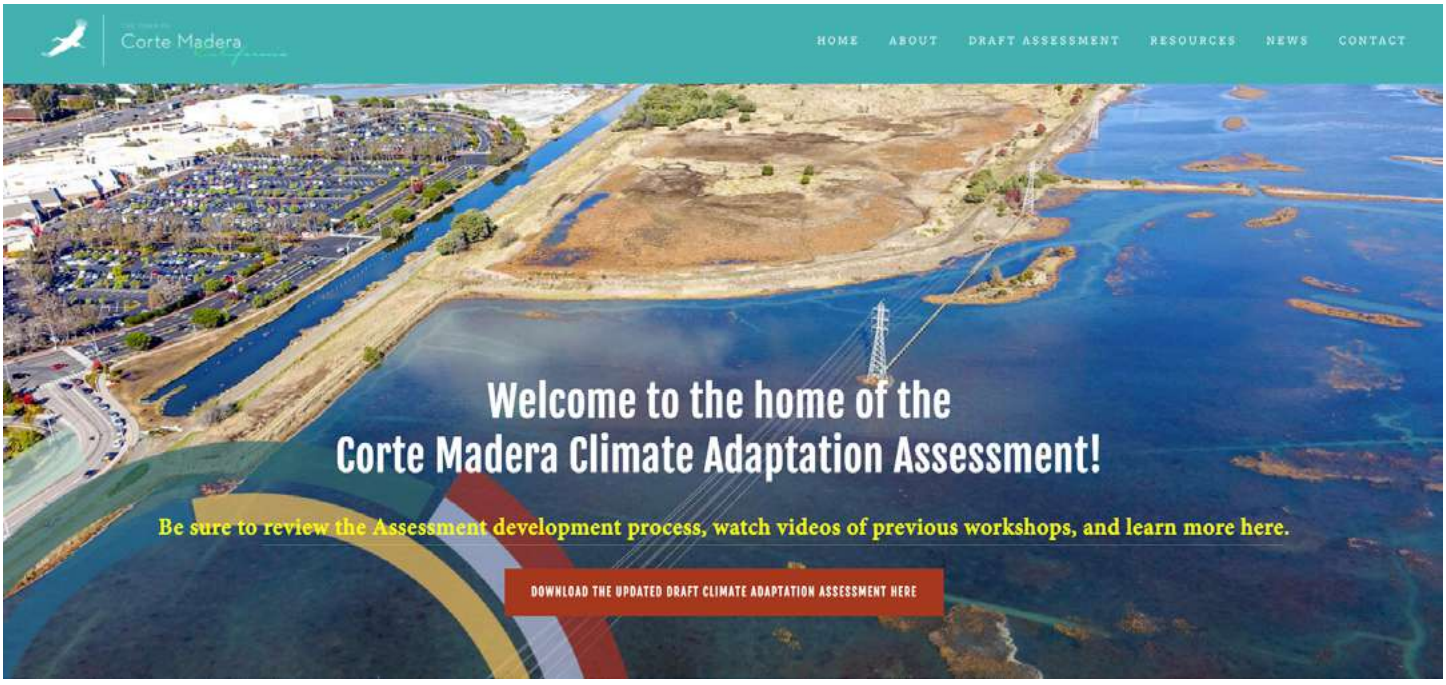


Figure 1.7. A screenshot of the landing page on the Corte Madera Adapts website.

Stakeholder Engagement Timeline

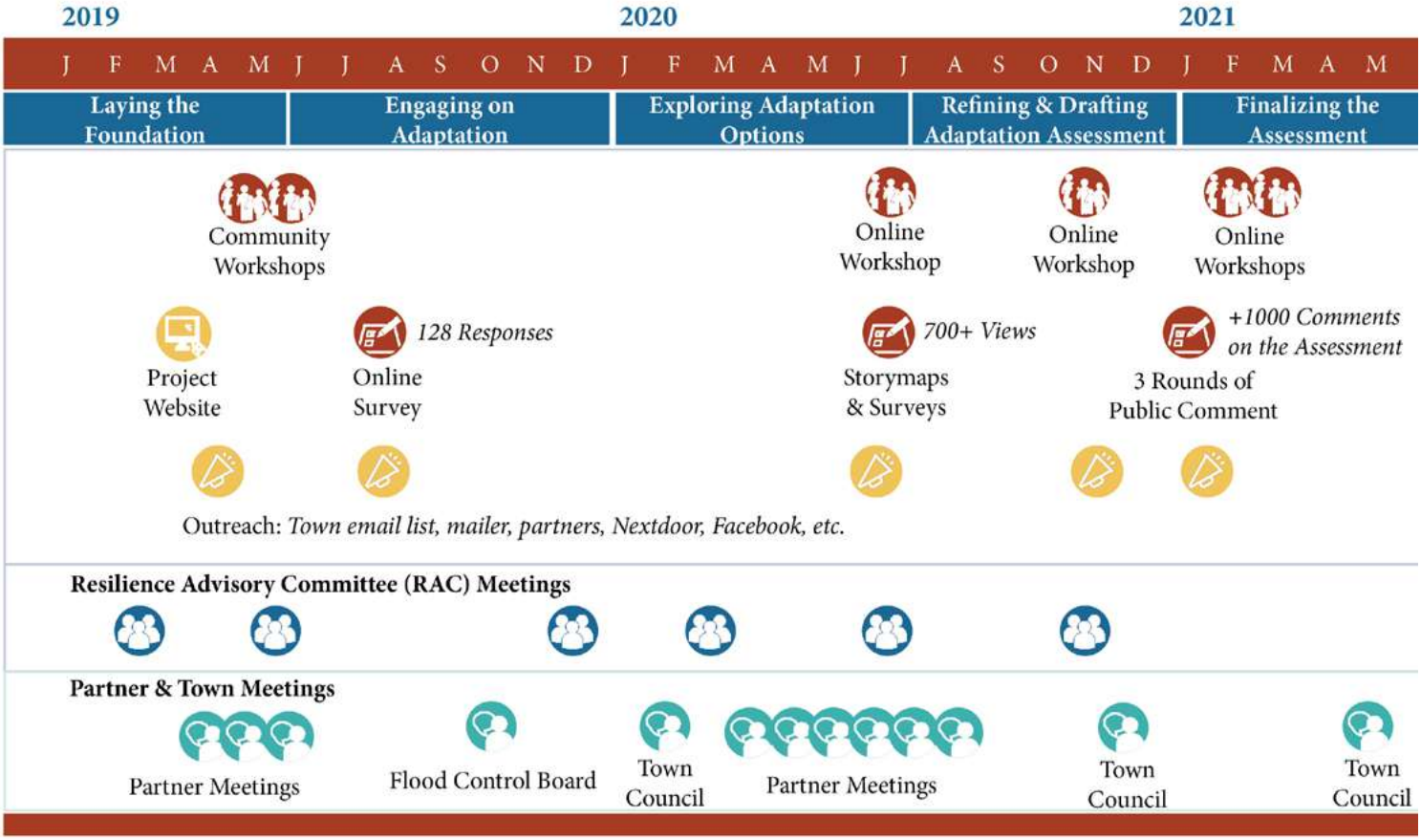


Figure 1.8. A high-level overview of the stakeholder engagement activities and timeline for the Assessment.

Figure 1.9. RAC meeting, February 2019 in the Town of Corte Madera council chambers. © Sascha Petersen

Understanding Town and Community Values

This community engagement process demonstrated that Corte Maderans are proud of their Town, love the "small town feel" and proximity to nature, and recognize their responsibility to be proactive in response to the climate crisis.

In the initial phase of this project, the project team conducted a survey that received 128 responses. Of the total respondents, 72% were very concerned about climate change and 90% thought that climate change was either already affecting the community or would affect the community in the next 10 years. The top three concerns of respondents (identified by the number of people who ranked the issues as something they were "very concerned" or "concerned" about) were wildfires, sea level rise, and flooding from heavy rainfall. More than 50% of respondents felt that it was important to ensure that critical services and community members were resilient.

Adaptation Actions

As part of the adaptation assessment process, the project team collected potentially relevant adaptation actions from discussions with Town staff, community member input, conversations with organizations and agencies around the region, other community adaptation plans in the State of California, and from communities across the country. These actions were then customized to fit Corte Madera's needs and were reviewed by Town staff and local experts. The compiled actions fall into three main categories of policies, programs and projects.

- ***Policies:*** Locally adopted laws, rules, and procedures can provide a foundation for a more resilient town. Policies are vetted through the Town Council.
- ***Programs:*** The Town and its partners can develop, maintain, and implement a range of programs that can bring the community together, solidify a commitment to resilience, and offer the critical human component to fighting the climate crises.
- ***Projects:*** Some of the Town's most critical adaptation solutions will require changes to the physical environment or infrastructure. Often these efforts take more time and investment from the Town.

Much like how multiple cords braided together create a stronger rope, braiding programs, policies, and projects together creates a stronger, longer-lasting, and more effective effort to build resilience (*see Figure 1.8*).

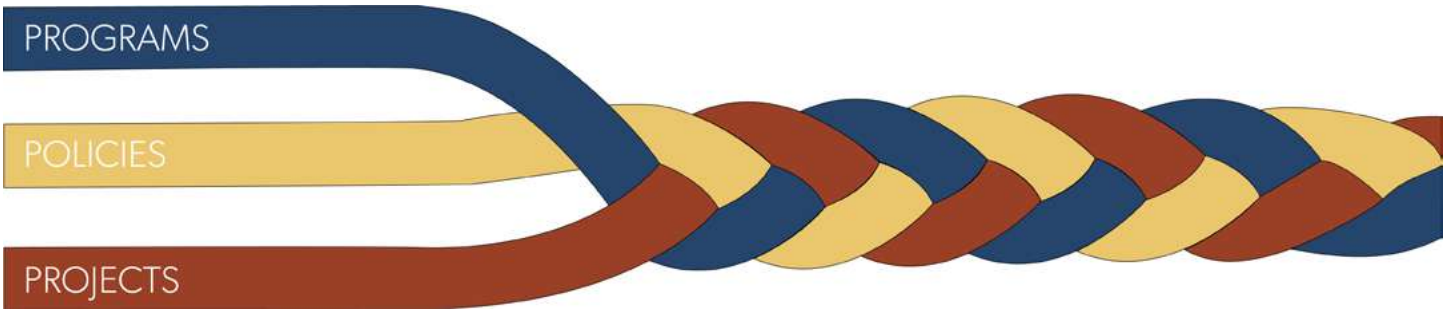


Figure 1.10. A graphic representing how policies, programs, and projects can be braided together to strengthen the Town's efforts to build resilience.

Evaluating Adaptation Actions

The evaluation process used to identify high priority actions is based on the United States Agency for International Development (USAID) framework for evaluating adaptation options.[13] Figure 1.9 illustrates the evaluation process, different screening "tiers," and possible outcomes. The Tier 1 screening focuses on a quick assessment of cost, feasibility, and effectiveness of the adaptation options being considered in light of the Town's goals and needs. Actions that are not discarded based on this screening are reviewed in more depth and rated across three evaluation criteria: effectiveness, efficiency, and feasibility in Tier 2. Actions that score well across all three criteria are particularly relevant and a great fit for the Town. These actions are moved to the final customized list of actions. Adaptation actions, or groups of actions, that need additional detailed evaluation or further comparison are passed through the Tier 3 screening process. This detailed analysis focuses on initial cost estimates, feasibility in specified locations, and the effectiveness of selected alternative investments. *For more information on the process, see Appendix C.*

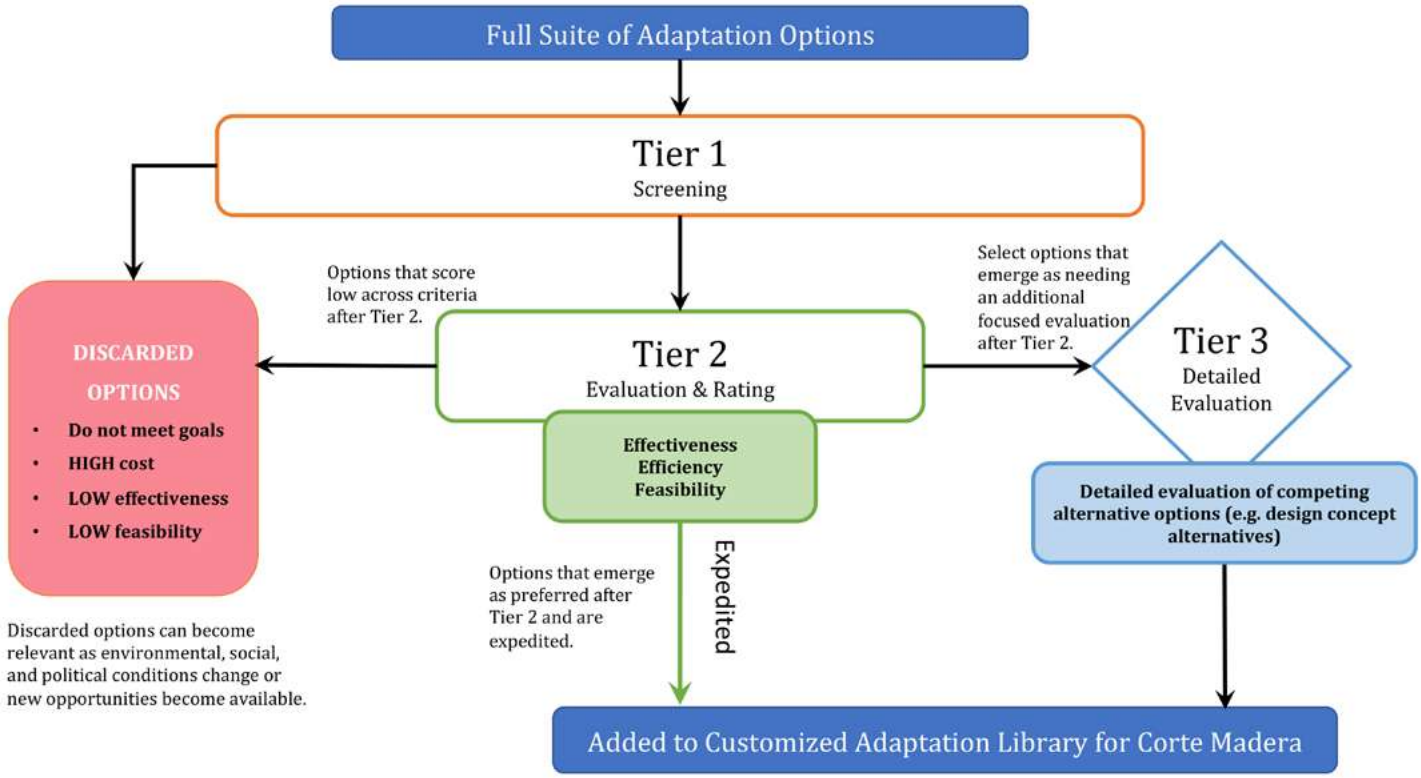


Figure 1.11. This figure illustrates the evaluation process for adaptation actions through Tier 1, Tier 2, and possibly Tier 3 screening.

Adaptation Action Evaluation Criteria

In the Tier 2 screening process, each action was scored 1-5 for each of the three main criteria to determine relative rankings for individual actions. These criteria were selected based on the Town's input, published literature, State-wide adaptation and resilience efforts, and leading examples of resilience work in other parts of the world.[14,15]

Effectiveness: ***The extent to which the action achieves the desired outcomes.*** The criterion considers how well the actions limits the short- and long-term impacts of climate change, the ability of the action to help meet the Town's goals, how well it prepares the town for the future, and whether it is commensurate with the exposure and the need.

Efficiency: ***The extent to which the action makes efficient use of resources including funding, expertise, and staff time.*** This criterion considers whether the direct, indirect, and external costs of implementing the action are balanced by the community, social, environmental, and economic benefits and whether it is equitable to all residents.

Feasibility: ***The extent to which the action can successfully be implemented.*** The extent to which the action can successfully be implemented. This criterion considers whether an action can actually be implemented and whether there is the current specific institutional, technical, community, and political setting and characteristics to be successful.

Adaptation Pathways Approach to Planning

Planning for climate change requires a shift in traditional planning approaches and the consideration of multiple possible outcomes and pathways to reach these desired outcomes. The adaptation pathway approach to planning can help local governments plan for multiple potential futures with differing environmental, social, and economic conditions. Additionally, the pathways approach helps address uncertainty by exploring the robustness, flexibility, and feasibility of various adaptation alternatives across multiple temporal and spatial scales and environmental conditions.

The timeframe for planning and implementing different adaptation strategies varies greatly across strategies and locations. For example, the time to plan, permit, design, and build a levee takes much longer than it does to implement a change in building code or municipal ordinance. While some adaptation actions highlighted in the assessment can stand alone, many of them are most effective when implemented concurrently with other actions. Some actions are contingent on particular decisions and are only effective if implemented before or after other actions. It can be important to identify "triggers" and "thresholds" associated with certain pathways or individual actions that can determine when a policy or project will become ineffective or critical decisions need to be made. Certain actions may only be effective for a discrete period of time or until particular environmental conditions are met or exceeded. For example, a levee may protect infrastructure until a particular amount of sea level rise, at which point it may be overtopped during an extreme storm event.

The main function of the adaptation pathway approach is to develop strategies that are robust for the most likely future scenarios and/or can be modified or adjusted at key junctures in the future. It is essential to identify in advance how these changes would be implemented and when these changes would need to occur.[16] This approach can help the Town plan for, prioritize, and stagger investment.

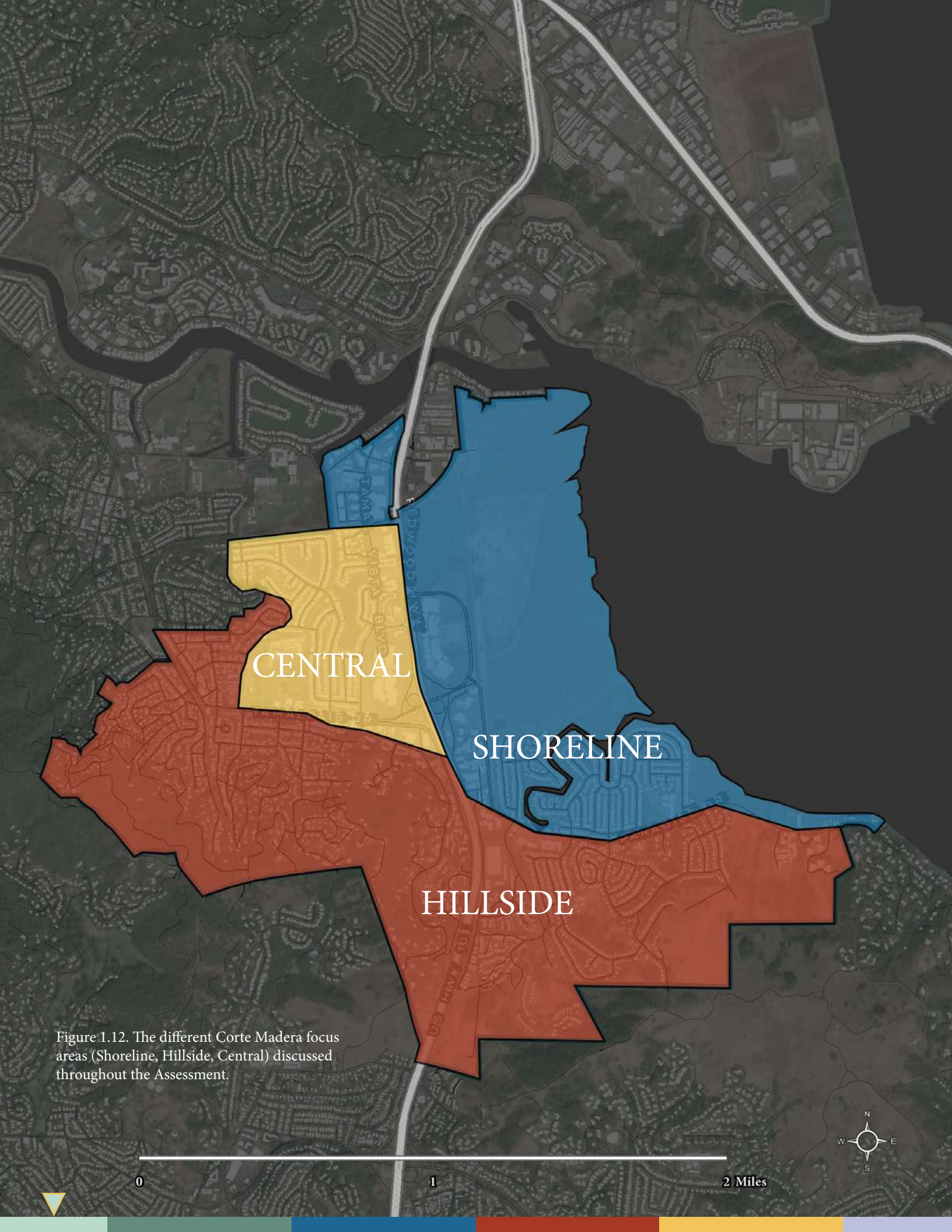
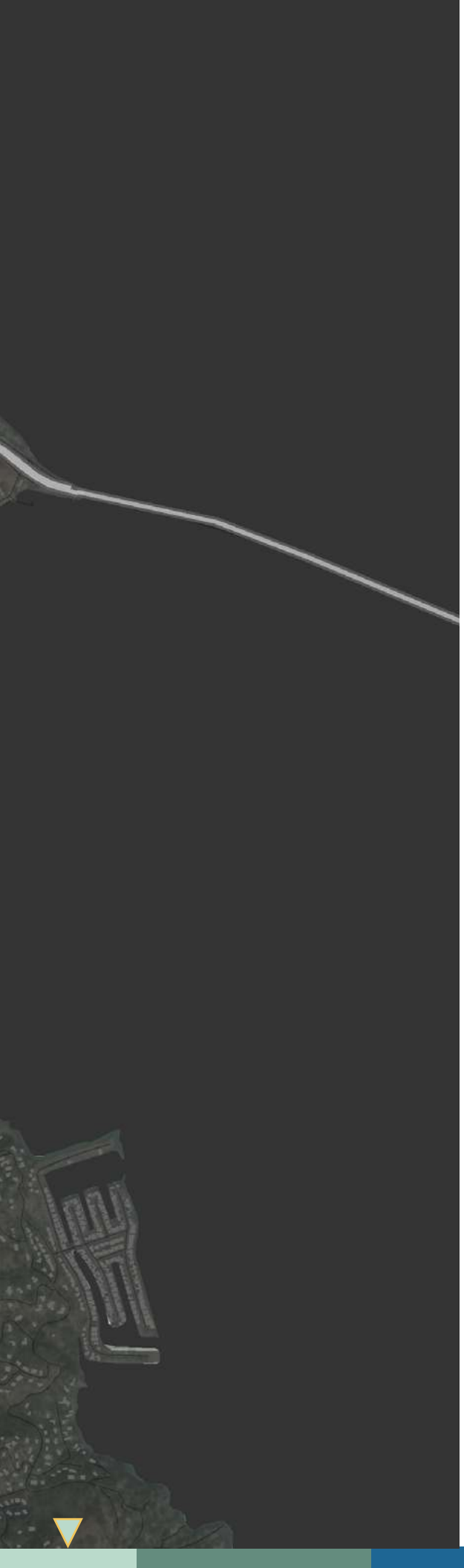


Figure 1.12. The different Corte Madera focus areas (Shoreline, Hillside, Central) discussed throughout the Assessment.



Strategic Planning in Corte Madera

Adaptation and resilience planning in Corte Madera requires a long-term, cross-sectoral, and multi-layered approach. While some actions will need to be taken in specific locations, many others will need to be implemented with the whole community in mind. The subsequent sections of the report focus on specific climate exposures that are particularly relevant to the hillside, shoreline, and central Corte Madera focus areas of the town. These location-hazard pairs (hillside-wildfire, shoreline-coastal flooding, and central-inland flooding) allow for detailed consideration of the exposures and concerns specific to each area. The Town as a whole faces an interrelated mixture of climate exposures (*see pages 27 - 38 for more information*), therefore the full suite of adaptation actions, and actions highlighted in the following sections of this assessment, were chosen to address specific hazards more broadly, and in some cases, help the Town address multiple hazards at the same time.

Adaptation actions highlighted in each focus area (*see Figure 1.12*) are nested within groupings of action and are described in more detail in the respective sections of the assessment.

Town-wide (pages 39 - 58):
1) Health and Wellness (pages 43 - 46)
2) Emergency Preparedness (pages 47 - 52)
3) Resilient Infrastructure (pages 53 - 56)
4) Education and Collaboration (pages 57 - 58)

The Shoreline (pages 59 - 92):
1) Accommodation (pages 75 - 80)
2) Protection (Engineered Infrastructure) (pages 81 - 82)
3) Protection (Nature-based and Hybrid Adaptation) (pages 83 - 91)

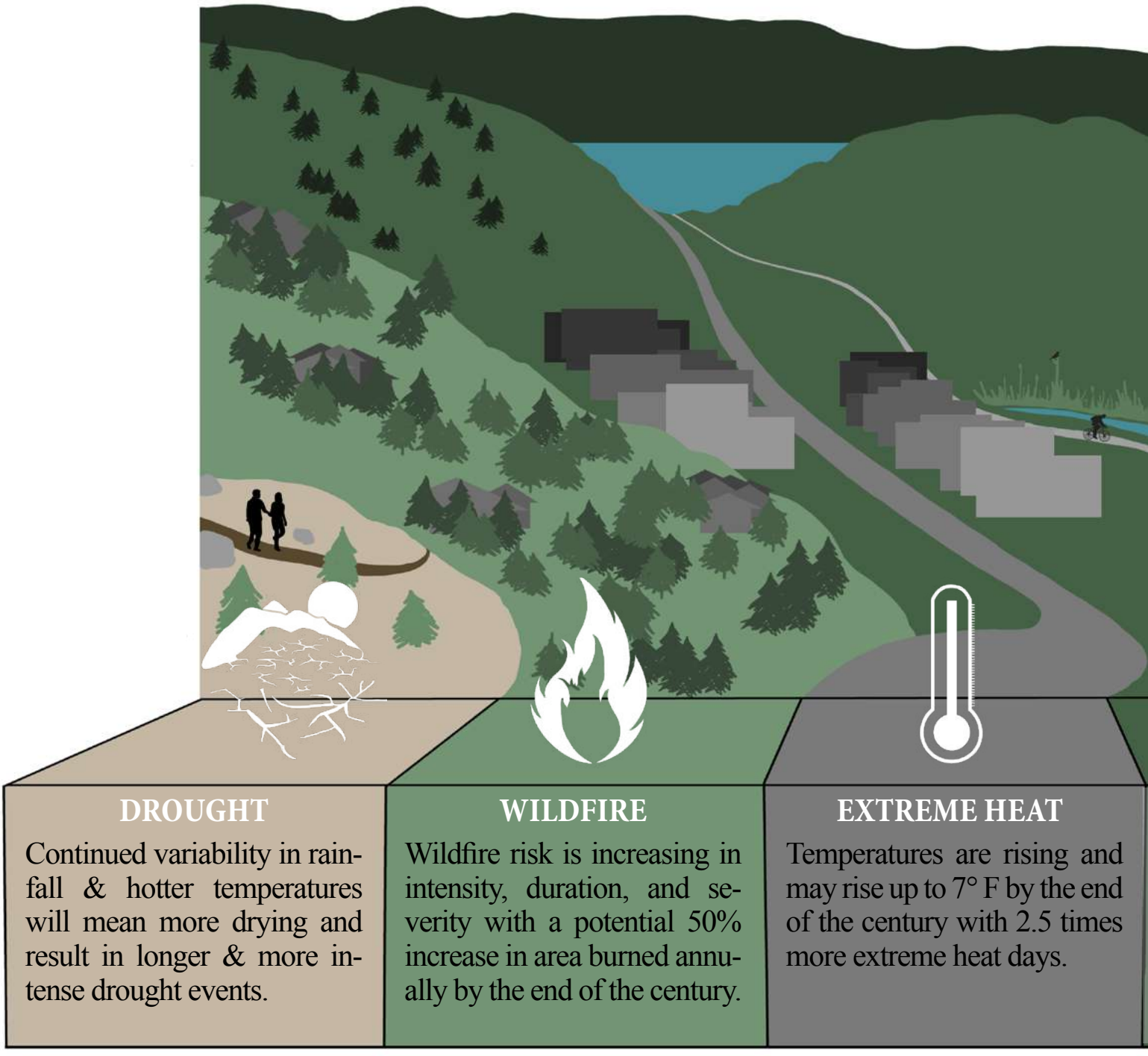
The Hillside (pages 93 - 122):
1) Wildfire Risk Mitigation (pages 97 - 106)
2) Evacuation (pages 107 - 116)
3) Protection (pages 117 - 120)
4) Education and Collaboration (pages 121 - 122)

Central Corte Madera (pages 123 - 134):
1) Collaboration (pages 127 - 128)
2) Prevention (pages 129 - 134)

The actions highlighted in this report represent a subset of a broader suite of adaptation actions that scored highly based on their potential effectiveness, efficiency, and feasibility for the Town. These actions (*see the full suite of actions in Appendix B*) provides the Town with a list of many of the most appropriate options to consider. ***It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented.***

CLIMATE CHANGE AND CORTE MADERA

The Town of Corte Madera is already experiencing the effects of climate change, and projections indicate that these impacts will continue to worsen throughout the century. This increase in climate impacts poses significant immediate, medium-term, and long-term risks to the community's health, safety, economy, ecosystems, and infrastructure. According to the California Climate Assessment, the Bay Area's average annual maximum temperature has increased by 1.7 degrees Fahrenheit from 1950 to 2005 and will continue to increase creating a cascade of additional impacts that vary in severity, scale, certainty, and timing including the immediate and unpredictable risk of wildfire and the long-term and unavoidable sea level rise.[17]



DROUGHT

Continued variability in rainfall & hotter temperatures will mean more drying and result in longer & more intense drought events.

WILDFIRE

Wildfire risk is increasing in intensity, duration, and severity with a potential 50% increase in area burned annually by the end of the century.

EXTREME HEAT

Temperatures are rising and may rise up to 7° F by the end of the century with 2.5 times more extreme heat days.

Climate vulnerability is dependent on three key factors: climate exposure, sensitivity, and adaptive capacity.[18,19] The way these components interact determines the vulnerability of the people, assets, and ecosystems at risk.

- ***Climate Exposure*** - an extreme weather event or changing climate condition that can adversely affect people, livelihoods, species, ecosystems, environmental functions, services, resources, infrastructure and economic, social, and cultural assets.
- ***Sensitivity*** - the degree to which one of these components is affected by a climate exposure.
- ***Adaptive Capacity*** - the ability to adjust to potential impacts, take advantage of opportunities, and respond to climate exposures.
- ***Vulnerability*** - the degree to which something is susceptible to the adverse effects of climate change.

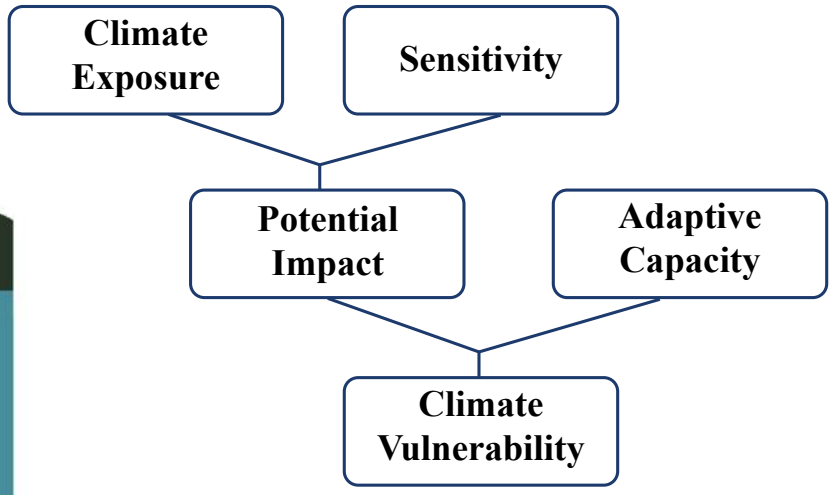


Figure 1.13. A graphic representation of the relationships between components that define climate vulnerability.

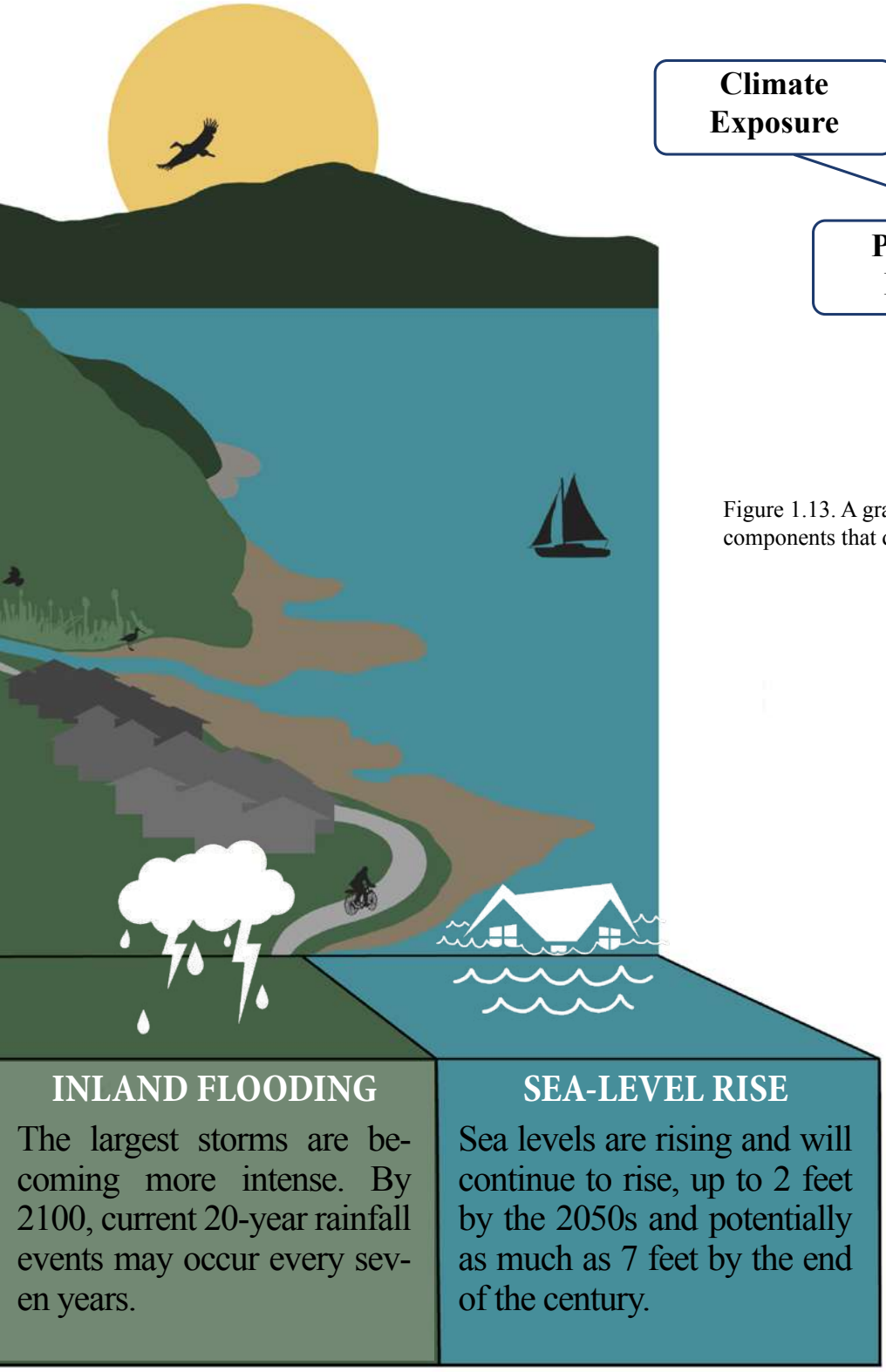


Figure 1.14. Climate exposures summary for Corte Madera. Climate projections are based on the higher climate change scenario (RCP 8.5) and medium-high risk aversion sea level rise scenarios.

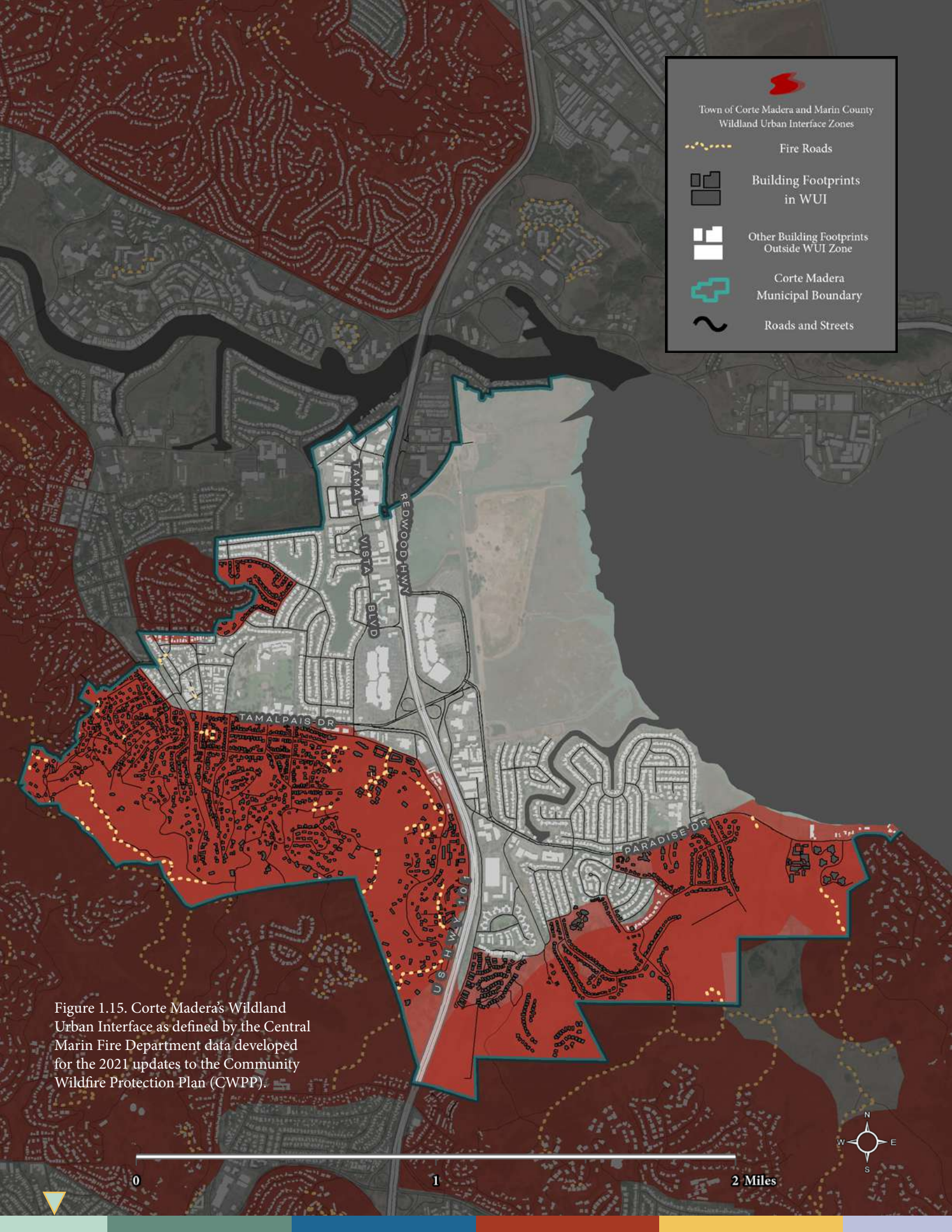


Figure 1.15. Corte Madera's Wildland Urban Interface as defined by the Central Marin Fire Department data developed for the 2021 updates to the Community Wildfire Protection Plan (CWPP).

Wildfire

In 2017-2018, California experienced its most deadly and catastrophic wildfire season in history to date. Since that time, it has only gotten worse. Of the 20 largest wildfires in California history, five burned in 2020.[20] In 2020 alone, over 8,500 wildfires statewide burned more than four million acres and California experienced its first "Gigafire," a term used to denote a wildfire that burned over one million acres (the August Complex Fire).[21] In the past few decades, there has been a significant increase in the number of wildfire ignitions, acres burned, and harmful impacts to humans and ecosystems in California.[22] Fires are becoming hotter, more severe, and more deadly.[23] Recent studies suggest that climate change has rendered the concept of a "fire season" in California obsolete — major wildfires can happen at any time throughout the year and areas previously considered to be low-risk can experience major wildfires. A 2019 study[24] showed that, due to changes in the North Pacific jet stream, the correlation between winter rainfall and the severity of the fire season can no longer be made.[25] In addition, according to the California Climate Assessment, the average area burned statewide could increase 77% by 2100 if greenhouse emissions continue to rise.[26] Wildfire risk in Corte Madera is significant due to several important factors: its unique climatic, topographic, and geologic attributes; ongoing longer and more severe droughts; current and historical fire-suppression policy in California; County-level environmental policies that support vegetation growth in Marin County;[27] population growth in the Wildland Urban Interface (WUI); and, the exacerbation of the frequency, intensity, and severity of wildfires across California due to climate change.[28] Wildfires are also exacerbated by factors such as a reduction in annual snowpack, decreasing water supply, and rising temperatures across the region. A wildfire in the Corte Madera community would put lives at risk and likely destroy homes and other infrastructure. Additional adverse impacts to the Town include poor to hazardous air quality, public safety power shutoffs (PSPS), and economic impacts from reduced retail visits. Research shows that there is a limited projected increase in the fire risk for Corte Madera until 2050 but a large increase in fire risk between 2050 and 2085. In addition to hotter and drier conditions, offshore winds (especially in the fall) drive even more dangerous and persistent wildfire conditions (*see the Hillside section - pages 93 - 122 for more information*). In addition, for more information on the GIS methods used to create this map, see Appendix D.

Sea Level Rise

Over time, sea level rise (SLR) has the potential to greatly impact the lives of Corte Maderans. Increases in bay water levels will intensify wave action on existing levees and marsh edges, potentially leading to the overtopping of the levees and increasing marsh erosion rates.[29] While these are long-term challenges with somewhat uncertain timing, the Town can begin to plan for ways to address these issues, prevent damage to the community in the future, and allow for Corte Maderans to continue thriving.

The risk of flooding from the Bay depends on the height of the land relative to the height of water in the Bay. The extreme water levels are a combination of tides, storm surges, and sea-level rise; the land elevation is dependent on tectonic movement, compaction, and subsidence of Bay Mud, and, where open to the tides, sediment deposition on marshes. Much of the Corte Madera shoreline infrastructure is settling because it was built on fill over very deep Bay Mud that is consolidating (compressing in volume); this is causing land subsidence and lowering the elevation of bayside neighborhoods relative to water levels in the Bay.[30] Today's coastal flooding is determined by the water level above usual high tides (referred to as mean higher high water, MHHW), and storm surges that can add as much as 3 feet of additional water. MHHW is the average elevation of the highest daily tide. Bay waters experience two low tides and two high tides of unequal height each day. Tides, and water levels during storms, will both increase as sea level rises over the next century. The sea level in San Francisco Bay has risen about eight inches in the past century[31] and is likely to continue rising at an increasing rate well beyond the end of the century (*see the Shoreline section - pages 59 - 92 for more information*).

Due to the wide range of global and regional factors that influence sea levels, in particular the rate of loss of ice sheets and glaciers in Antarctica and Greenland and the global rate of future greenhouse gas emissions, scientific models cannot pinpoint the exact rate at which sea levels will rise in the future. The best available scientific projections specifically for San Francisco Bay come from the California Ocean Protection Council Science Advisory Team (OPC-SAT). They provide regular updates on the latest scientific observations and projections and give guidance to state agencies for incorporating sea-level rise projections into planning, design, permitting, construction, investment, and other decisions. This guidance was initially adopted in 2010, updated in 2013 and updated again in 2018. The present guidance is based on a synthesis of the current science on sea level rise related to California (Kopp et al. 2014, Griggs et al. 2017). Given the long planning lead times and the relatively rapid rise in sea level, the State of California advises that waiting for complete certainty on future rates of sea level rise is not a safe option. Instead, the probabilistic approach developed by Kopp et al. (2014) and refined for San Francisco Bay by Griggs et al. (2017) can help guide planning efforts by relating likelihoods of occurrence to risk tolerance. For different rates of future greenhouse gas emissions, the probability associated with rates of sea level rise describes the likelihood that rising sea levels will meet (or exceed) a particular amount within a given timeframe.

The State of California's latest guidance document (CNRA-OPC 2018) relates these probabilities to a decision-making framework that can be used by local communities (*see Figure 3.3 on page 66*). Where the consequences of overtopping and inundation are severe (as with critical infrastructure or homes), the more risk-averse planning should be, which means giving greater consideration to lower likelihood, higher magnitude sea level rise projections in planning and design. Where the potential impacts of flooding are less serious (as with a trail or park), planners can be less risk-averse and use a higher likelihood, lower magnitude projection of sea level rise. This report presents information from the State of California sea level rise guidance but does not suggest what projection should be used in planning for any particular adaptation project in Corte Madera.

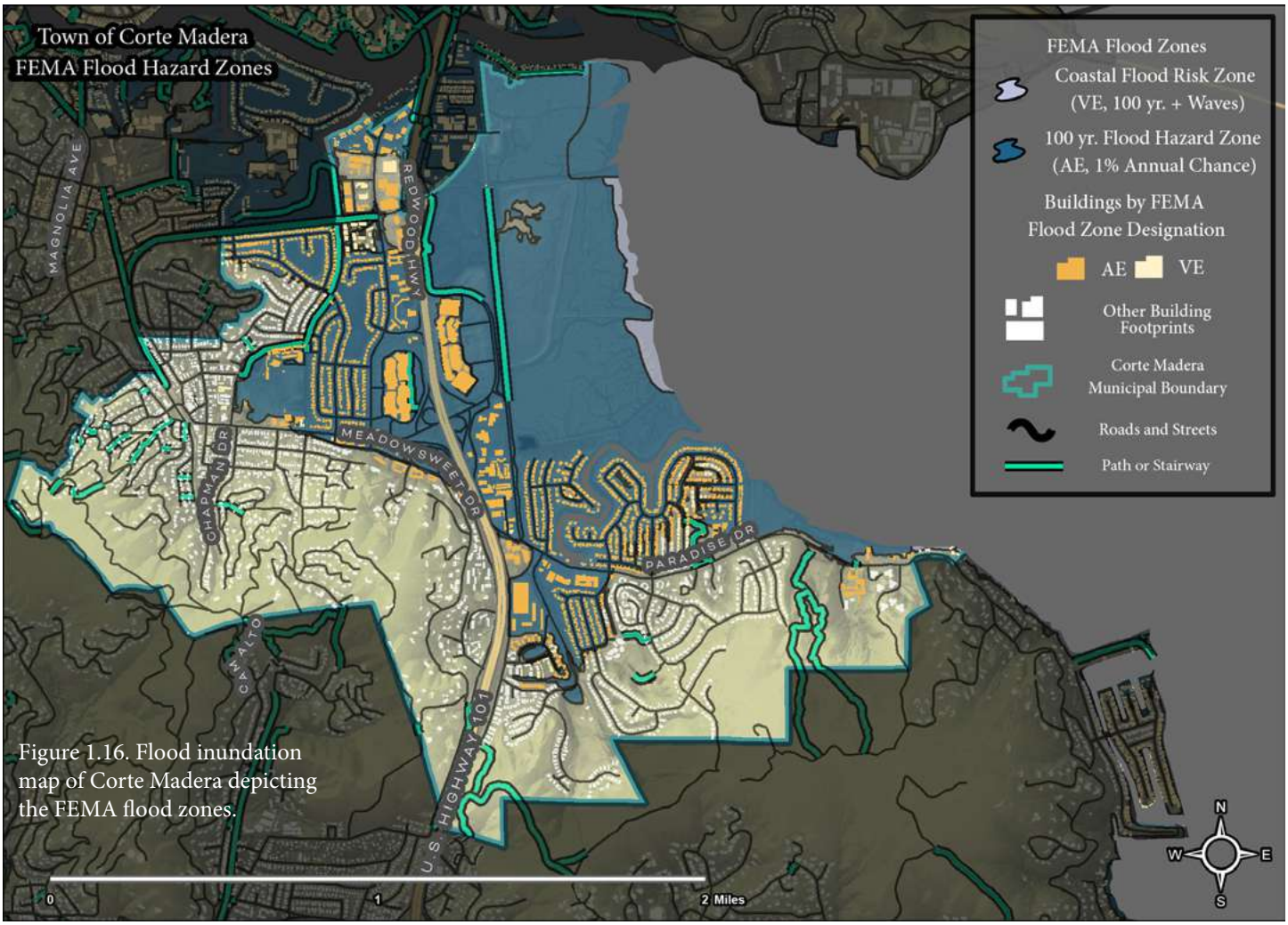


Figure 1.16. Flood inundation map of Corte Madera depicting the FEMA flood zones.

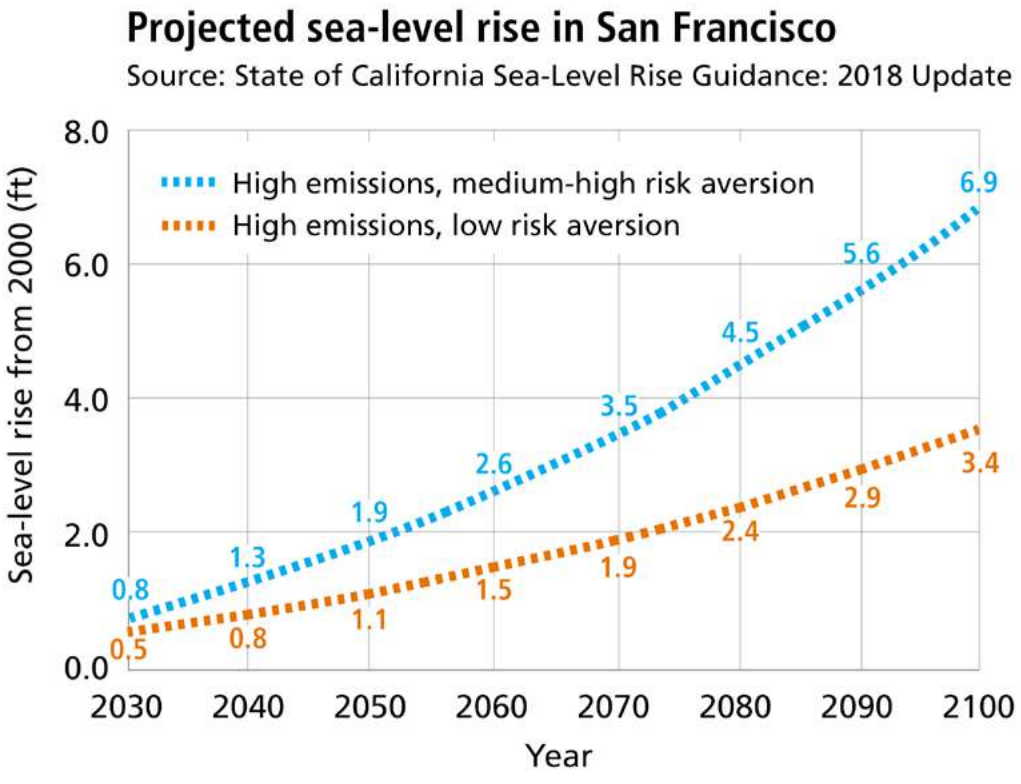


Figure 1.17. Projected sea-level rise (in feet) in the San Francisco Bay area, relative to mean sea levels in 2000. The orange line displays the upper bound of the likely range of SLR under a high emissions scenario (17% probability of exceedance), which is the State guidance recommended when planning for projects with low risk aversion. The blue line displays the 1-in-200 chance (0.5% probability) of SLR under a high emissions scenario, which is the State guidance recommended to consider when planning for projects with medium-high risk aversion. These projections and associated probabilities, and additional categories of risk, are described in greater detail in the State of California Sea Level Rise guidance document (CNRA-OPC 2018).

Extreme Heat

According to the California Climate Assessment, climate projections for the San Francisco Bay area show an average annual warming of approximately 4.4 degrees Fahrenheit by mid-century, with an increase in up to 7.2 degrees Fahrenheit by the end of the century.[32] Extreme heat days in Corte Madera (temperatures above 94.7°F) historically averaged four days per year (1961-1990). If greenhouse gas emissions continue unchecked, there are projected to be 20 extreme heat days a year by the end of the century.[33] Rising heat days are a substantial concern due to the lack of air conditioning in most homes in the Bay Area. Extreme heat events can greatly impact physical and mental health by exacerbating existing and underlying conditions and causing heat stress and stroke in generally healthy populations. These impacts can be particularly acute for the very young, the elderly, those without adequate access to cooling areas, individuals who work outdoors, and the unhoused. Extreme heat may also damage transportation infrastructure through pavement rutting and heave, warping railroad lines, and construction and maintenance challenges.[34] The increased frequency of extreme heat events impact the frequency and severity of drought and wildfires; this cascade effect leads to an increase in energy consumption through higher demand for air conditioning, further adding to greenhouse gas (GHG) emissions, and could increase the number of PSPS events.

Drought

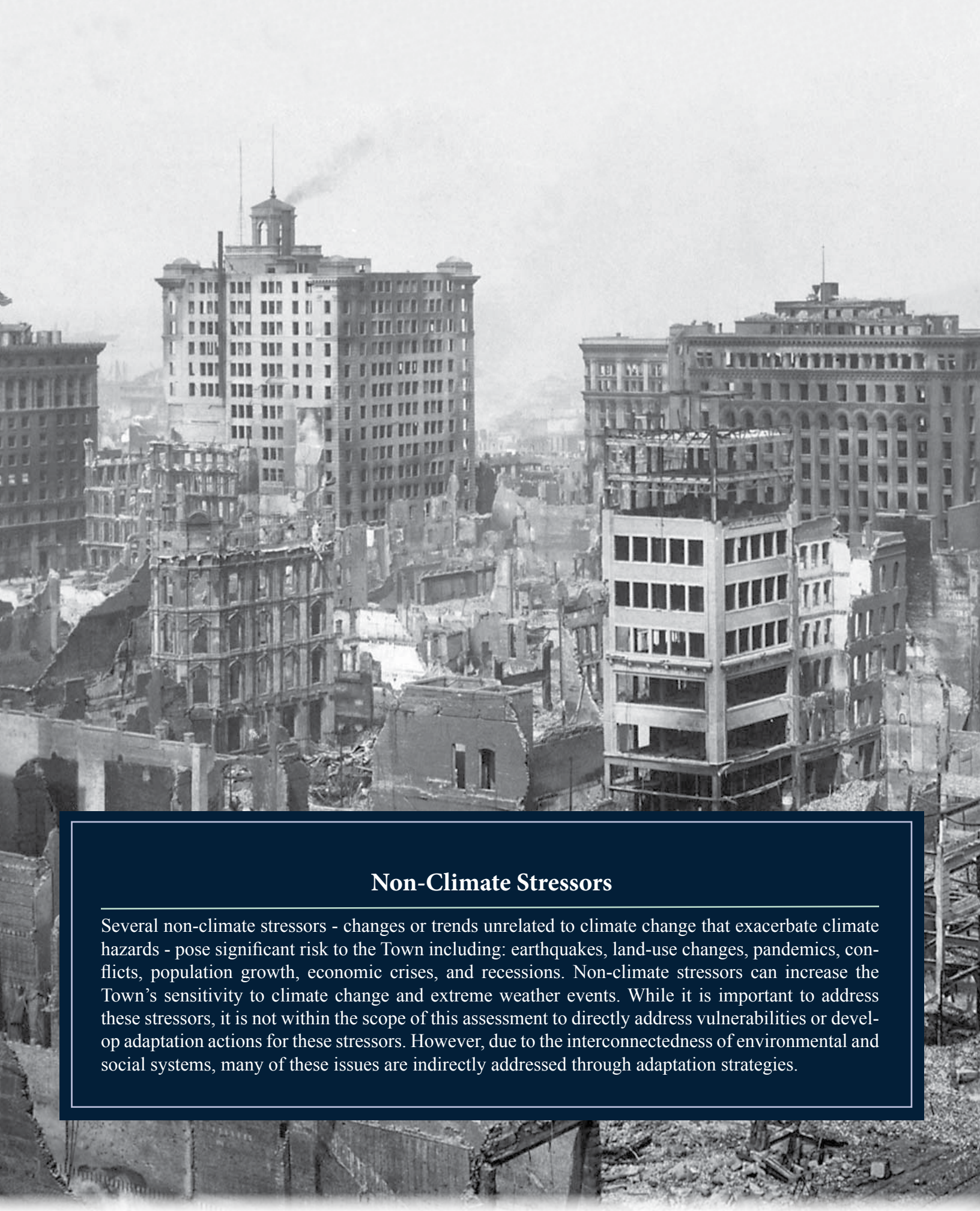
According to the California Climate Assessment, droughts are projected to increase in duration and intensity across the state.[35] The Marin Municipal Water District (MMWD) supplies Corte Madera and the eastern corridor of Marin County with surface water sourced from seven local reservoirs, augmented by supplies from the Sonoma County Water Agency (SCWA).[36] The water supply comes from local runoff and the Russian River. Historically, during periods of extreme drought, MMWD has been able to successfully meet water demands through a combination of rationing, conservation, and additional supply from SCWA.[37] However, more pervasive and sustained drought periods will likely limit the ability of MMWD to meet demands. Droughts also reduce the amount of water available to fight wildfires and increase the exposure of residents to extreme heat events, flash flooding, and degraded water quality. Further, increasingly intense and longer periods of droughts can stress natural systems, including the trees that cover Corte Madera hillsides, creating opportunities for disease, infestation, and drier, more wildfire-prone landscapes.

Figure 1.18. A composite image of two images through the Corte Madera marsh, taken 5 months apart. © Roger Johnson, Flickr.com.

Inland Flooding

Increasingly intense and frequent extreme precipitation events,[38] altered drainage patterns, and increased development with impermeable surfaces are likely to increase the frequency and intensity of inland flooding in Corte Madera. This is not a surprise to residents as larger storm events coupled with king tide events already cause extensive inundation and the temporary closure of major streets. Additional factors that affect flooding in Corte Madera include fluvial hydrology, precipitation, tides, sea level rise, sedimentation, and land subsidence. Inland flooding is exacerbated when the Town experiences simultaneous high tides and severe storms or a heavy amount of upland watershed runoff. Heavy precipitation events, such as atmospheric rivers,[39] not only cause inland flooding in low lying areas, but also can lead to landslides and other damaging events. Some uncertainty remains in future projections for total precipitation; however, understanding the general trend in increased heavy precipitation events is important for decision-making and planning purposes.

Figure 1.19. Flooding from an extreme precipitation event on Casa Buena drive on February 12, 2019 in central Corte Madera. © Leslie Regan



Non-Climate Stressors

Several non-climate stressors - changes or trends unrelated to climate change that exacerbate climate hazards - pose significant risk to the Town including: earthquakes, land-use changes, pandemics, conflicts, population growth, economic crises, and recessions. Non-climate stressors can increase the Town's sensitivity to climate change and extreme weather events. While it is important to address these stressors, it is not within the scope of this assessment to directly address vulnerabilities or develop adaptation actions for these stressors. However, due to the interconnectedness of environmental and social systems, many of these issues are indirectly addressed through adaptation strategies.

Destruction caused by the San Francisco Earthquake of 1906. © H.D. Chadwick - Wikimedia Commons

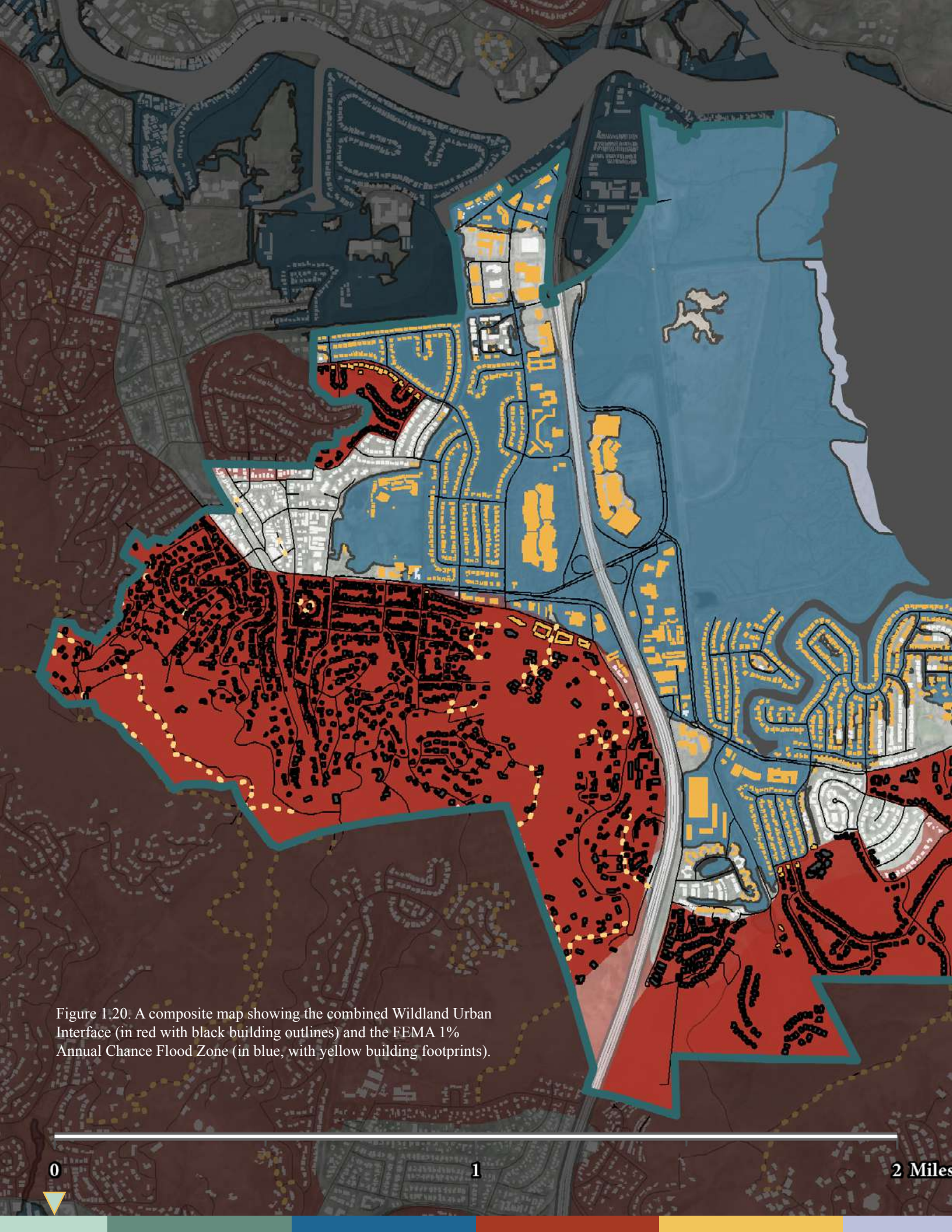
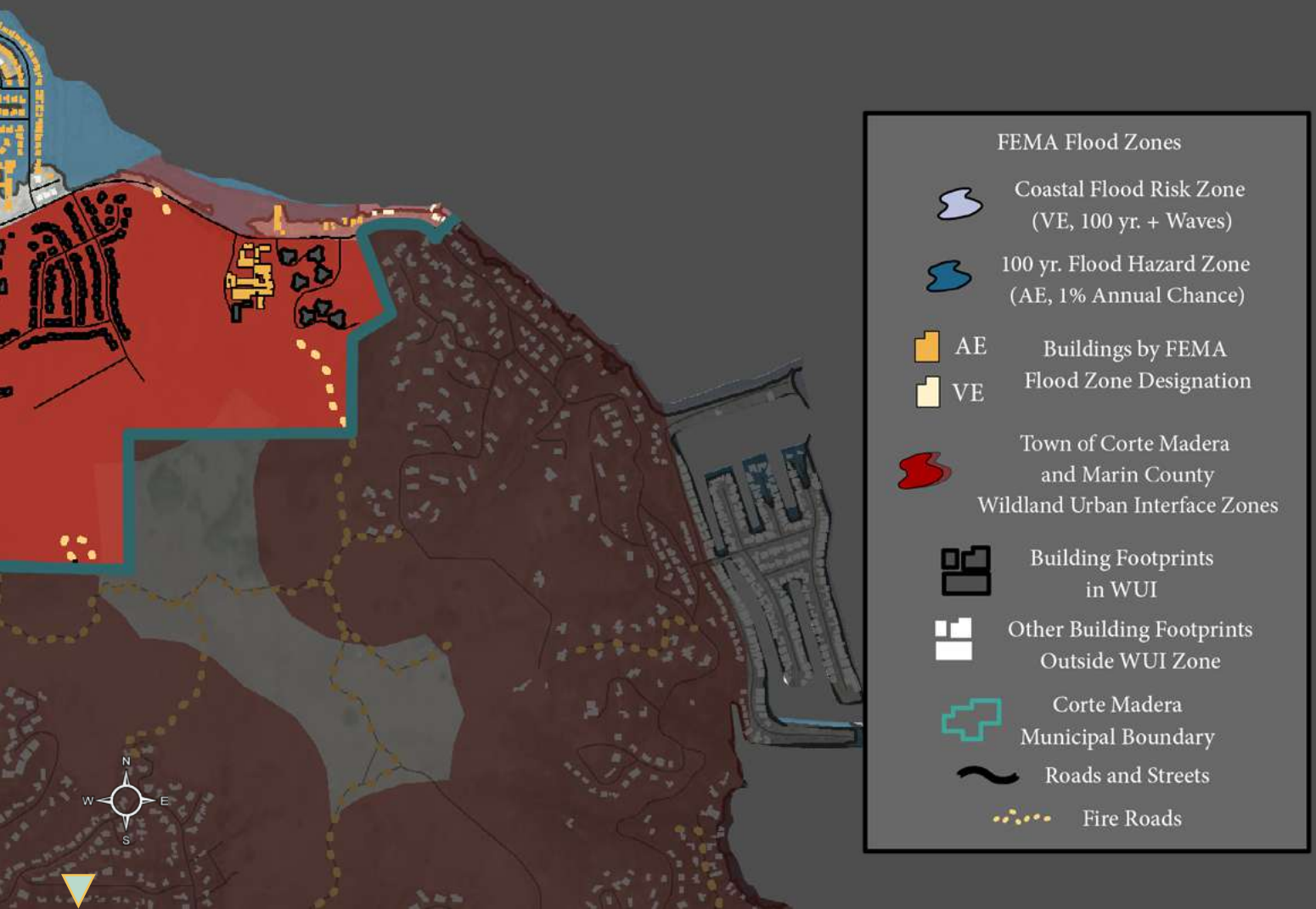


Figure 1.20: A composite map showing the combined Wildland Urban Interface (in red with black building outlines) and the FEMA 1% Annual Chance Flood Zone (in blue, with yellow building footprints).

The Town, Climate Change, and Public Health

Climate change will affect all Corte Maderans. Extreme weather events, such as heat waves, flooding, and wildfires can affect the direct health and safety of residents and visitors. Disruptions to the transportation network from flooding or wildfire events limit the ability of people to evacuate and move away from danger, decrease access to hospitals and medical care facilities, and reduce the ability of emergency first responders to protect residents. Indirect effects, such as degraded air quality from regional wildfire smoke and ash also threaten the health and wellness of Corte Maderans. Climate-related events that require people to remain indoors more often can also affect mental health and strain social relationships that bind families and the community.[40,41] While all residents of Corte Madera are at risk, these changes can be particularly impactful for frontline community members that have chronic health conditions or other underlying disease burdens. For more information on the GIS methods used to create this map, see Appendix D.




2
town-wide


© Alan Durham | YouTube.com/Droneshots

town-wide

BY THE NUMBERS

46.5
Total miles of Corte Madera roads in the FEMA flood zones or the Wildland Urban Interface (WUI).

87
Percentage of Corte Madera homes located in the WUI or FEMA flood zones or both.

956
Corte Madera acres exposed to flooding with 60" SLR + current 100-year flood.

49
Percentage of homes in Corte Madera located in the WUI.

1,588
The total number of Corte Madera structures located in the WUI.

35
Percentage of homes in Corte Madera vulnerable to current 100-year flood levels.

1,250,000,000
Estimated total value (in dollars) of structures located in the FEMA flood zones.*

* Determined using BayWAVE Scenario 6.

The Town as a whole faces a variety of climate change related concerns including wildfire, sea level rise, drought, extreme heat events, and extreme precipitation events. For more information on the climate related hazards that are already impacting (and will continue to impact) Corte Madera, see pages 27 - 38. These individual climate exposures are also addressed more specifically in the subsequent sections (shoreline, hillside, central), yet each plays a role in and affect the town as a whole. These hazards will impact community members across the Town in unique and multi-faceted ways, therefore a variety of solutions will be required to address those impacts. For example, actions developed and used to protect residents (and in particular front-line community members) from wildfire smoke will be different from those used to address extreme heat or drought. All of these hazards present unique challenges individually and all of them must be looked at from a holistic lens. The hazards posed by a changing climate are all interconnected. For example, evacuation from a hillside neighborhood due to wildfire will rely on the transportation network that is located in the central or shoreline sections of the Town. This will present unique and complex challenges, particularly as climate change exacerbates flooding and sea level rise in the central or shoreline parts of the Town. Developing resilient infrastructure will require investments across the community and across the region.

For more information about the specific impacts of sea level rise in Corte Madera and potential solutions to address it, see pages 59 - 92. For more information about Corte Madera's wildfire risk and potential solutions to address it, see pages 93 - 122. For more information about the impacts of flooding in central Corte Madera and potential solutions to address it, see pages 123 - 134.

Town-wide Focus Areas

The actions highlighted in this report represent a subset of a broader suite of adaptation actions that scored highly based on their potential effectiveness, efficiency, and feasibility for the Town. These actions (and the full suite of actions in Appendix B) provides the Town with a list of many of the most appropriate options to consider. ***It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented. The local or regional organization, agency, or department responsible for implementing any action will need to be determined on a case-by-case basis.*** Adaptation actions applicable town-wide are divided into four primary focus areas:

HEALTH AND WELLNESS - (pages 43 - 46)
EMERGENCY PREPAREDNESS - (pages 47 - 52)
RESILIENT INFRASTRUCTURE - (pages 53 - 56)
EDUCATION AND COLLABORATION - (pages 57 - 58)

HEALTH AND WELLNESS

The events of the last few summers have shown that summer heat waves and smoke from regional wildfires, can affect everyone in the community. Dense wildfire smoke, which directly impacts physical health, mental health, and limits the ability of all Corte Maderans to go outside (*100 AQI or above for sensitive populations, and 150 AQI and above for healthy adults*),[42] has become a regular occurrence. While extreme heat events are uncommon in Corte Madera, hot summer days and warm nights are projected to become more frequent and last longer. Wildfires not only affect the health and safety of residents but have lasting mental health impacts related to the trauma of leaving ones' home or the loss of possessions and income. Both the direct and indirect impacts from heat and wildfire smoke can be particularly damaging to the health of frontline community members such as older adults, youth, those with chronic health conditions, outdoor workers, and the unhoused.[43] The Public Safety Power Shutoff (PSPS) program by PG&E is designed to reduce the likelihood of wildfire ignitions due to downed power lines or other system malfunctions during red flag warning days (days with high temperatures, high winds, and low humidity) has created lasting power outages throughout the region, county, and the Town. Experiences from these events have shown that power outages that last more than a day affect the functionality of critical infrastructure in Corte Madera, including cell-towers, traffic signals, sanitary district pump stations, and refrigeration.[44]

As the Town explores these Health and Wellness actions, partnerships will be critical, as well as the use of innovative funding mechanisms. There are a variety of funding mechanisms cities are using to support local resilience including: implementing local revenue sources, land-use costs, embedding resilience standards into future infrastructure investments, leveraging development opportunities for public-private partnerships, utilizing federal funding niches, identifying and using state funds, and developing financial innovations like district-scale financial structures.[45]

Ensure all Town buildings have smoke and particulate filtration systems, especially in dedicated emergency evacuation shelters and resilience hubs. Ensuring that buildings and resilience hubs in Corte Madera have effective smoke and particulate filtration systems is key to ensuring the health and well-being of residents, especially during an emergency. Additional actions include deploying low-cost particulate matter sensors in relevant Town locations that provide data for indoor and outdoor levels in real-time. Resilience hubs can also incorporate solar and battery storage systems to provide a reliable center for cooling, water, power, and communications during power outages and reduce utility costs during daily operations.

Support regional healthcare providers as they develop climate change-related mental health and trauma treatment measures and incorporate them as appropriate into existing town plans, trainings, programs, and policies. Extreme weather events can have significant impacts on mental health, and this connection is often challenging to integrate into regional planning efforts. Yet it is critical that this issue receives dedicated attention and resources. Example organizations include the Psychological First Aid (PFA), Skills for Psychological Recovery (SPR), or the Good Grief Network.

Continue to prioritize implementation of green and sustainable adaptation strategies across the Town's built environment. This action would provide the framework for understanding, defining, and planning green infrastructure. Continuing to invest in green infrastructure will not only enhance resilience, but also add to resident well-being and quality of life. This includes coordinating with regional partners to identify and prioritize protecting, restoring, and planting genetically appropriate vegetation suited for projected climate conditions.

Work with or support community organizations, especially environmental justice, LatinX, and other community organizations as they identify gaps in frontline community resilience planning and further engage frontline community members in wildfire risk, evacuation, and resilience work. Collaborating with regional organizations dedicated to engaging and supporting frontline communities are key to building trust and ensuring the health, safety, and well-being of all residents.

Complete an equity impact evaluation for climate action and adaptation planning and implementation processes. Historic and current systems of oppression (including racial segregation and racism, poverty, income inequality, lack of living wage jobs, gaps in educational opportunities and attainment, concentrated neighborhood disinvestment, political disenfranchisement, and low social capital) result in social and biological factors that increase the vulnerability of some community members to climate change.[46] Conducting an equity impact evaluation for development and redevelopment plans will provide Town staff and leadership with the tools to ensure that community members are not adversely impacted by these planning efforts.

Conduct and map urban tree canopy cover evaluation for specified areas (e.g., commercial district, Highway 101 corridor) to identify urban heat islands. Urban heat islands - developed areas that experience significantly warmer temperatures due to the built environment - can impact the health, safety, and wellbeing of community members. Temperature fluctuations can differ drastically between urban and rural areas due to a large concentration of buildings, roads, and other structures that absorb heat. Understanding if and where Corte Madera currently experiences elevated temperatures due to the heat island effect as well as how climate change may exacerbate those areas will inform decision-making and the implementation of strategies that reduce its impacts.

Support and participate in the development of a regional and local drought contingency plan. As droughts increase in severity and duration across the State, working with local and regional partners to develop a drought contingency plan that includes Corte Madera will support better planning and informed decision-making.

Work with regional and local health agencies to evaluate extreme heat warning thresholds and protocols and incorporate enhanced extreme heat preparedness into local operations. While not historically an issue, extreme heat is an emerging threat, especially for older residents, outdoor workers, and other frontline community members. Incorporating plans for extreme heat into Town operations can help ensure that it is prepared to deal with extreme heat events that will become more frequent in the future.

Support regional partners in education and outreach efforts focused on water conservation measures for Town residents. Supporting water conservation outreach and education measures may be particularly important during periods of drought. In addition, campaigns should consider the support of individual rainwater harvesting, water storage, and other water conservation techniques including water reuse, water use, and irrigation efficiency.

Green Infrastructure and Low Impact Development

Green infrastructure relies on plants, soils and natural systems to manage rainfall by absorbing, delaying, and/or treating stormwater.[47,48] Green infrastructure solutions are multi-beneficial in that they can help reduce pollution from runoff, prepare for extended droughts by retaining water, reduce temperatures in urban areas during hot weather, improve air quality, lower building energy demands, protect coastal areas, and reduce energy spent on managing water.[49] Additionally, green infrastructure in urban areas has been proven to improve mental health and wellbeing.[50] Similarly, low impact development (LID) is a method of building design and community development with the intention of minimizing and mitigating climate impacts like flooding or urban heat.[51]

Green infrastructure can be woven into the community from small-scale site specific elements to larger-scale elements across the entire watershed. Examples include permeable pavement, trees and other deep-rooted plants, rainwater catchment systems, and bioswales. Swales and bioretention areas can be integrated into landscaped areas, medians and parking strips. Permeable pavements can provide volume reduction and water quality treatment without taking up additional space.[52] The Environmental Protection Agency (EPA) has a plethora of resources, including a section on overcoming hurdles of Green Infrastructure implementation on its website.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EMERGENCY PREPAREDNESS

Emergency preparedness requires proactive planning, strong communication, and reliable and clear sources of information available through multiple channels. In order to minimize the impact of potential disasters for community members, the Town plays an important role in making sure residents and visitors have the correct information about what to do and where to go in the event of a disaster. Individuals also have a responsibility in emergency preparedness, and should stay informed, prepare emergency kits, and otherwise take precautions to minimize risk to themselves and their families.

In addition, clear evacuation protocol, planning, and practice are important factors for community preparedness. To support regional communication around evacuation planning, FIRESafe Marin currently has an agreement with all Marin municipalities (except Tiburon and Belvedere) to develop wildfire evacuation maps and plans set to be published in 2021. To learn more about what Corte Madera is doing to mitigate fire risk, see the Hillside section on pages 93 - 122.

Future planning efforts should focus on regional connectivity and communication, engaging the right regional partners in Town evacuation planning, optimizing the Town and Counties evacuation protocols, and identifying key potential challenges in regional evacuations. For example, there have not been any regional evacuation-focused traffic studies done necessary to determine important details regarding regional choke points, the amount of time required to evacuate the entire Town, and other important details. In addition, several of the county's transit services and partner agencies are not adequately integrated into the emergency operations or chain of command, nor are they properly integrated into the Marin Emergency Radio Authority (MERA) communications system and therefore don't have an effective and efficient way of communicating with the public during an emergency.[53]

Rethinking Evacuation Notification Systems in Corte Madera

Reaching all Town residents with clear and up-to-date information in emergency situations remains one of the biggest challenges Corte Madera currently faces. For example, the Town currently relies on Alert Marin and Nixle which are free, opt-in emergency alert systems. Yet as of 2019, only around 10% of the county's residents had signed up to receive alerts.[54] Communication challenges are compounded by difficulties reaching residents who do not have internet service or those who lose power during a PSPS event or an emergency. Over the last several years, catastrophic and deadly wildfires have ignited critical reviews of inconsistent emergency management measures and notification systems across the State of California. Concerns have been focused on "gaping holes in the state's county-controlled warning systems - a mix of services from multiple vendors, subscriber programs with low participation rates, outdated landline lists, and a federal cellphone alert system so imprecise some emergency managers are afraid to use it."[55] Some lawmakers have pushed for measures that would "override state privacy laws" to create automatic, mandatory, opt-out emergency notification systems. In addition, several counties (including Sonoma County) are improving the way they communicate with and engage non-English speaking residents and other frontline community members in emergencies. Currently, the Town uses several key emergency notification systems to ensure that residents have the most pertinent and up-to-date information about emergency and evacuation measures including:

- **Alert Marin** - The single most important source for specific emergency and evacuation notifications in Marin County (e.g., shelter in place, flood or wildfire notices, house or neighborhood specific evacuation warnings and orders). Residents can sign up for this opt-in notification service from Alert Marin at www.alertmarin.org
- **Nixle** - A service used by regional agencies to send out informational notices about an issue in the community (e.g., Red Flag days, vehicle accidents, or road closures). Nixle notifications are sent to users by zip code, therefore has less specificity than Alert Marin. Residents can sign up for opt-in notifications from Nixle at www.nixle.com/
- **Social Media** - The Central Marin Fire Department and the Marin County Sheriff's office uses Twitter, Facebook, and NextDoor to relay pertinent information about evacuation, road closures, and resources. Residents can follow the County Sheriffs office on Twitter, Facebook, and NextDoor using the handle @marinsheriff and the County Fire Department at @marincountyfire
- **Local TV and Radio Stations** - Local media sources are often reliable sources of specific information regarding evacuation and wildfire preparedness.
- **Wireless Emergency Alerts (WEA)** - This notification service sends "push notifications" by text message to residents by zip-code who have a compatible cell phone and who sign up for the service. Notably, if power lines or cell towers are disrupted or damaged due to wildfire, these notifications may no longer work. Additional critiques across the State have pointed out inadequacies and distrust of the WEA system and have requested broad improvements.

All residents should review, understand, and complete the FIRESafe Marin checklist here to ensure that they are prepared for an emergency evacuation in the case of a catastrophic wildfire. Broader town and county-wide discussions about the current emergency notification systems, upon which Corte Madera relies, should focus on addressing gaps in planning and engagement as well as integrating emerging best practices from around the State. Overall, there are no silver bullet solutions for this complex problem. Yet, additional attention to, and continued collaboration with, regional entities to improve these systems will help to save lives.

Support updates (if necessary) to ensure that the Town and County emergency response plans reflect equitable approaches to emergency preparedness and fully address the needs of ALL residents (e.g., hearing/seeing impaired, non-English speakers, the aging, etc.). Ensuring that emergency response plans for the Town and County reflect best practices and consider all community members is critical for making sure nobody is left behind. This includes proactively empowering frontline community members to access and understand neighborhood evacuation route maps (e.g., consider access to the internet and modern approaches to sharing information for QR codes being developed with CalFire Collector App).

Require that climate projections and the impacts associated with them are included in all Town planning documents, policies, programs, and ordinances as they are reviewed or updated, as necessary. Ensuring that all Town plans are consistent, reflect the best available data and knowledge for regional climate projections, and support the Town's efforts to reduce climate change and extreme weather impacts is essential. It is also critical that updated climate projections are used to inform capital improvement projects (e.g., new or upgraded roads) which should meet design standards that incorporate flood risk, landslides, and sea level rise projections.

Educate all community members about evacuation protocols, maps, and procedures for emergency preparedness and evacuation. The Town needs to more proactively identify and address gaps in their communication and messaging when it comes to evacuation. This includes consistent messaging around Alert Marin and the nationally recognized *Ready, Set, Go program*,[56] participating in and integrating the regional collaboration and current evacuation mapping work into Town materials and presentations, coordinating with County evacuation notification partners (Central Marin Fire and Sheriff's Office) and working with FIRESafe Marin to make sure that residents have access to and are engaging in their wildfire preparedness and evacuation programs. This includes putting people on the ground in neighborhoods to engage with residents directly.[57] In 2018, the Central Marin Fire Authority conducted a public evacuation drill in which only 18% of residents participated. A recent report also indicated that residents in Marin County were presented with inconsistent information specific to wildfire preparedness and this message "failed to reach most citizens, especially parents of young children", prompting a call by the Marin County Civil Grand Jury to better educate, inform, and engage the public about emergency preparedness in the case of a catastrophic wildfire.[58]

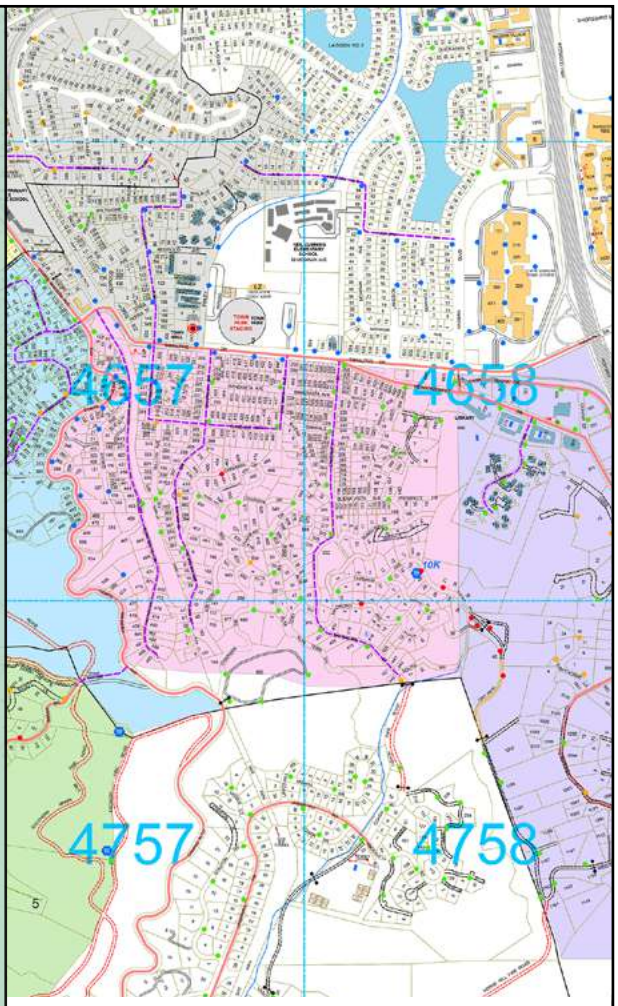

Figure 2.1. The Corte Madera area featured in the Marin mutual threat zone plan evacuation zone maps.

Assess housing and zoning laws to identify how they may impact frontline community members negatively before, during, or after a disaster. Historic and current laws or practices may impact the resilience of frontline community members to climate change.[60] Assessing current housing and zoning laws for potential discriminatory practices will ensure that future development and redevelopment policies will support ALL community members before, during, and after a disaster. This includes particular attention to renters and residents of multi-family housing units.

Coordinate regularly with surrounding municipalities and Marin County to enhance evacuation and emergency management protocols, agreements, and processes. Good pre-disaster planning requires continuous engagement and coordination with regional partners. This includes defining roles, creating formal agreements, reviewing and improving communication mechanisms, refining protocols, and institutionalizing future projections for risk in regional planning efforts.

Identify opportunities to expand access to emergency and evacuation notices via multiple sources, including voice, text, siren, radio, and outdoor broadcasts. In the 2018 Camp Fire in Paradise, California, all communications went down for residents due to telecommunications infrastructure being destroyed in the fire. This disaster highlighted many flaws in an antiquated notification system that many communities (including Corte Madera) rely on. Recently, the California Public Utilities Commission ordered wireless communication service providers to develop resilience plans and investments in their networks (including generators that run 72 hours following an emergency) in order to make sure users have access to communications and notifications during an emergency.[59] The Town should also identify opportunities to increase engagement and subscription of Town residents to key evacuation notification systems (e.g., *Alert Marin*). This includes considering a mandatory alert notification system or creating an opt-out system.

Integrate protocols, systems, and planning best practices for managing the impacts of evacuation, emergency response, and health care during a global pandemic from federal emergency response agencies (e.g., Red Cross and FEMA). There is no denying that the COVID-19 pandemic has changed the way communities, schools, and organizations operate. It is unlikely to be the last such sweeping health crisis that changes how we deal with emergency response during a pandemic. Currently, new protocols are being written and tested by groups like FEMA and the Red Cross to address this issue, such as how best to protect evacuees and use hotels instead of communal shelters to house. These protocols incorporate the 5 C's - Communication, coordination, cooperation, collaboration, and connection, and ensure that we break down agency and jurisdictional silos and integrate public health planning into emergency operations. Corte Madera can learn from these experiences and should incorporate key findings and recommendations into its emergency plans and protocols.

Ensure that emergency staging locations and temporary evacuation refuge areas are not situated in areas subject to temporary or permanent flooding or in high risk wildfire zones. Reviewing evacuation protocols and plans to ensure that temporary refuge or staging locations will not be located areas vulnerable to flooding or wildfire based on current climate change projections will support informed decision-making at the local and regional levels. Updates will be necessary as better data will become available. In addition, consider enhanced planning and/or building permit requirements for backup generators or other emergency equipment for critical services such as food stores, pharmacy, and fueling stations, among others.

Work with regional partners to identify gaps in current wages and working conditions for all first responders and workers who are participating in fire protection. Due to the high cost of living, retaining emergency responders that live in Corte Madera can be a challenge.[61] Consider identifying opportunities to create affordable housing options for first responders and their families in Town. Ensuring emergency responders are able to live and thrive in the Town will ensure the long-term safety of the community.

Identify opportunities to enhance the capacity of Town and school facilities to become Resilience Hubs, evacuation centers, cooling centers, and charging stations, during extreme heat or weather events. The Town has already applied for grants to help make the new Town Hall expansion a Resilience Hub for the community. The building will be earthquake resistant, provide shelter for people during extreme weather events, provide resources and information for residents on emergency management and preparedness, power for public uses during power outages, and provide other public services.

Resilience Hubs in Corte Madera

Resilience Hubs are unique "community-serving facilities" that are emerging in cities across the country in order to support residents, enhance communication, and serve as a centralized location for distributing services before, during, and after a natural hazard. They use a physical space - a building and its surrounding infrastructure - to meet numerous goals, both physical and social. Resilience hubs can effectively improve emergency preparedness, reduce climate pollution, and enhance community resilience.[62] By retrofitting, or augmenting established, trusted, and community-managed facilities, Resilience Hubs also provide community members and decision-makers with an opportunity to work together on climate mitigation, adaptation, and equity efforts in a holistic way that also builds community resilience and community well-being.[63]

Work by the Urban Sustainability Directors Network has brought this emerging practice to the forefront of adaptation and resilience efforts for leading communities across the country. Corte Madera knows first hand how wildfire smoke, power shutoffs, flood events, and extreme heat events can stress the Town's infrastructure and its community members. Older adults, kids, those with disabilities, low-income residents, BIPOC (Black, Indigenous, and people of color), LGBTQIA+ (Lesbian, Gay, Bisexual, Pansexual, Transgender, Genderqueer, Queer, Intersex, Agender, Asexual and other queer-identifying community), ESL (English as a Second Language) communities, the unhoused, those who lack transportation, and those with chronic illnesses or specific ongoing medical needs may be particularly at risk during natural hazards or extended periods without power. PG&E's PSPS events,[64] or other extended periods without power, can limit the ability of residents to cook, work, complete schoolwork, or communicate with friends and family. Resilience Hubs should be designed by and built with the neighborhoods they serve in collaboration with local businesses, nonprofits, and others invested in community resilience and well-being. If done well, Resilience Hubs are co-designed with the neighborhoods they serve and effectively support at-risk community members. They also serve as a focal point for additional community investment, are managed by community members, and support and strengthen individual neighborhoods.

- **Buildings** - The best locations to house Resilience Hubs are trusted community locations in different neighborhoods across the Town such as the new Town Hall, Cove School, or Neil Commings Elementary. Ideal buildings have solar energy storage or generator backup systems, are ADA accessible, have air-conditioning and heat, are earthquake resistant, are equipped with air filtration systems (in the case of extreme wildfire smoke), have kitchens, and provide enough space to shelter residents in case of an emergency are all important considerations. In addition, Hubs should be located in safe areas away from (or above) flood plains or high fire risk areas.
- **Emergency Needs** - Hubs should be able to supply needs during a crisis such as freshwater, food, ice, refrigeration, charging stations, and emergency medical supplies. Ideally, the hub could supply power for at least 72 hours via renewable sources and battery storage or generators. These energy systems can reduce the use of fossil fuels on normal days (and thus reduce GHG emissions) and support critical services during emergencies.
- **Supporting Activities** - These Hubs shouldn't only be used in times of disaster. They can support community activities, after school programs, health screenings, or other important community functions. In addition, those amenities should be designed with the community/neighborhood to ensure that it meets the needs of its residents.
- **Social Cohesion** - Building on the long standing tradition and support of Neighborhood Response Groups, the Resilience Hubs can act as safe spaces for community members to gather, strengthen relationships, and foster an inclusive year-round community. These investments will pay off in times of emergency as neighbors continue to find opportunities to support each other.

RESILIENT INFRASTRUCTURE

Throughout the community, people are generally reliant on personal vehicles and utilize a limited number of roadways. This leads to congestion throughout the transportation network, which is especially dangerous during an emergency. Where and how the Town's infrastructure is built will determine how well it can protect residents and accommodate or mitigate future climate and extreme weather impacts.

Further, the Town does not own electricity, drinking water, or telecommunications infrastructure directly, but must work directly with those companies, agencies, and organizations to enhance the resilience of those systems. Increased investment in transportation infrastructure and policies are needed to facilitate mobility throughout the Town in both everyday life and in an emergency. Some of those investments are discussed here, and others are discussed in both the Hillside and Shoreline sections of the Assessment. For the Shoreline section, see pages 59-92. For the Hillside section, see pages 93-122. Such investments will create a more resilient transportation network and simultaneously support the Town's environmental, health, economic activity, and equity values and goals.

Advocate for and work with regional utilities to enhance the preparedness, protection, and resilience of water, energy, and telecommunications infrastructure. The infrastructure we rely on is far more than just our roads, ferries, trains, and planes. We rely on telecommunications, water, and energy systems, all of which have their own unique challenges and characteristics when it comes to climate resilience. Each partner operates differently, and each partner plays a key role in supporting the Town. For example, Corte Madera obtains its drinking water from the Marin Municipal Water District (MMWD) which services ~190,000 customers within 147 square miles along the eastern corridor of Marin County from seven local reservoirs.[65] If a fire were to happen in the hills North and West of the Town, silting, erosion, and landslides would inevitably impact the water quality throughout the watershed. In addition, there are areas of the Town in which there is minimal water supply (Casa Buena Drive) or no water mains at all constructed (Meadow Valley).[66]

Invest in and expand bike infrastructure and e-bike policies and programs. Corte Madera has a strong culture of outdoor recreation, including bicycling. While the hillside neighborhoods don't seem the most hospitable to bicycling, the rapid and accelerating adoption of e-bikes (bicycles with an electric assist motor) offers mobility choices that could prove crucial in emergencies while providing additional benefits. Corte Madera, should consider policies to support the use of e-bikes such as designating charging stations to subsidize adoption.

Explore a regional approach to meeting housing development goals that locates new housing areas within the County that are less vulnerable to climate hazards. One way to reduce climate risk is to limit exposure by building in areas that are less prone to damage from extreme weather events.

Ensure that transit agencies are involved in the Town's evacuation preparedness planning, comprehensive safety protocols, and emergency command structure. Regional transit representatives are key partners in the chain of command responsible for planning and implementing emergency evacuation. According to the Marin County Civil Grand Jury Report on Wildfire Preparedness, Marin Transit is the only transit provider represented in the Marin Emergency Operations Center (EOC). In addition, key regional partners are not included in these discussions (including Golden Gate Transit emergency managers, SMART representatives, Whistlestop, Marin Airporter and ferry operators). Proper communication and close collaboration would enable the County and Town to evacuate residents as quickly and as safely as possible.

Support a county-wide study (or support the potential upcoming CalTrans and FIRESafe Marin grant) to assess whether the core transportation network and critical infrastructure are protected, being used appropriately for evacuation, and have the appropriate capacity to support evacuations. Understanding and addressing local choke points that hinder effective evacuations are critical, but supporting regional-focused planning efforts will ensure that the core transportation network and critical infrastructure are protected and support effective evacuations for residents of Corte Madera. For more information on the limited roadway network, see the Our Transportation Story section on page 56.

Enhance the capacity and resilience of the transportation network with multimodal and local access improvements. Rather than solely accommodating vehicles, the Town should cultivate strategies that increase community members' ability to regularly utilize pedestrian pathways, bikeways, and transit, including improving and expanding multimodal infrastructure. Potential local infrastructure enhancements that support evacuations can be referenced on page 111. Lastly, the Town should also work with regional agencies to incorporate statewide and regional transportation goals and land use plans to produce a cohesive multimodal adaptation approach.

Improve transportation infrastructure to streamline traffic flow in case of an emergency evacuation. This includes updating traffic control centers, solar powered signs, and optimizing merge conditions and signals that can operate reliably during PSPS and emergency events. Preserving and improving the transportation network will require time, resources, and planning. The Marin Wildfire Protection Authority (MWPA) will publish an evacuation study that will assess Town and County evacuation connections including a focus on transportation infrastructure, roadways, and traffic control centers in 2021. As appropriate, recommendations from this effort should be integrated into all existing local and county plans, including the General Plan, the Capital Improvement Plan, and the Hazard Mitigation Plan, among others.

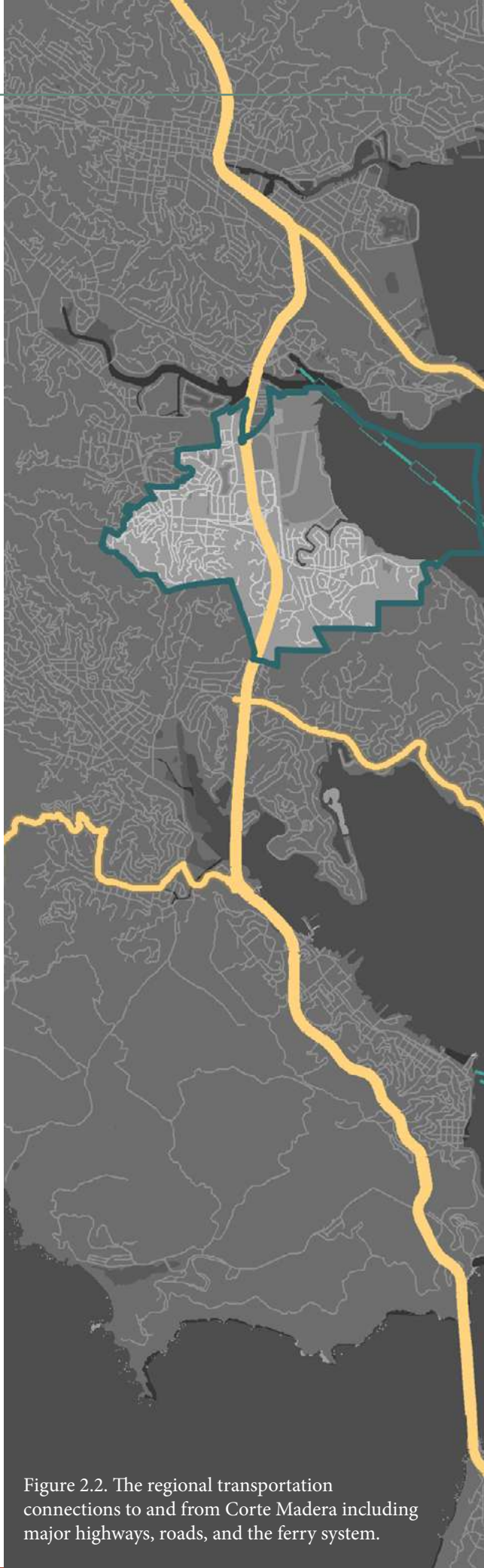

Figure 2.2. The regional transportation connections to and from Corte Madera including major highways, roads, and the ferry system.

Our Transportation Story

While there is access to both the Larkspur Ferry Terminal and Sonoma-Marin Rail Transit (SMART), the town straddles US Highway 101 and most trips are made by car. Due to the town's sparse multimodal transportation network, people are reliant on personal vehicles and also funneled through a limited number of roadways. This leads to congestion throughout the network, which is especially dangerous during an emergency. In particular, the hillside neighborhoods have very limited connectivity within and between them and also lack multimodal connections. In some cases, the transportation network across the town is supplemented by paths and stairways; however, the existing pedestrian paths are limited - not all are ADA-compliant and bicycle facilities are very limited. In addition, portions of important low-lying transportation routes, such as Lucky Drive, already experience flooding, which will continue to get worse. Given Corte Madera's vulnerability to climate change, the redundancy and resilience of the transportation network is especially important to ensuring the safety of the town's residents, employees, and visitors.

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EDUCATION AND COLLABORATION

The complexity and interconnectedness of climate change requires a significant investment in community engagement and education in order to increase awareness and resilience. In addition, Marin County's unique land-use, geography, and transportation network infrastructure necessitates comprehensive and multi-jurisdictional adaptation approaches and solutions in partnership with local, regional, and state partners. Programs that educate and inform residents, visitors, businesses, and local decision-makers can empower individuals to take actions to reduce risk for themselves. Programs that seek to bring community members together can create lasting connectivity among neighbors who can plan together to get out of harm's way.

Develop a climate awareness communications program and campaign that helps community members understand potential risks, solutions, and opportunities to address climate impacts. Community awareness is a foundation for community action. Although the climate crisis is an immediate and urgent issue, it is complex and requires a dedicated effort to build broad awareness and support for adaptation efforts.

Identify additional staff and/or resources to focus on education and the implementation and monitoring of the Climate Adaptation Assessment. Corte Madera is a small town with a limited number of staff members who often have a wide range of duties. The Town could benefit from having an adaptation and resilience coordinator to help coordinate across departments, guide the implementation, monitoring, and tracking of the resilience actions identified in this assessment, and support education efforts happening across the community. In accordance with recommendations by the Marin County Civil Grand Jury, this coordinator could work directly with other regional agencies in order to better coordinate efforts.[67]

Publish a guide or online portal of actions that commercial and residential property owners can take to make their homes and buildings more resilient to climate change. Supporting commercial and residential property owners to make their homes and businesses more resilient by providing resources, tools, and knowledge is an effective and efficient way to enhance resilience across the Town.

Build the capacity of community groups to increase their engagement in climate change adaptation related activities. Community support for the Town's climate change adaptation and resilience efforts are crucial to their success. Town staff and community organizations play an important role in capacity building and community engagement. Engagement activities include supporting young people in climate adaptation through school education initiatives and involving community groups in the monitoring of trigger/threshold level indicators to determine when adaptation actions should be implemented.

3 the shoreline

the shoreline

BY THE NUMBERS

257
Total acres of marsh located in the Shoreline neighborhoods of Corte Madera.

16
Miles of road in Corte Madera vulnerable to 60" SLR + current 100-year flood.*

201
Number of parcels vulnerable to 10" SLR + current 100-year flood.

956
Corte Madera acres exposed to flooding with 60" SLR + current 100-year flood.*

1500+
Number of living units in Corte Madera vulnerable to 60" SLR + current 100-year flood.*

79
Total number of commercial parcels vulnerable to 60" SLR + current 100-year flood.*

1,250,000,000
Estimated total value (in dollars) of structures located in the FEMA flood zones.

* Determined using BayWAVE Scenario 6.

The Shoreline neighborhoods of Corte Madera are home to valuable residential properties, critical infrastructure facilities, and vital portions of the Town's transportation network. The prominent areas include the eastern residential neighborhoods of Mariner Cove and Marina Village, the Paradise Drive corridor, the Corte Madera State Ecological Reserve and tidal marshlands, and the northwestern neighborhood along Lucky Drive adjacent to Corte Madera Creek. Some of these areas already experience periodic flooding from stormwater runoff and/or king tides, and all reside at low elevations, putting them at risk of flooding during prolonged storm events and future sea level rise.

Mariner Cove and Marina Village are established bayside neighborhoods, which were built on filled baylands in the 1950's.[68] Channels, culverts, pump stations, and the existing levee protecting Marina Village have largely curtailed flood impacts over the years, but yards, garages, and foundations along Golden Hind Passage in Mariner Cove flood during king tides; and sometimes pumping is required for drainage. Flood tides also overtop the banks on the west side of San Clemente Creek and flow to the detention basins at the Marina Village Pump Station.[69] The neighborhoods have subsided as the bay mud and former marsh solids consolidate under the weight of the overlying infrastructure.[70] These neighborhoods have settled up to four feet since construction (depending on the thickness of the bay mud) and are projected to continue settling for the coming decades, with an average of up to 2 additional feet of settlement by the end of the century (*see Figure 3.1*).[71]

This settlement further exacerbates the risk of coastal flooding and the localized impacts of sea level rise. Many homes are situated directly on the bank of San Clemente Creek and are currently protected from storm surge by earthen levees, while those on the bay side of Golden Hind Passage are not. During king tides, backyards and driveways can be flooded in both areas.

Corte Madera's remaining tidal marsh and mudflats provide ecosystem services and have intrinsic value. The marsh and mudflats act as a first line of defense between the Bay and shoreline infrastructure, reducing wave heights and protecting inland areas from bay-side flooding. The tidal marshes also improve water quality by filtering out pollutants and trapping sediment, and they store carbon from the atmosphere. The Corte Madera Ecological Reserve, a large part of the marsh complex managed by the CA Department of Fish and Wildlife, is home to populations of rare and endangered species like the Ridgway's rail, San Pablo song sparrow, and California black rail.[72] The marshes of the Corte Madera Ecological Reserve provide valuable long-term habitat for these species and ecosystem services for the Town of Corte Madera. However, tidal marshes are vulnerable to the impacts of climate change, and future planning efforts must integrate adaptation planning for marsh ecosystems with planning for the built environment in order to preserve this valuable landscape, which is intrinsic to the character of Corte Madera and critical natural habitat as one of the largest marshes in Southern Marin.

Bay Mud Thickness (ft.)	Settlement to Date (1958-2006) (ft.)	Estimated Future Settlement (100 years) (ft.)	Total Calculated Settlement from 1958 (ft)
50	4.6	0.7	5.3
70	4.1	1.8	6.1
90	3.5	2.2	6.7

Figure 3.1. Calculated and estimated settlement of residential development in Marina Village and Mariner Cove based on bay mud thickness below the infrastructure. Table adapted from Town-Wide Storm Drainage and Flood Control Study – Phase I, 2007.

Shoreline Focus Areas

ACCOMMODATION - (pages 75 - 80)
PROTECTION (ENGINEERED INFRASTRUCTURE) - (pages 81 - 82)
PROTECTION (NATURE-BASED AND HYBRID ADAPTATION) - (pages 83 - 91)

THE SCIENCE OF SEA LEVEL RISE

Sea levels have risen about eight inches in the San Francisco Bay area in the last 100 years and are projected to continue to rise over the coming decades (CNRA-OPC 2018). As the scientific understanding of how the climate and Earth systems respond to increasing concentrations of greenhouse gases in the atmosphere, these scientific projections of sea level rise are being updated on a regular basis. Staying connected with the latest State guidance[73], regional guidance[74,75], and sea level rise studies[76,77] will be critical to inform the development of appropriate and effective adaptation efforts. While remaining apprised of the latest science and guidance is important, it is equally important to begin planning using the best available science and guidance and update these plans as more information becomes available.

Corte Madera's bayside neighborhoods and infrastructure are susceptible to a number of natural and man-made hazards that are likely to be exacerbated by increases in sea levels over the next few decades. More areas of the town will likely begin to experience periodic flooding (from both the bay and watershed runoff sources). Neighborhoods that are built on bay fill are expected to continue to subside, which will further intensify and exacerbate the risk of flooding. Consistently higher sea levels may cause groundwater tables to rise, challenging existing stormwater and drainage facilities and increasing liquefaction and seismic risks during earthquakes.[78]

Considering a range of different sea level rise projections gives decision makers the opportunity to evaluate the vulnerability of people, natural resources, and infrastructure under various future conditions. It is vital to consider a range of projections and determine the tolerance for risk associated with making various adaptation decisions.[79] The State of California Sea Level Rise Guidance (CNRA-OPC 2018; pg. 22) states that: "Risk aversion is the strong inclination to avoid taking risks in the face of uncertainty. State and local governments should consider the risks associated with various sea-level rise projections and determine their tolerance for, or aversion to, those risks." The State recommends picking a risk aversion level that is appropriate for the type of asset, and considering this risk aversion level during the project planning and design phases. The State's specific recommendations for using this approach are included as follows:

- **"Projection for decisions with low risk aversion:** *Use the upper value of the "likely range" for the appropriate timeframe. This recommendation is fairly risk tolerant, as it represents an approximately 17% chance of being overtopped [for the selected time horizon], and as such, provides an appropriate projection for adaptive, lower consequence decisions (**e.g., unpaved coastal trail** [emphasis added]) but will not adequately address high impact, low probability events" (pg. 25).*

- **"Projection for decisions with medium – high risk aversion:** *Use the 1-in-200 (0.5%) chance for the appropriate time frame. The likelihood that sea-level rise will meet or exceed this value is low, providing a precautionary projection that can be used for less adaptive, more vulnerable projects or populations that will experience medium to high consequences as a result of underestimating sea-level rise (**e.g., coastal housing development** [emphasis added])" (pg. 25).*

Sea levels in San Francisco Bay are likely (17% probability of exceedance) to rise 1.1 feet by mid-century and 3.4 ft. by 2100; however, sea level rise could be as much as 1.9 feet by mid-century and up to 6.9 feet by the end of the century (0.5% probability of exceedance), depending on global and local emissions and other complex regional and global environmental responses (*see Figure 3.2 and Figure 3.3 on pages 65-66*).

In portions of Corte Madera, the rate of relative sea level rise - amount of sea level rise measured relative to a fixed point on land - varies due to subsidence and settling of the underlying soils (Bay Mud), meaning relative sea levels may rise faster in Corte Madera than in the region as a whole. Subsidence and settling of soils is an important consideration for our shoreline neighborhoods, especially when comparing sea level risk to that in other communities around the Bay area that are not prone to future settlement.

Summarizing Rising Seas and Corte Madera

- The rate of sea level rise is increasing. This means that historical rates of local and global sea level rise are insufficient for estimating future sea levels.
- Certain parts of the Corte Madera shoreline are subsiding (sinking), essentially doubling the rate of observed sea level rise.
- Natural shorelines are eroding today, and marsh edge erosion rates are projected to increase with SLR.[80]
- It is also important to note that still water levels[81] (i.e., the amount of sea level rise) are not the only indicator of flood risk and that storms will still likely cause the majority of flooding, especially in the near-term.
- For planning purposes, the Town is considering a range of possible future sea level scenarios.
- Future decisions should be made on a project-by-project basis using the acceptable risk profile of the particular action/project.
- As sea level rise science and guidance is updated, the Town will follow those updates and reflect them in future adaptation planning.

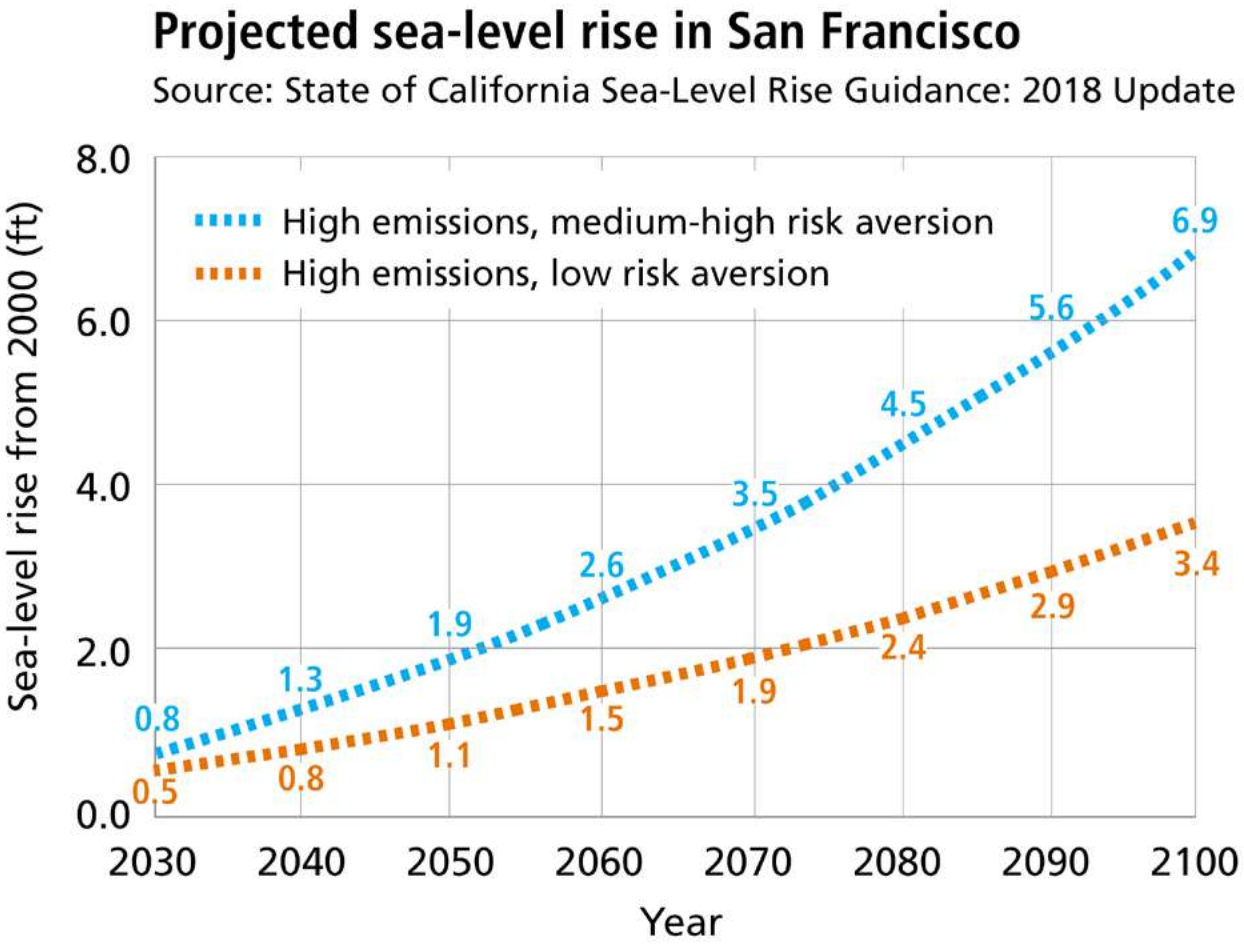

Figure 3.2. Projected sea-level rise (in feet) in the San Francisco Bay area, relative to mean sea levels in 2000. The orange line displays the upper bound of the likely range of SLR under a high emissions scenario (17% probability of exceedance), which is the State guidance recommended when planning for projects with low risk aversion. The blue line displays the 1-in-200 chance (0.5% probability) of SLR under a high emissions scenario, which is the State guidance recommended to consider when planning for projects with medium-high risk aversion. The data used to create this graph can be found in the table in Figure 3.3 on the adjacent page of this report. These projections and associated probabilities, and additional categories of risk, are described in greater detail in the State of California Sea Level Rise guidance document (CNRA-OPC 2018).

Source of Sea Level Rise Projections

In 2017, the Governor of California tasked a working group within the Ocean Protection Council to compile the best available science of sea level rise to provide guidance for planning decisions. The resulting State of California guidance projections were prepared and peer-reviewed by some of the nation's foremost experts in coastal processes, climate and Sea Level Rise science, and decision-making under uncertainty. The probabilistic approach to sea level rise and coastal planning[82] is considered by the State of California the best available science on sea level rise and creates the foundation for the SLR discussion in this assessment.

This report presents information from the State of California sea level rise guidance but does not suggest what projection should be used in planning for any particular adaptation project in Corte Madera.

Projected Sea-Level Rise (in feet) for San Francisco

Probabilistic projections for the height of sea-level rise shown below, along with the H++ scenario (depicted in blue in the far right column), as seen in the Rising Seas Report. The H++ projection is a single scenario and does not have an associated likelihood of occurrence as do the probabilistic projections. Probabilistic projections are with respect to a baseline of the year 2000, or more specifically the average relative sea level over 1991 - 2009. High emissions represents RCP 8.5; low emissions represents RCP 2.6. ***Recommended projections for use in low, medium-high and extreme risk aversion decisions are outlined in blue boxes below.***

		Probabilistic Projections (in feet) (based on Kopp et al. 2014)					*H++ scenario (Sweet et al. 2017) *Single scenario*
		MEDIAN	**LIKELY RANGE**		**1-IN-20 CHANCE**	**1-IN-200 CHANCE**	
		50% probability sea-level rise meets or exceeds...	*66% probability sea-level rise is between...*		*5% probability sea-level rise meets or exceeds...*	*0.5% probability sea-level rise meets or exceeds...*	
				Low Risk Aversion		**Medium - High Risk Aversion**	**Extreme Risk Aversion**
High emissions	2030	0.4	0.3 -	0.5	0.6	0.8	1.0
	2040	0.6	0.5 -	0.8	1.0	1.3	1.8
	2050	0.9	0.6 -	1.1	1.4	1.9	2.7
Low emissions	2060	1.0	0.6 -	1.3	1.6	2.4	
High emissions	2060	1.1	0.8 -	1.5	1.8	2.6	3.9
Low emissions	2070	1.1	0.8 -	1.5	1.9	3.1	
High emissions	2070	1.4	1.0 -	1.9	2.4	3.5	5.2
Low emissions	2080	1.3	0.9 -	1.8	2.3	3.9	
High emissions	2080	1.7	1.2 -	2.4	3.0	4.5	6.6
Low emissions	2090	1.4	1.0 -	2.1	2.8	4.7	
High emissions	2090	2.1	1.4 -	2.9	3.6	5.6	8.3
Low emissions	2100	1.6	1.0 -	2.4	3.2	5.7	
High emissions	2100	2.5	1.6 -	3.4	4.4	6.9	10.2
Low emissions	2110*	1.7	1.2 -	2.5	3.4	6.3	
High emissions	2110*	2.6	1.9 -	3.5	4.5	7.3	11.9
Low emissions	2120	1.9	1.2 -	2.8	3.9	7.4	
High emissions	2120	3	2.2 -	4.1	5.2	8.6	14.2
Low emissions	2130	2.1	1.3 -	3.1	4.4	8.5	
High emissions	2130	3.3	2.4 -	4.6	6.0	10.0	16.6
Low emissions	2140	2.2	1.3 -	3.4	4.9	9.7	
High emissions	2140	3.7	2.6 -	5.2	6.8	11.4	19.1
Low emissions	2150	2.4	1.3 -	3.8	5.5	11.0	
High emissions	2150	4.1	2.8 -	5.8	5.7	13.0	21.9

**Most of the available climate model experiments do not extend beyond 2100. The resulting reduction in model availability causes a small dip in projections between 2100 and 2110, as well as a shift in uncertainty estimates (see Kopp et al. 2014). Use of 2110 projections should be done with caution and with acknowledgement of increased uncertainty around these projections.*

Figure 3.3. Table of projected sea-level rise (in feet) for San Francisco, relative to mean sea levels in 2000 from page 18 of the State of California Sea Level Rise guidance document (CNRA-OPC 2018). Recommended projections for use in low, medium-high, and extreme risk aversion decisions are outlined in blue boxes above and are reflected in the graph in Figure 3.2 on the adjacent page of this report.

COASTAL FLOODING

Impacts to Date

In San Francisco Bay, king tides occur naturally and regularly. They are predictable and expected tides that generally occur only a few times each year and are noticeably different from daily high tides. King tides are the highest tides of the year, about 1-2 feet higher than the average high tides.[83] King tides themselves are not tied to, or caused by, sea level rise; however, current observed king tides allow residents to get a glimpse into the future and experience what higher regular tides will look like. Though temporary, water elevations and subsequent flooding impacts observed in backyards and on streets, beaches, and wetlands, can be comparable to future conditions caused by sea level rise. Imagine seeing these kinds of tides almost daily in a few decades. Understanding the impacts caused by king tides today can help the Town and residents plan for sea level rise in the future. It is important to note that flooding can occur in shoreline neighborhoods both during heavy rainfall events and king tides. High tides or storms can limit the ability for the water to flow into the Bay during heavy rainfall events and further exacerbate flooding.


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Future Risks/Vulnerability

A lot of work has already been done to consider the potential impacts of sea level rise on the land, assets, and communities throughout the Bay Area. In 2017, Marin County developed an extensive vulnerability study: the "Marin Shoreline Sea Level Rise Vulnerability Assessment: Marin Bay Waterfront Adaptation and Vulnerability Evaluation (BayWAVE)."[84] This assessment identified areas at risk based on a series of three different sea level rise scenarios (10 inches, 20 inches, and 60 inches of sea level rise) in combinations with the 100-year storm surge (36 inches). The study grouped these into three buckets - near-term (Scenario 1: 10 inches of sea level rise and Scenario 2: 10 inches of sea level rise plus a 100-year storm); medium-term (Scenario 3: 20 inches of sea level rise and Scenario 4: 20 inches of sea level rise plus a 100-year storm); and long-term (Scenario 5: 60 inches of sea level rise and Scenario 6: 60 inches of sea level rise plus a 100-year storm) (*see Figure 3.4*).

While it is not the purpose of this report to reiterate the findings of the BayWAVE assessment for Corte Madera, it is useful to note that 255 buildings around Lucky Drive, in Marina Village, and the bay front homes of Mariner Cove are vulnerable in the Near-Term scenario with a 100-year storm (*see Figure 3.4*). It is also of note that the Marin County Multi-Jurisdictional Local Hazard Mitigation Plan (2018), adopted by the Town of Corte Madera Council in September 2019, outlines the need to consider sea level rise and future storm effects due to climate change and specifically mentions the vulnerabilities outlined in the BayWAVE assessment.

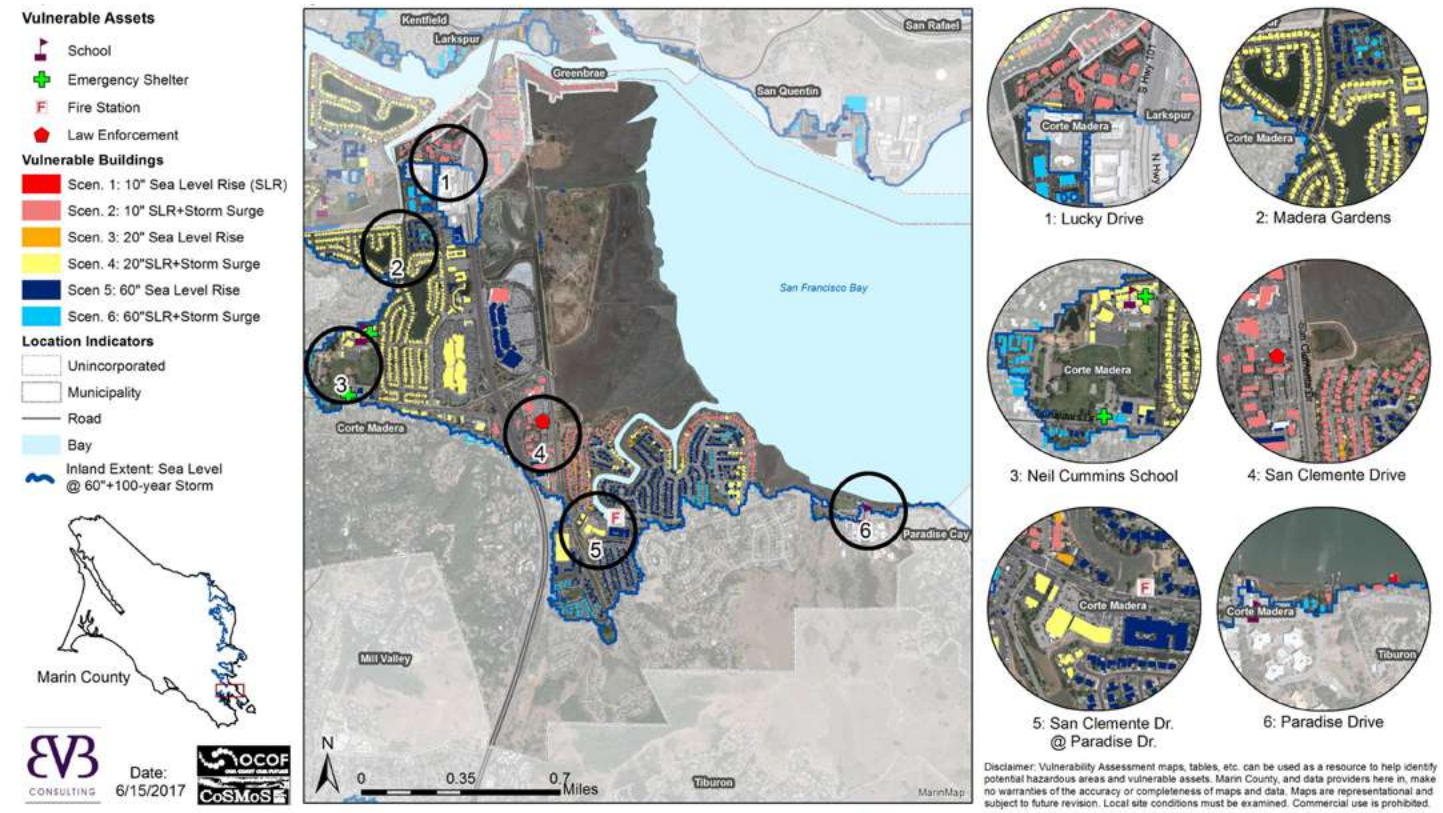


Figure 3.4. Screenshot of a map of vulnerable buildings in Corte Madera, taken from Page 226 of the BayWAVE Marin Shoreline Sea Level Rise Vulnerability Assessment.

Since the BayWAVE report was published, more recent (2019) LiDAR[85] based elevation data has become available. This high-resolution elevation data can provide additional insight into the properties and parcels that may be at risk at different water level elevations. In order to explore how this new information can help inform the Town's adaptation efforts, the project team compiled and mapped potential inundation using three elevations (1 foot above current mean higher high water; 3 feet above current mean higher highwater, and 5.5 feet above current mean higher high water). The maps developed as part of this project can be viewed as supplemental material to this assessment.[86]

Stormwater/Runoff

Residents in shoreline neighborhoods and central Corte Madera are already affected by storms and stormwater run-off. Many of the storm drain systems rely on gravity pipes that discharge into the bay and during high tides, the pipe outfalls are often underwater and are unable to release the storm water as they would if the tidal waters were below the pipe elevations. Events of this nature can flood streets and temporarily overwhelm the storm drainage infrastructure until the high tide subsides, and the "gravity" storm system is able to properly release the water that was temporarily trapped. Increasingly intense and frequent extreme precipitation events, higher daily tides, altered drainage patterns, and increased development with impermeable surfaces are likely to increase the frequency and intensity of inland flooding in Corte Madera. Heavy precipitation events, such as atmospheric rivers,[87] not only cause inland flooding in low lying areas, but also can lead to landslides and other damaging events. Some uncertainty remains in projections of precipitation; however, understanding the general trend in increased heavy precipitation events is important for decision making and planning purposes.

Groundwater Rise

Groundwater levels in Corte Madera fluctuate over time due to variations in rainfall and water levels in the Bay, nearby lagoons, and channels. When groundwater levels are high, the ground becomes saturated and groundwater seepage can enter foundations, causing property damage.[88] Saline conditions or saltwater intrusion can further complicate problems from groundwater seepage, impacting buried infrastructure and damaging vegetation. Groundwater seepage is a common occurrence in the residential bayside neighborhoods, and many residents do not have sump pumps to remove standing water from around their houses. How sea level rise will affect groundwater seepage and saltwater intrusion has not been widely assessed and planned for across the state, though pilot investigations have shown that local impacts can be severe in some communities including low-lying coastal areas.[89,90]

Information on SLR-driven groundwater inundation in California is limited by the lack of data on shallow coastal aquifers, which are not commonly studied because they are not suited for domestic or agricultural use. However, initial regional studies have found that Corte Madera is one of many urban areas around the Bay with very shallow coastal groundwater.[91,92] In relatively permeable substrates, groundwater levels respond to tidal forcing.[93] Chronically higher sea levels may cause groundwater tables to rise even in areas with less-permeable substrates that do not show a tidal signal today. Discharge of rising groundwater to creeks, lagoons, and stormwater channels may reduce storm-water conveyance capacity and increase fluvial flood risk. But, even before emergence flooding becomes an issue, groundwater at shallow and intermediate depths (e.g., <6 ft. depth) will present significant challenges to the maintenance of existing and new infrastructure (including foundations, basements, and buried utilities) and can affect human health due to mobilization of buried contaminants.[94]

Engineering approaches to mitigate flooding (e.g., levees) usually do not address groundwater inundation, so assessment of this risk is an essential step Corte Madera and neighboring communities should take to be able to plan for the full impacts of climate change.[95] When a levee is constructed, rising groundwater levels landward of the levee increase the level of pumping required to protect local infrastructure. Pumping groundwater from former wetland soils can increase the rate of consolidation (leading to subsidence) in already-subsiding areas. A localized groundwater monitoring program specifically focused on the shallow coastal aquifer will help the Town collect the data needed to develop adaptation plans that thoroughly address this threat.

Defining Sea Level and Water Height

For Corte Madera, there are generally two high tides and two low tides within a 24-hour period. High tides elevate water levels and low tides decrease water levels, and those changes are currently measured in a vertical datum known as the North American Vertical Datum of 1988 (NAVD88); it provides a common reference point for discussions of sea levels, which vary substantially due to the irregular shape of the planet, tidal forces, and average gravitational forcing on sea level height. As such, this datum is commonly used for tidal forecasts and used in describing infrastructure elevations. Elevations provided in NAVD88 are heights above 0.0 ft NAVD88. Though, because they are used commonly, residents and Town staff do think of high and low tides based on this reference elevation.

In adaptation planning, water levels are discussed in reference to mean higher high water (MHHW), the average elevation of the highest daily high tide. This water elevation is used because many homes and other infrastructure are generally built to accommodate the highest high tide, and periodic flooding and water levels beyond MHHW is a concern. In Corte Madera, MHHW is about 6 ft. NAVD88 (5.95 ft).[96]

SHORELINE ADAPTATION PLANNING

Adapting to sea level rise and coastal flooding requires proactive planning to ensure protection of coastal resources and development. In general, approaches to responding to sea level rise and their associated actions fall into four main categories: **no-action**; **flood accommodation**; **shoreline protection**; and **managed retreat**.[97] Of these categories of actions, working to help residents and coastal infrastructure accommodate rising sea levels and protect critical areas from coastal hazards are likely to be the most effective and efficient in the near- to medium-term,[98] whereas actions that proactively move infrastructure out of harm's way are longer-term possibilities that may need to be discussed at both the local and regional levels as sea levels continue to rise over time.

Town staff and its elected officials are committed to protecting its residents, property owners, businesses and infrastructure, but this can only be achieved by partnering with the community to develop and implement adaptation actions that are widely supported.

- **No Action** *(status quo - continue to maintain current infrastructure while feasible)*: this action refers to the option to take no additional collective action towards managing coastal climate hazards; however, it does not preclude residents and individuals from taking actions to protect their property on their own. Over the coming years, or decades, routine maintenance of public infrastructure will likely not be adequate to keep up with changing conditions.

- **Accommodation** *(live with water - design for the hazard)*: these actions require modification of existing developments, or design for new developments, to decrease flood risk, therefore increasing the resilience of development to the impacts of sea level rise. Accommodation can happen at the individual parcel or structure scale (raising homes, flood-proofing retrofits, building material requirements, elevating structures, etc.) as well as at the community-scale (zoning ordinances, land use designations). Different types of accommodation actions include regulations or policy, market-based incentives, and floodplain management.

- **Protection** *(keep the water out)*: these actions utilize some kind of engineered structure, or other means, to defend a resource in its current location, generally without changing the development itself. Protection actions can further be divided into "engineered" and "nature-based or hybrid" measures. Engineered actions refer to structures such as seawalls, revetments, levees, and bulkheads that defend infrastructure against coastal hazards such as waves, erosion, and flooding. Nature-based or hybrid actions refer to the creation or enhancement of natural infrastructure like coarse beaches, wetlands, and other systems that buffer coastal areas. The construction of these nature-based solutions, oftentimes called "living shorelines", can capitalize on the natural ability of the local environmental systems to protect the shoreline from hazards while also enhancing habitat and ecosystem services.[99]

- **Managed Retreat** *(move out of harm's way)*: proactively choosing to move infrastructure away from coastal risk zones and rising sea levels is called managed retreat. It may be necessary to consider this longer-term set of adaptation options as sea levels continue to rise.

No single category of action(s) is considered "better", or "best", as different types of actions are appropriate for different locations and for different vulnerabilities and resource protection goals. Additionally, approaches can change over time depending on resources available as well as community goals and needs. ***In many instances, a hybrid approach to adaptation that utilizes actions across multiple categories is necessary to reduce vulnerability.*** The effectiveness and implementability of many actions are contingent upon decisions made around other actions. So, development and consideration of larger strategies (groups or series of actions) which can get implemented over space and time may be more effective and efficient. These larger strategies are ideally designed to be robust for the most likely future scenarios and/or can be modified or adjusted at key junctures in the future. It is essential to identify in advance how these changes would be implemented and when these changes would need to occur in order to help the Town plan for, prioritize, and stagger investment.[100]

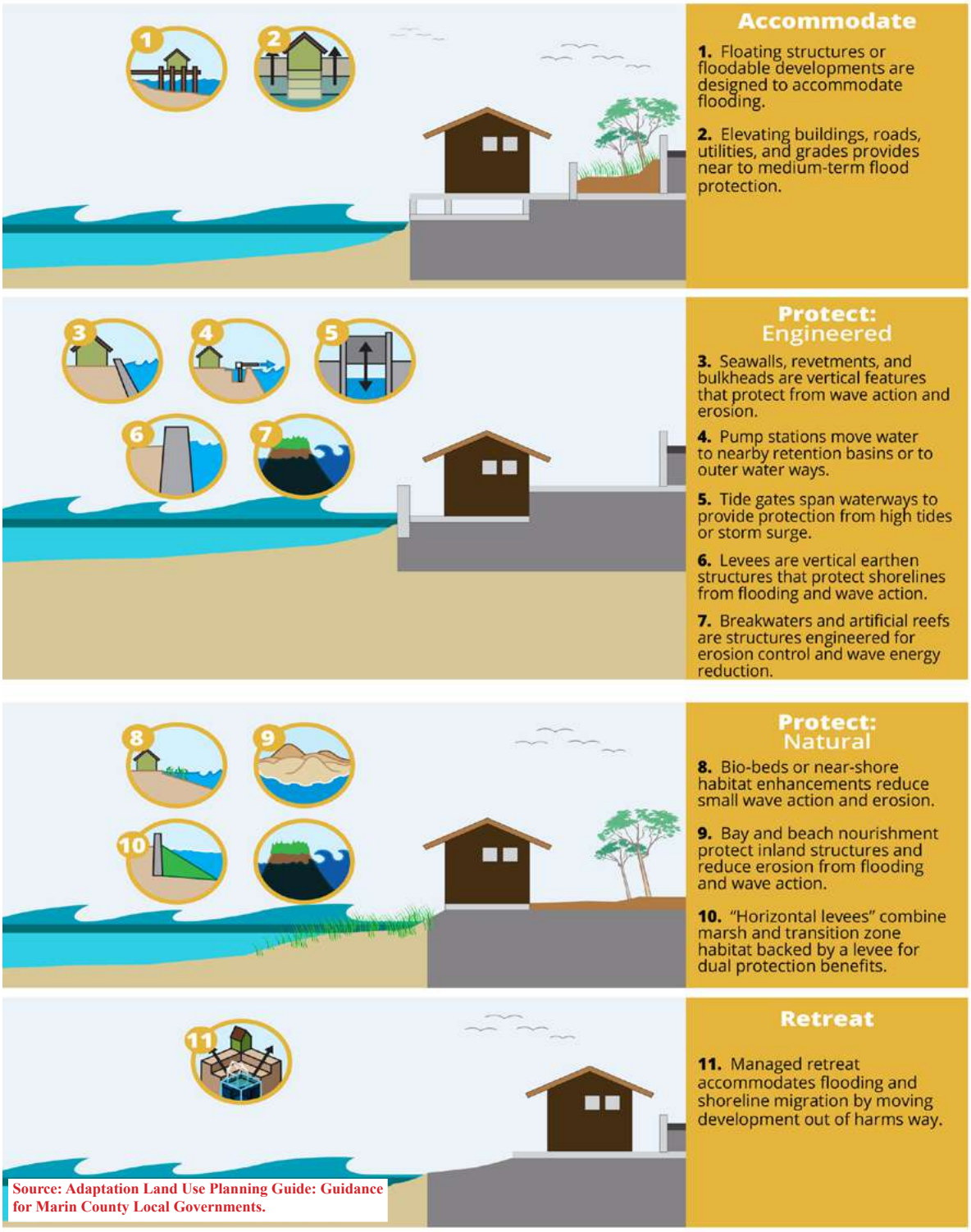
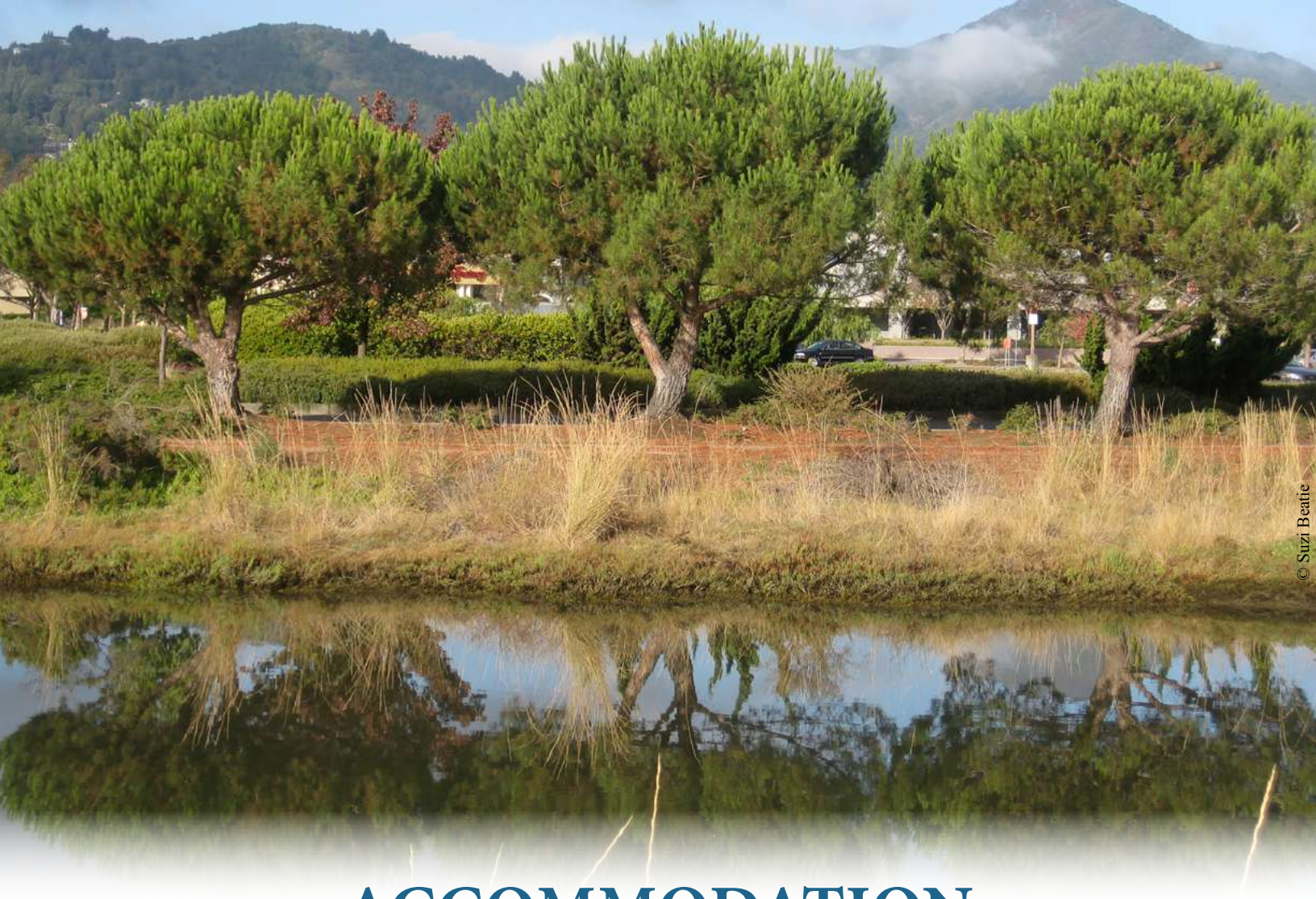


Figure 3.5. Graphic depicting and explaining groupings of adaptation and planning solutions designed to manage, mitigate, and avoid impacts from sea level rise and flooding. (Source: Adaptation Land Use Planning Guide: Guidance for Marin County Local Governments, pg. 17).

There are a suite of possible adaptation actions for the shoreline neighborhoods of Corte Madera.

Corte Madera's shoreline neighborhoods are home to many of the Town's residents, shopping malls and other businesses critical to the town's economy, schools, and other services. Though these neighborhoods are vulnerable to coastal flooding, residents prefer to stay in place as long as possible, preserve the natural ecosystem, and protect their assets. While episodic flooding is a current reality, the Town has time to plan for and proactively manage future flooding. Due to the range of impacts that can occur as a result of sea level rise, a combined suite of policies, programs, and projects are needed to protect critical infrastructure and residents, reduce vulnerability, and enhance the resilience of the community. It is important to acknowledge that future conditions (environmental, financial, and social) are uncertain and can change rapidly, which may require adjusting plans and considering options that may not be currently among the top considerations for the Town and surrounding region. In addition, these decisions impact people's lives, safety, and property; critical ecological resources; and public resources. Therefore, planning inclusively, with contingencies, and allowing for flexibility is extremely important. Two of the near-term categories of actions are explained in more detail in the following pages.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ACCOMMODATION

As discussed above, one way to adapt to rising seas is to learn how to live with water or design infrastructure capable of withstanding the current and future flood hazards. Creating space for more water in the landscape is a critical piece of the adaptation puzzle for Corte Madera. In many instances, accommodating rising sea levels by modifying existing structures and infrastructure can provide a cost-effective way to help reduce current and future flood risk. Actions like elevating certain road segments or encouraging residents to elevate finished floor elevations can prevent or minimize flood damage. To further reduce the community's vulnerability to flooding, the Town can take additional actions while maintaining the flexibility needed to adjust as conditions or community needs change.

Accomodation Happening Today

A large portion of the Town currently lies in the floodplain, which is considered a Special Flood Hazard Area (SFHA) designated by FEMA. To accommodate flooding from bay and creek sources in these areas, development must meet particular building requirements and adhere to specific regulations. In an effort to reduce flood insurance rates for residents, the Town participates in the FEMA/NFIP Community Rating System (CRS), which determines insurance discounts based on flood risk reduction and floodplain management efforts. The CRS credits community efforts to reduce flood risk by assigning points for different activities. Corte Madera is currently credited as a CRS Class 7, which translates to a 15% savings on all flood insurance rates.[101] For more information on the CRS classes and requirements, refer to FEMA's resources. While the FEMA and CRS community participation requirements help reduce vulnerability to flooding, these requirements are based on historical flood data and do not account for future flood risk from extreme precipitation events or sea level rise.

The actions highlighted in this report represent a subset of a broader suite of adaptation actions that scored highly based on their potential effectiveness, efficiency, and feasibility for the Town. These actions (and the full suite of actions in Appendix B) provides the Town with a list of many of the most appropriate options to consider. ***It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented. The local or regional organization, agency, or department responsible for implementing any action will need to be determined on a case-by-case basis.***

Partner with the community to enhance understanding of sea level rise science, projections, and associated vulnerabilities. Work toward a community wide consensus on which sea level rise projections should be adopted for future Town efforts. This action could include: community discussions and workshops to explore sea level rise data and probabilistic projections; enhanced collaboration with regional and state entities working on sea level rise; identification of appropriate risk aversion levels based on facility type; and identification of thresholds for action.

Conduct a comprehensive, finished floor elevation inventory of buildings within current and projected flood risk areas. This inventory can help the Town make the most informed decisions on where and when to most effectively invest resources by not relying solely on the bare-earth elevation data to determine at-risk structures or areas for future investments.

Encourage more resilient and adaptive building types for all new commercial and residential developments. Explore modifying existing regulations and development standards to encourage more resilient structures (such as modification to height, lot coverage, and floor area requirements, or design review processes), and providing design criteria for modifications to landscaping, parking and transitions in height that would ensure consistent aesthetic approaches to community adaptation. This action would include the need to continue to review and revise regulations and design standards to ensure they match with state and federal requirements and guidelines and account for and minimize the impacts of coastal flooding.

Encourage or require additional freeboard above base flood elevation for new construction or significant remodels of critical facilities. Encouraging or requiring additional freeboard for new structures in flood hazard areas (e.g., 3 feet above base flood elevation) can help reduce vulnerability to flooding for critical facilities in these areas. Other non-critical buildings could also be encouraged to elevate their structures.

Provide regulatory assistance to property owners by streamlining zoning regulations and the development permitting process to enhance the resilience of homes and property. Reducing the amount of time, effort, and cost needed to fill out, review, and approve permits related to hazard preparedness can greatly improve compliance, and ultimately the resilience, of homes and properties in the flood hazard zone. The Town could explore modifying regulatory processes for design review, approval of variances, and other requirements when proposed projects increase the resilience of the property.

Lucky Drive

Lucky Drive is a short-yet-essential stretch of roadway that connects Corte Madera, Larkspur, Kentfield and other areas of central Marin to Highway 101. This stretch of road is a critical access point to Highway 101 and the only way to get to many homes and commercial properties in the Town without enduring significant detours. Lucky Drive is susceptible to flooding from Corte Madera Creek during heavy precipitation events and vulnerable to sea level rise.

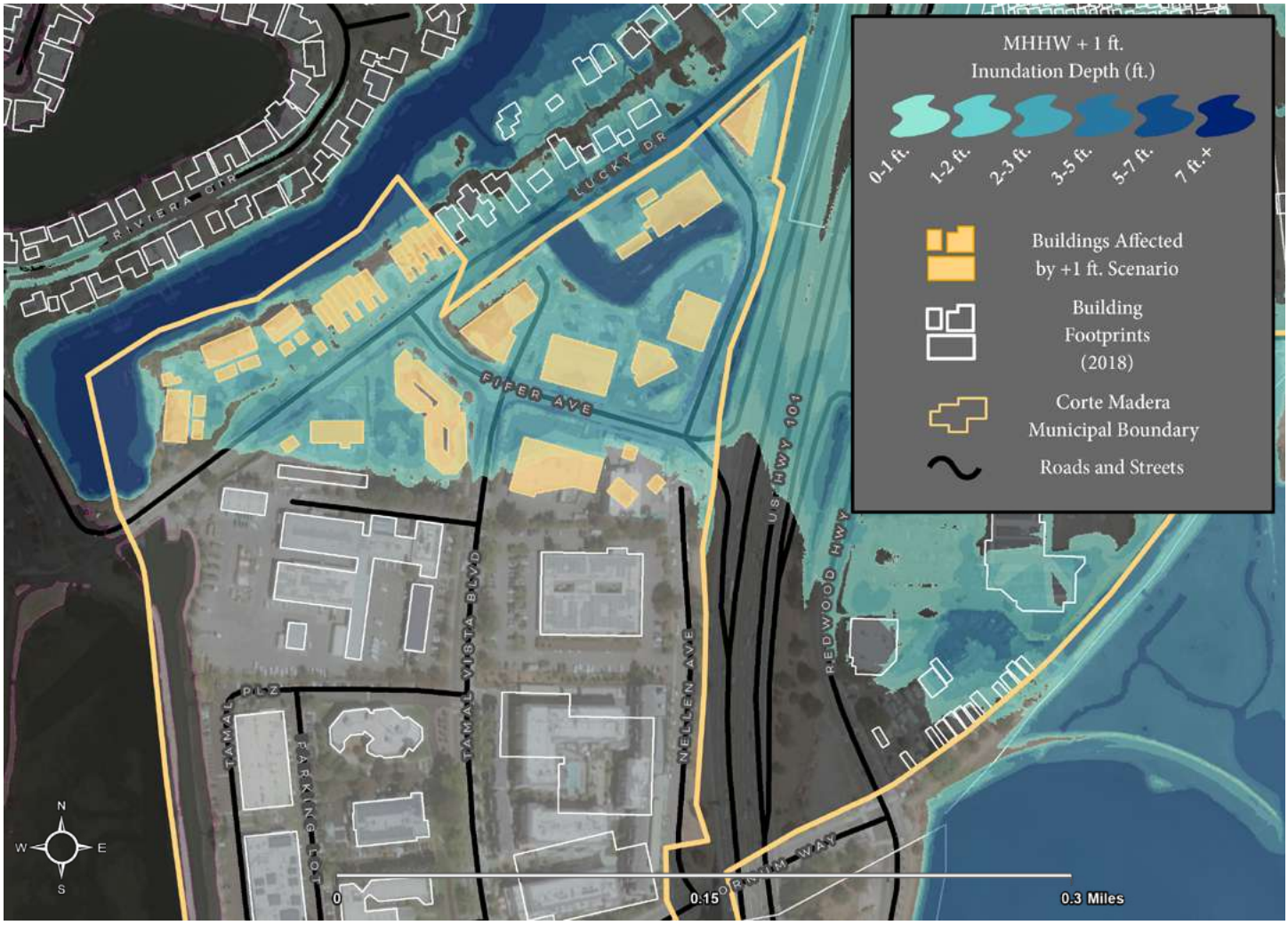

Figure 3.6. Section of Lucky Drive under a MHHW + 1 ft. scenario (approximately equivalent to a king tide). The area highlighted in yellow is currently protected by stormwater infrastructure, but coloring depicts water inundation levels without existing infrastructure in this protected area. Mapping is based on 2019 LiDAR Data collected by Marin County and methodology can be found in Appendix D.

Despite being protected from temporary flooding by a storm water pump station, a section of Lucky Drive still floods during king tide events, especially when a king tide occurs during a period of high intensity rainfall. To reduce the risk of flooding Lucky Drive, the roadway should be raised, and the localized storm drain network should be improved. The project team explored and assessed one concept of raising Lucky Drive from Doherty Drive to the northern Town border at a "planning level" to a minimum elevation at the back-of-sidewalk of 10.7 ft (NAVD 88). The 10.7 ft NAVD88 elevation would move the roadway above the current 100-year flood and allow for an additional 13" of sea level rise over the typical lifespan of the roadway (~25 years). This adaptation strategy next steps should include the analysis of additional roadway heights, various multi-modal enhancement options (Class IV, buffered Class II bike lanes, etc.) along with the respective environmental studies, preliminary engineering, FEMA benefit-to-cost analysis, and community engagement. The Town should prioritize coordinating with Larkspur and the County of Marin, given their jurisdictions to the immediate north and west, to work collaboratively to identify and submit grant applications to improve this essential roadway in the near term. Given the regional importance and roadway flooding events to date, this strategy should be prioritized for further advancement as soon as outside fund sources are identified.

Paradise Drive

Paradise Drive is another critical regional transportation corridor connecting Tiburon and the County of Marin to the Town and Highway 101. It is a part of the Bay Trail and provides access to the Marin Montessori and Marin County Day schools and other residences. The Town has been looking into resurfacing the road, expanding bike lanes, and making other roadway improvements for 5+ years and given the typical lifespan of a roadway (~25 years), it became apparent that future sea level rise should be evaluated prior to investing significant Town funds.

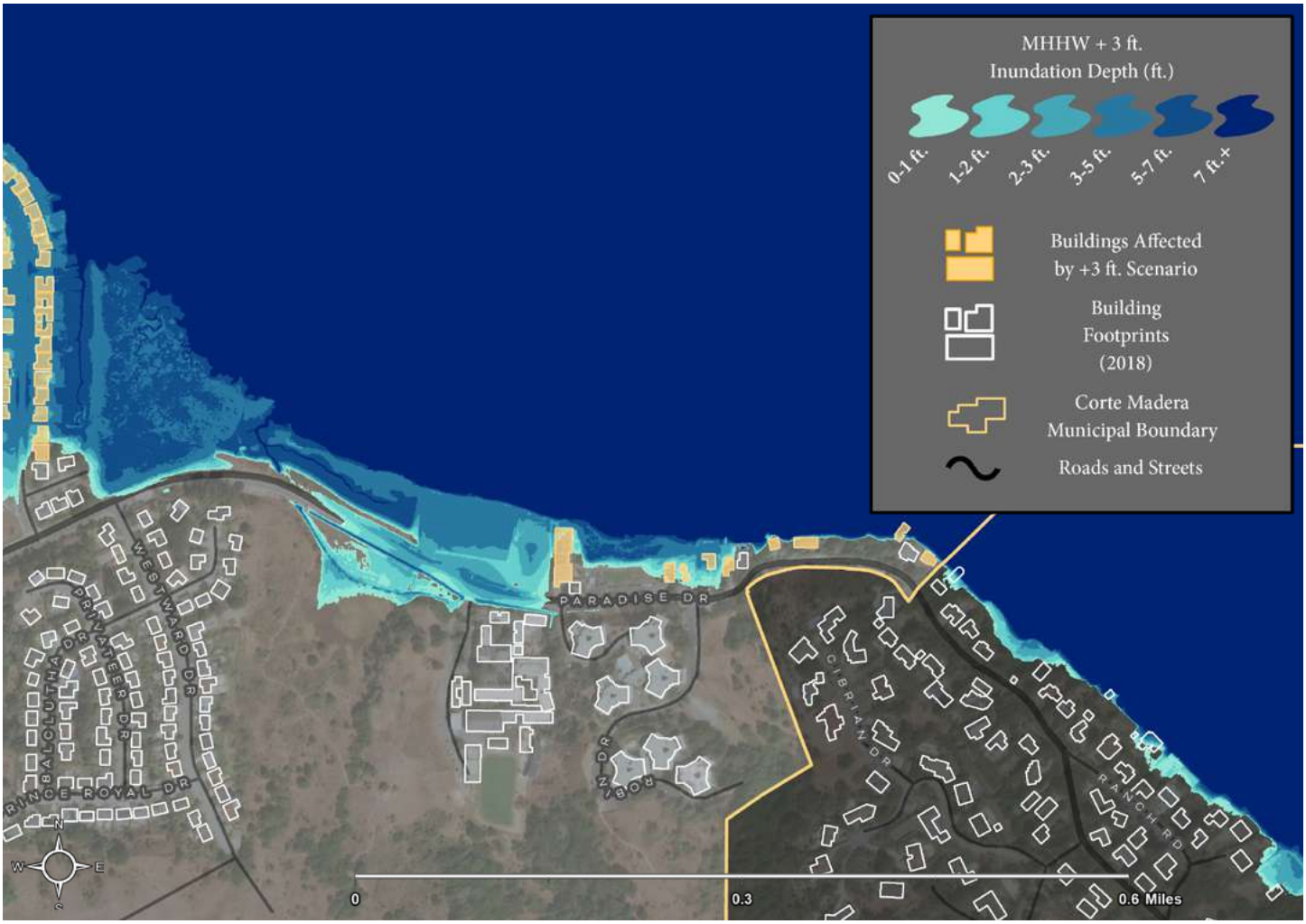

Figure 3.7. East Paradise Drive under a MHHW + 5.5 ft. scenario. Color shading depicts approximate depth of inundation. Mapping is based on 2019 LiDAR Data collected by Marin County and methodology can be found in Appendix D.

To reduce the risk of flooding Paradise Drive, the roadway should be raised. The project team evaluated and assessed one concept of raising Paradise Drive from Westwood Drive to Robin Drive to 11.6 ft (NAVD 88), in conjunction with the proposed widened roadway. This adaptation strategy next steps should include the analysis of additional roadway heights (and/or alternative adaptation strategies), various multi-modal enhancement options; along with the respective environmental studies, preliminary engineering, FEMA benefit-to-cost analysis, and community engagement (including coordination with the schools).

Since a portion of the funds needed to initiate design services were obtained as part of a prior Safe Pathways grant, the Town should identify a team of qualified professionals and discuss possible consideration of authorizing this initial project development phase at a Town Council meeting in the near future. For more information on the GIS methods used to create these maps, see Appendix D.

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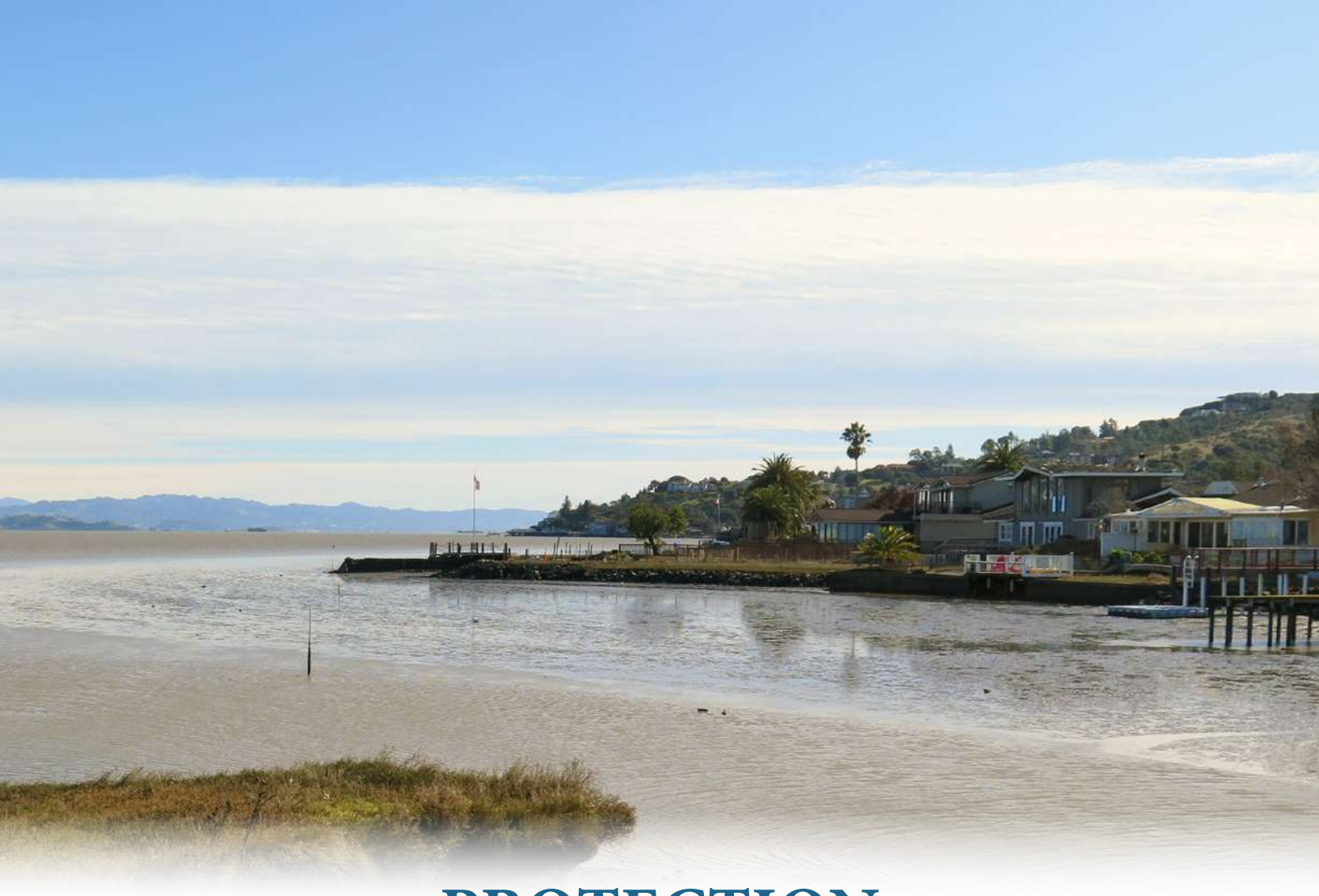
In response to community feedback, no specific actions have been developed for Corte Madera's bayside neighborhoods. The Town is committed to engaging with community members, and specifically residents of Marina Village and Mariner Cove, to create a shared understanding of risk and to co-develop solutions to these challenges.



PROTECTION

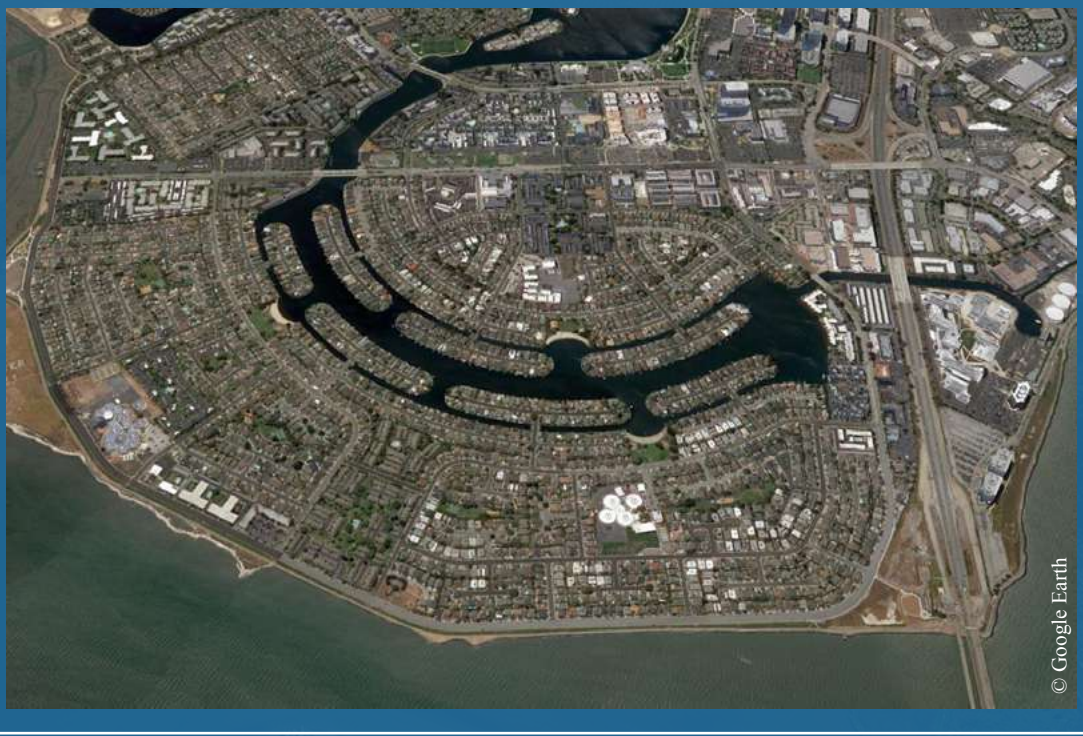
(Engineered Infrastructure)

Earthen levees and a network of flood control systems currently protect portions of the Town and residences from high water levels and storm surge. Continued use of protection action can be critical to near- and medium-term resilience. It remains important for the Town to regulate the construction of protective infrastructure to limit potential negative environmental impacts.[102] Well-designed programs can help select appropriate actions, monitor environmental conditions, and assist residents and decision-makers in making appropriate investments.

Case Study: Levee Improvements at Foster City

Foster City is a bayside development on former marsh that faces similar challenges to Corte Madera. A levee surrounds much of Foster City, protecting the low-lying area from flooding. In 2014, the Federal Emergency Management Agency (FEMA) determined that the existing levee (at elevation 12-13 feet NAVD) does not meet minimum flood protection requirements. To meet FEMA's current standards it must be raised to 16 feet NAVD in certain areas, and even higher to protect from future sea-level rise. The levee crest elevation will be raised by adding a sheet pile wall. Due to view impacts and geotechnical limitations, continuing to raise the sheet pile wall to protect from both storm surge and wave runup beyond 2050 may not be possible. A coarse beach has been proposed bayward of the levee to reduce wave runup and extend the life of the sheet pile wall. To reduce risk and avoid designating Foster City as a flood zone (which would require expensive flood insurance for homeowners), voters passed a bond measure in 2018 to fund the levee improvement project.

There are some key differences between Foster City and Corte Madera; today, much of Corte Madera lies within the FEMA floodplain, while Foster City (though very low-lying) has been exempt from flood insurance requirements due to the levee system. Nearly all of Foster City is protected by the levee, while only a portion of Corte Madera is vulnerable to coastal flooding. Foster City has an existing natural fringing beach along part of the shoreline, where Corte Madera does not (though it does have more extensive marshes). Both cities aim to protect residential neighborhoods constructed on Bay fill in former marshlands from the impacts of rising sea levels. More information about the Foster City Levee can be found available here.



PROTECTION

(Nature-based and Hybrid Adaptation)

The marsh serves as a natural buffer to sea level rise, so marsh restoration and enhancement efforts will be essential to improving the natural habitat and protecting the shoreline from rising seas and wave action. Actions in this category tend to address near-to medium-term resilience needs that can, through a mix of nature-based and hybrid solutions, provide flood protection and ecological enhancements to help protect current and future development near the shoreline. Natural and nature-based measures are physical landscape features that are created and evolve over time through the actions of environmental processes. Nature-based measures mimic characteristics of natural features but are created by engineering and construction (in concert with natural processes) to provide coastal protection and other ecosystem services.[103] Nature-based adaptation measures are only appropriate in certain landscape settings. They can be used in combination with other appropriate nature-based measures. There are also hybrid combinations that include both nature-based measures and conventional engineered measures. The Town will need to balance engineered and nature-based adaptation efforts, as well as fiscal constraints, in order to find the optimal way to protect both private property and natural resources while maintaining community's quality of life and community values. Two examples of suites of nature-based adaptation measures working in concert with engineered measures to provide flood protection and habitat benefits are shown in Figure 3.8 and 3.9. Examples of nature-based measures that are suitable in Corte Madera are tidal marshes, ecotone slopes, submerged aquatic vegetation, and coarse beaches, each of which are described in more detail in the following section.

Nature-based solutions can be effective at attenuating wave energy and reducing the near-term effects of storm surges; however, they are unlikely, on their own, to be effective longer-term solutions to address rising sea levels.

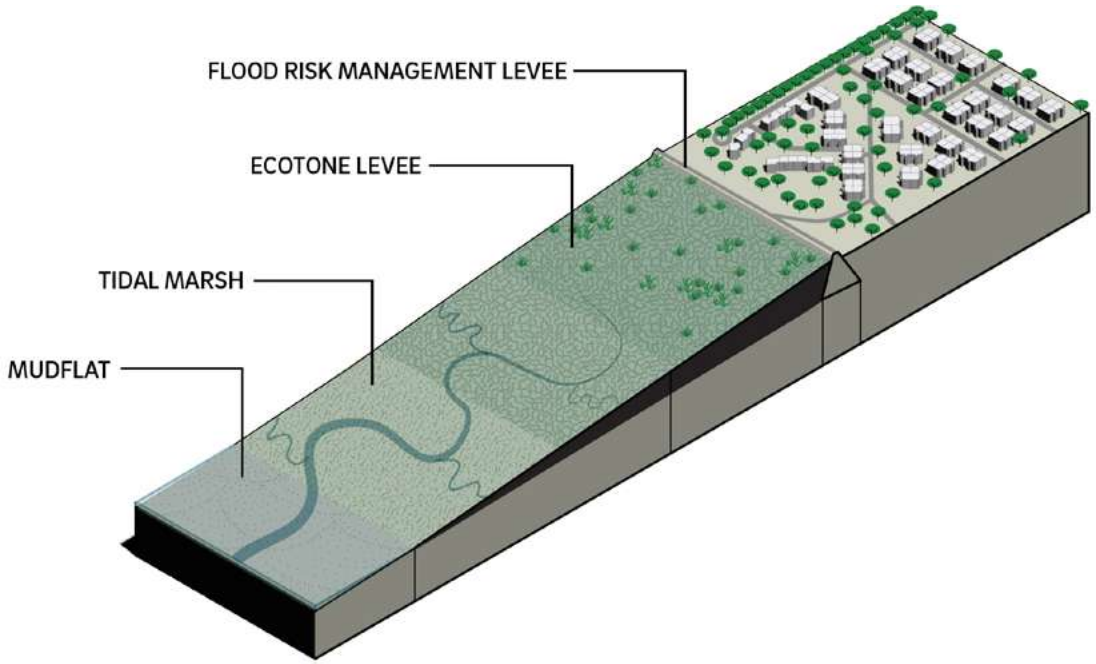


Figure 3.8. Example of multiple "gray" (traditional) and "green" (nature-based) adaptation actions working in concert to provide flood protection and habitat benefits. Illustration by Micaela Bazo, SFEI. Adapted from the SF Bay Adaptation Atlas (SFEI & SPUR 2019).

Tidal Marshes

Protecting, maintaining, and restoring tidal marshes and their associated tidal flats is critical for sustaining their flood risk management services with a changing climate.[104] The topography of the marsh and its associated mudflat plays a significant role in wave refraction, shoaling, and breaking. Wide marshes at Corte Madera are an asset in wave attenuation. Stabilizing the outer edge of the marsh by placing coarse beaches can help maintain marsh width by reducing the erosion-causing force of wave action. Other potential actions include restoring tidal action to diked baylands to restore marshes, planting native species to accelerate colonization, placing sediment to raise subsided areas, and creating marsh mounds - higher areas within marshes to provide high-tide refuge.[105] In existing marshes this measure might also include sediment placement to help maintain marsh elevation with sea level rise.

Ecotone Slopes

Ecotone slopes are ramps (with a length to height ratio of 10:1 or gentler) bayward of flood risk management levees and landward of a tidal marsh. They can provide wetland-upland transition zone habitat when properly vegetated with native clonal grasses, rushes, and sedges.[106] Ecotone slopes can attenuate waves before they reach the levee, provide high-tide refuge for marsh wildlife, and allow room for marshes to migrate upslope with sea level rise.[107] In Corte Madera, there is a unique opportunity to use on-site material (dredge spoils at the Golden Gate Bridge District parcel) to create an ecotone slope along the former railroad embankment, connecting a potential future flood-risk management levee to the marsh.[108]

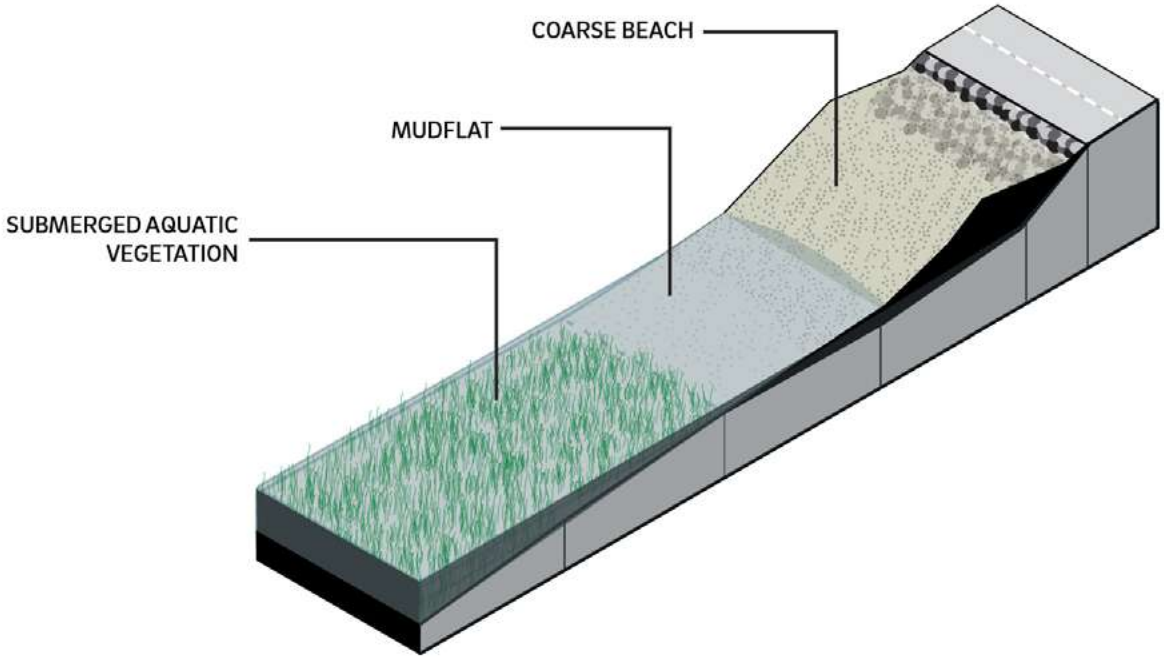


Figure 3.9. Submerged aquatic vegetation, mudflats, and coarse beaches are natural features that can reduce the impact of wave action on the shoreline. Illustration by Micaela Bazo, SFEI. Adapted from SF Bay Shoreline Adaptation Atlas (SFEI & SPUR 2019).

Submerged Aquatic Vegetation

Submerged aquatic vegetation refers to all underwater flowering plants and contributes to trapping sediment and slowing shoreline erosion.[109] Eelgrass (Zostera marina) is the main species in the lower parts of the San Francisco Estuary, but other submerged vegetation species exist throughout the Bay as well. However, submerged aquatic vegetation cannot grow anywhere; salinity, light, and substrate are limiting factors for eelgrass beds, and they do best where current speeds and wave energy are not excessive. Potential exists to establish eelgrass beds at depths less than 2 meters in broad swaths along the shores of Corte Madera bayward of the tidal marsh.[110,111]

Beaches

Coarse or composite estuarine beaches are dynamic features that can consist of a mixture of sand, shell, gravel, or cobble.[112] Coarse gravel and cobble beaches can dissipate wave energy over shorter distances than marshes and therefore may be more suitable within an urbanized estuary that has limited space.[113] Beaches can be placed in front of levees, roads or other infrastructure vulnerable to wave overtopping, or in front of marshes vulnerable to erosion. In addition, groins or other retention structures (large woody debris is one option) should be considered for beaches implemented along shorelines where the dominant waves tend to transport sediment down the shoreline.

For more information about nature-based sea level rise adaptation strategies, please refer to the San Francisco Bay Shoreline Adaptation Atlas.

Case Study: Marsh Restoration and Levee Improvements at Tiscornia Marsh (San Rafael)

Tiscornia Marsh is located at the mouth of the San Rafael canal and owned by the Marin Audubon Society. One of the last remnants of ancient marsh in the area that has remained unaltered by human development, Tiscornia Marsh has experienced considerable erosion over the past 30 years, with approximately 3 acres lost over that period.[114] This erosion has resulted in significant loss of habitat for the endangered Ridgway's rail and salt marsh harvest mouse, migratory shorebirds, and other important marsh wildlife. In addition, the levee behind the marsh is relatively low, exposing parts of San Rafael's canal neighborhood to flooding during an extreme coastal storm. Erosion and flood risk will be exacerbated by sea level rise, and the proposed restoration design addresses both concerns.

The preliminary design for a habitat restoration and sea level rise adaptation project was created by Environmental Science Associates. The project design includes ecosystem enhancements (restoring an eroded section of the existing tidal marsh, opening the diked marsh to tidal action, providing transition zone habitat) and levee enhancements (improving a section of degraded levee and enhancing public access opportunities on the Bay Trail). The next phase of the Tiscornia project is funded by a Measure AA grant to the Marin Audubon Society.

This project pilots several elements relevant to adaptation designs for Corte Madera, including the use of coarse beaches for erosion reduction at the marsh edge, an integrated plan for marsh restoration and levee enhancements, inclusion of an ecotone slope connecting the marsh and levee, and the enhancement of public access to improve the site as an asset to the community. More information about the Tiscornia Marsh restoration project is available at http://www.tiscorniamarshp.org.

© Douglas Mundo, Multicultural Center of Marin. Courtesy of Marin Audubon Society

Corte Madera Marsh & Railroad Right of Way

Corte Madera Marsh is a unique and valuable community asset. When combined with the existing earthen levee along the current SMART right-of-way, the area provides both flood protection and habitat for endangered species. The area is critical to the medium and long-term resilience of the community and provides an opportunity for a variety of partners to benefit from improved flood protection, healthy natural habitat, and enhanced recreation and multi-modal transportation opportunities. Any actions to increase resilience in this area will require collaboration within and across jurisdictions. Much of the Corte Madera baylands (including Muzzi Marsh and Marta's Marsh) were diked and filled for pastureland in the early 1900s, then later restored to tidal action. Heerdt Marsh is one of the few historical tidal marshes in the Bay that has never been cut off from tidal action by dikes.[115] Today, much of the marsh is managed by the California Department of Fish and Wildlife as the Corte Madera Ecological Reserve. The Golden Gate Bridge and Highway Transportation District (Bridge District) parcel is separated from the Bay by berms. The Bridge District parcel has received significant amounts of fill in the form of dredged material from Corte Madera Creek and much of it is above tidal marsh elevation today. Behind the Bridge District parcel, Shorebird Marsh acts as both a refuge for waterbirds and a detention basin for stormwater flows from the Town. A tide gate connects the Shorebird Marsh to the Bay, allowing for management of water level. Sonoma-Marin Area Rail Transit (SMART) owns a railroad right of way along the old railroad berm at the back of the marsh. The railroad berm provides flood protection as well as public access — including biking, walking, and wildlife-viewing opportunities. In the future, SMART may extend their rail line south from Larkspur along this alignment, connecting San Rafael to The Village at Corte Madera shopping center.

Figure 3.10. Potential location for an integrated adaptation strategy for the marsh and railroad alignment.

Flood Protection Levee with Ecotone Slopes Along Some Segments

The potential climate adaptation actions for this corridor include improvements to existing berms and to multi-modal transportation infrastructure, both of which would address sea level rise and storm surge. A raised flood risk management levee along the back of the marsh could take various forms depending on the north-south location along the existing corridor and desired design characteristics, and construction could be combined with marsh restoration efforts. In accordance with the 2016 Bicycle and Pedestrian plan, the Town also stands to enhance this area by considering amenities like a Class 1 bicycle facility which would offer a quieter and safer bike route parallel to the Bay Trail on Redwood Highway.

Figure 3.11. Conceptual design for potential restoration and adaptation options at Corte Madera Marsh and the railroad right-of-way.

Marsh Enhancements

Recent restorations, like Marin Audubon's Madera Bay Park restoration, have continued to reshape and enhance this area of shoreline. Marsh restorations help preserve essential habitat and provide flood protection and recreational benefits for the Town. Small-scale restoration has been recently completed for part of the Bridge District parcel, which also presents opportunities for larger-scale restoration projects. For example, the dredge spoils on the site could be moved to create an ecotone slope and enhance flood protection along the railroad berm.[116] In the older, more pristine marshes, such as Heerdt Marsh and inner Muzzi Marsh, small marsh mounds to create high tide refuge may be a more appropriate adaptation strategy than ecotone levees, which require more fill to be placed on the marsh.

The edge of the Corte Madera marshes has eroded consistently over the last 25 years, with erosion rates averaging 0.5-2 m/yr.[117] On the outboard edge of the marsh, coarse beaches could be placed to reduce ongoing wave erosion. A recent conceptual design for a marsh-fringing coarse beach at Muzzi Marsh suggests using large woody debris to stabilize areas of cohesive marsh that are acting as "headlands" and placing beach sediments below the marsh scarp. Over time, waves would build the coarse material into a natural beach profile, slowing erosion of the marsh scarp.[118] This design also suggests the use of endangered plant, *Suaeda californica*, to create high tide refuge and trap sediment.

Ecotone slopes are a way to soften the steep slope of a flood risk management levee, creating a gradient of vegetation and habitat types from tidal marsh to upland. This elevation gradient allows marsh species to seek high tide refuge above rising waters, and also provides a path (albeit a narrow one) for marshes to migrate as the seas rise. Ecotone slopes, given their gradual nature (10:1 to 20:1 slope), take up more space than a traditional flood risk management levee (3:1 slope). This can mean filling portions of current marsh to make way for future marsh as the climate continues to change. There is an inherent tension between conserving tidal marsh habitat for today and preserving it for tomorrow. Ecotone slopes would be most beneficial in locations with degraded marsh, or on upland fill, and not in locations with high habitat value today. In more sensitive areas, marsh mounds can be used as an alternative strategy to attenuate some waves and provide high tide refuge.

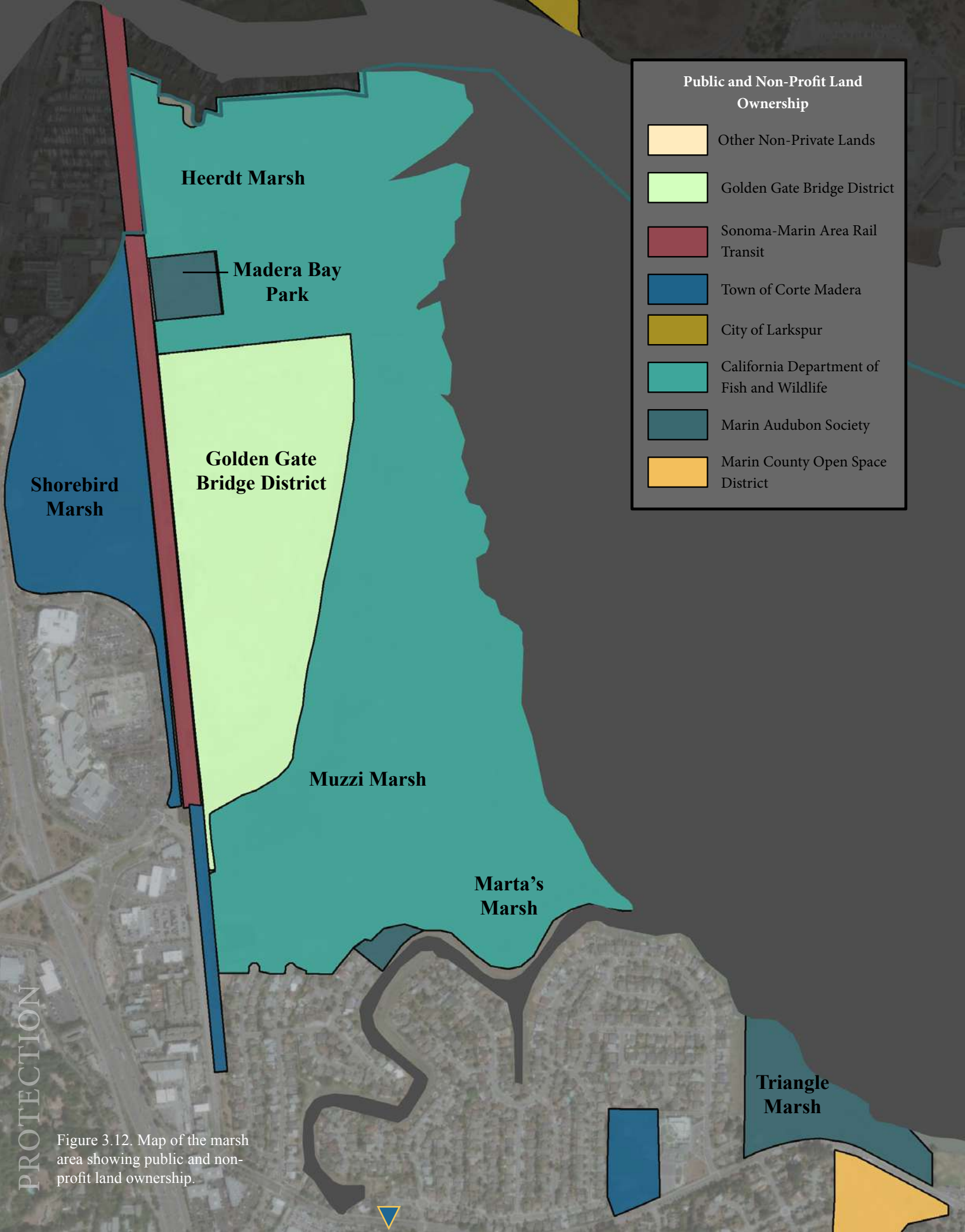


Figure 3.12. Map of the marsh area showing public and non-profit land ownership.

Building Partnerships for Adaptation at Corte Madera Marsh

During April and May 2020, the Town and SFEI held a series of calls with interested partner organizations to discuss a vision for a resilient Corte Madera Marsh. All organizations were interested in participating in regional sea level rise and marsh restoration planning. Partners were also interested in providing general support to undertaking near term pilot adaptation projects while developing a long-term planning process. Such a process could include developing a regional shoreline master plan, similar to the Hayward Shoreline Master Plan. Critical partners included the following organizations:

- **The California Department of Fish and Wildlife (CDFW)** - CDFW manages most of the marsh and mudflats but has limited resources and no plans for any restoration or adaptation projects. Their focus is on managing and protecting the existing marshes, especially issues related to public access. CDFW responds to either an "immediate risk" or an "immediate need" and does not have the resources for the long-term management of new marsh restorations.

- **The San Francisco Regional Water Quality Control Board (RWQCB)** - RWQCB generally takes a long-term view on planning, looking for a net gain of ecological value. RWQCB would generally prefer the flood risk management levee encroach on the marsh as little as possible. RWQCB sees benefits in not delaying adaptation and developing a regional shoreline plan, although there was no reason some actions could not be piloted before the regional plan was complete. The RWQCB suggested that plans would benefit from an early review (10% design), by the Bay Restoration Regulatory Integration Team (BRRIT).

- **The County of Marin** - The County of Marin has interests in the Greenbrae Boardwalk and the underlying jurisdiction of the SMART alignment north of Madera Bay Park. The County is interested in helping facilitate a discussion among stakeholders about projects, such as discussions of any action in the Heerdt Marsh/Greenbrae boardwalk area, which would require a partnership among Corte Madera, Larkspur, and the County.

- **The Golden Gate Bridge, Highway, and Transportation District (GGBHTD)** - GGBHTD is focused on the restoration of a 4-acre marsh by the Shorebird Marsh channel. Following that project, the GGBHTD is to prepare an environmental impact report (EIR) for the extension of the Larkspur Ferry Service, which will likely require the mitigation of marsh erosion due to ferry wakes.

- **The Marin Audubon Society** - The Audubon Society has recently completed the Madera Bay Park, where fill was removed to create tidal marsh habitat for the endangered Ridgway's rail and other marsh species. The Audubon Society believes there is potential to utilize some of the remaining upland fill from this project elsewhere but does not see many opportunities, however, north of the Madera Bay Park, including Heerdt Marsh.

- **The Bay Conservation and Development Commission (BCDC)** - BCDC recently passed the "Fill for Habitat Bay Plan Amendment" - which was written with Corte Madera in mind to place fill adjacent to existing marshes. BCDC sees this amendment was part of an adaptive management approach. They also have a keen interest in public access along the shoreline.

The actions highlighted in this report represent a subset of a broader suite of adaptation actions that scored highly based on their potential effectiveness, efficiency, and feasibility for the Town. These actions (and the full suite of actions in Appendix B) provides the Town with a list of many of the most appropriate options to consider. ***It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented. The local or regional organization, agency, or department responsible for implementing any action will need to be determined on a case-by-case basis.***

Remain up-to-date on scientific studies, local and state policies and regulations, and relevant reports that increase and refine the body of knowledge regarding sea level rise affecting Corte Madera and the innovative responses that are available to address it. Our combined scientific knowledge of changing climate conditions, including rates of sea level rise, is constantly evolving. Staying abreast of those changes and the local, regional, and state level responses, guidance, and best practices can inform how Corte Madera chooses to respond and the actions it decides to take.

Participate in collaborative regional efforts to establish agreement on sea level rise models, risk, and actions necessary to protect people and the natural and built environment from rising sea levels. This action could take a variety of forms but would connect with on-going regional efforts and help building consensus on rates of sea level rise and ideal elevations to plan for will help ensure consistency across the region.

Support the establishment of a multi-jurisdictional planning group for marsh conservation and coastal adaptation planning efforts. The marshlands are not within the Town's jurisdiction and will require extensive collaboration and planning to determine feasible and effective solutions for combating sea level rise and protecting and conserving essential marshlands and habitat.

Engage with community members to create a shared understanding of risk and to allow for residents to participate in the co-development of solutions to these challenges. The collaborative process allows for residents to provide valuable input and perspectives to the complex challenges and risks the shoreline neighborhoods face. Co-development of solutions provides the opportunity for residents to be a part of the process of selecting, evaluating, and refining possible solutions to these challenges and participating in the future analysis of adaptation alternatives.

LOOKING TO THE FUTURE

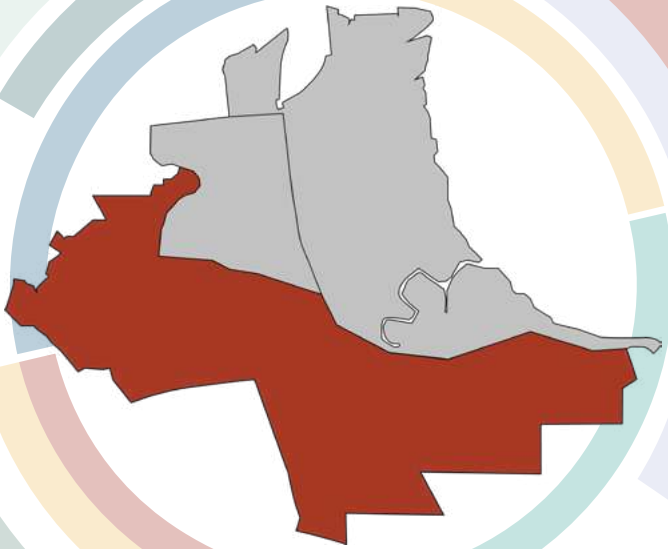
Shoreline areas and neighborhoods currently deal with flooding from king tide events and extreme rainfall events. These risks are projected to increase with climate change. Finding solutions for these current issues and preparing for future risks is not necessarily easy, in particular, finding the right balance between proactive planning and disrupting the status-quo can be a challenge. To be successful, it will require working together to better understand the concerns of residents, businesses, and institutions, the nature of the risk, and the feasibility of different solutions.

Moving forward, the Town staff will re-engage with community members, particularly residents in the Marina Village and Mariner Cove neighborhoods, as well as appropriate local and regional partners, to work closely and collaboratively to determine how best to respond to these challenges. Community members and residents of these neighborhoods are essential to this multi-step process and need to be actively involved in adaptation planning in order to define and reach our goals of creating a resilient community and region.

The immediate next steps involve engaging community members with information intended to create a shared understanding of the risks facing our shoreline neighborhoods; considering whether Town-led responses are necessary; exploring different avenues of response; and evaluating the effectiveness, efficiency, and feasibility of different actions. Given the importance of these steps, this collaborative approach to planning could start by engaging our residents at their homes, ensuring that residents are given the opportunity to express their own perspective and understanding of future risks, and encouraging them to participate in co-developing the solutions to these challenges. Guided by community input, a robust analysis of alternatives would allow the community to make holistic and informed decisions. The Town Council, staff, and community will need to decide when it makes sense to move forward with this additional level of collaborative planning.

Ultimately, achieving the Assessment's first goal of protecting the health, safety, and wellness of all community members will rely on an intimate collaboration between community members, Town staff, neighboring jurisdictions, the County, state agencies, and other partners. It cannot be done by one entity alone, nor can it be done without bravely facing the real risks that climate change poses to our community.


4
the hillsides



the hillsides

9
Total cost (in billions) in damages from Wildfire in California in 2018 alone.

1,943,500,000
The total dollar value of all commercial properties and homes located in the WUI in Corte Madera.*

49
Total percentage of Corte Madera structures located in the WUI.

26
Total number of road miles in hillside neighborhoods.

3.5
The total cost (in billions) of damages from wildfires in California in 2018 alone.

150
The number of acres in the Christmas Tree Hill neighborhoods.

1,588
The total number of Corte Madera structures located in the WUI.

BY THE NUMBERS

* Value calculation assumes $1.3 million average/structure and includes all areas within the Town from Zillow.

Wildfires present the most immediate threat to the health and safety of Corte Madera's residents, employees, and visitors in the hillside neighborhoods. A significant portion of the hillside neighborhoods are wooded and lie directly within the WUI (based on areas with a high structure density and their proximity to fuels). Evacuation routes are relatively limited and steep, posing significant challenges for resident evacuation of emergency responder mobility and access. This is especially true as fires become bigger, hotter, and more severe due to the impacts of climate change. For more information on how climate change is exacerbating wildfire risk in the region, see the Climate Change and Corte Madera section on pages 27 - 38.

Corte Madera is on the National Fire Plan list (managed by CalFire) of communities at high risk of damage from wildfire.[119] Many of the homes in these neighborhoods were built prior to present code requirements; therefore, many structures do not meet minimal standards for fire protection and safety. In addition, vegetation management requires a significant amount of time, money, and energy from individual homeowners, Town staff, and regional entities.

Based on the Marin County Community Wildfire Protection Plan update (completed in January 2021), the Town is using the most up-to-date and locally-specific information available to redefine its risk to wildfire and identify strategies to reduce that risk.[120] These data indicates that 49% percent of the Town is located in the WUI and that around 65% of all living units in Marin County - valued at a combined $58.5 billion - are located in the WUI. For more information, you can view the updated Marin County CWPP here.

Significant local and regional investments are being made to reduce the risk of wildfire across the County. Notably, the creation of the Marin Wildfire Prevention Authority (MWPA) in 2020 was a significant step forward in supporting regional wildfire risk mitigation and coordination efforts. It provides an innovative example about cross-regional collaboration that will surely be replicated across the West. For more information on the MWPA, see page 98.

Wildfire is a regional story, therefore a wildfire risk assessment at the county level is essential in quantifying and planning for risk at the local level. No single investment will eliminate the risk of wildfire for Corte Maderans and ongoing strategic investment in policies, programs, and infrastructure over the next ten years and beyond is going to be needed to adapt.

Hillside Focus Areas

The actions highlighted in this report represent a subset of a broader suite of adaptation actions that scored highly based on their potential effectiveness, efficiency, and feasibility for the Town. These actions (and the full suite of actions in Appendix B) provides the Town with a list of many of the most appropriate options to consider. ***It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented. The local or regional organization, agency, or department responsible for implementing any action will need to be determined on a case-by-case basis.*** Adaptation actions for the hillside are divided into four primary focus areas:

WILDFIRE RISK MITIGATION - (pages 97 - 106)
EVACUATION - (pages 107 - 116)
PROTECTION - (pages 117 - 120)
EDUCATION AND COLLABORATION - (pages 121 - 122)

WILDFIRE RISK MITIGATION

Fuel hazard reduction, vegetation management, defensible space, and home hardening in the WUI are essential to reducing wildfire risk across Corte Madera. Investments in homeowner wildfire risk mitigation programs are also needed. These programs ensure homeowners have the tools, education, and resources necessary to conduct their own home hardening, defensible space, and vegetation management and reduce their individual wildfire risk. In addition, increasing enforcement of existing policies can ensure homeowners are aware of and in compliance with WUI codes and regulations.

Following the 2018 wildfire season (California's deadliest in history to date), Senate Bill No. 901 was adopted to address the increasingly catastrophic wildfires burning across the State.[121] This bill dedicated $1 billion dollars in State funds to accelerate wildfire mitigation measures State-wide.[122] Fuel hazard reduction efforts (e.g., defensible space and vegetation management) require a significant amount of resources, staff, maintenance, inter- and intra-agency coordination, and policy enforcement. According to the 2019 Marin Wildfire Preparedness Grand Jury Report, "the [current] policies and procedures intended to manage and reduce vegetation [in the county] are inadequate."[123] The report cites several challenges to effectively maintaining fuel hazard reduction measures in Corte Madera including vacant properties with overgrown vegetation and incomplete defensible space work, the lack of individual homeowner resources, knowledge, and engagement, and the lack of dedicated staff needed to enforce policies and ensure compliance.[124] The newly formed Marin Wildfire Prevention Authority (MWPA) (*see adjacent page)* is dedicated to mitigating wildfire risk in the region and will support regional partners like Central Marin Fire Authority and Corte Madera in these efforts.[125] The Town and the Town's Municipal Code dictates Central Marin Fire's ability to enforce and/or provide fire mitigation efforts throughout the community.

The Marin Wildfire Prevention Authority

On September 24, 2019, the County of Marin Board of Supervisors adopted a resolution with the support of over 70% of Marin County residents to formalize the Marin Wildfire Prevention Authority (MWPA). This multi-jurisdictional joint powers authority (JPA) will fund proactive wildfire prevention and emergency preparedness efforts in the County for the next 10 years. Specifically, the passage of Measure C dedicates $21 million to: 1) vegetation management; 2) wildfire detection and evacuation program improvements; 3) grants; 4) public education; 5) defensible space evaluations; and, 5) local specific wildfire prevention mitigation.[126] The creation of the MWPA is a significant and innovative achievement that will funnel in substantial investments into the Town and broader region's wildfire protection, education, and mitigation efforts.

There are 17 agencies involved in the newly established JPA representing more than 98 percent of the land area and more than 96 percent of the residents of Marin County. Using a variety of mechanisms, including MWPA staff, an advisory committee, a board of directors, an operations commitee, and ad hoc committee, and the Ecologically Sound Practices Partnership (the ESP), the MWPA will redefine the work happening to address increasing wildfire risk across the region by serving as a funding mechanism for local agencies to complete mitigation efforts that are outlined in the mission or goals of the MWPA. That funding then directly passes through Central Marin Fire, who identifies and manages all of the fuel reduction projects within Corte Madera.

Support the Central Marin Fire Department to conduct individual home assessments for all homes located in the hillside. Corte Madera can play an important role in supporting Central Marin Fire's efforts by reducing wildfire risk and improving consistent messaging for evacuation and fuel hazard reduction efforts in the hillside neighborhoods. Individual site assessments are an important part of understanding, defining, and improving compliance across the Town. The Wildfire Hazard Mitigation Specialist, an employee of Central Marin Fire but funded through the Marin Wildfire Prevention Authority, will be responsible for overseeing the county-wide home assessments, identifying homes that are not in compliance, and encouraging local action. Defensible space evaluators are hired through the Marin County Fire's seasonal firefighter program. For more information on the MWPA, see page 98.

Support 100% of Corte Madera hillside neighborhoods in the WUI to become Firewise Recognized Communities. The Firewise Recognition Program is an innovative national program that supports local wildfire preparedness goals by recognizing communities for working together on vegetation management, defensible space, and home hardening measures. While the program motivates residents to comply with local WUI codes and supports regional efforts to reduce wildfire risk, these efforts can be time-consuming and expensive to implement. Marin county leads California in the number of recognized Firewise sites (with more than 30), and leads the nation in growth of this important program - a testament to the hard work of local communities.[127] Certifying 100% of hillside neighborhoods by 2022, will better prepare Corte Madera for wildfires. The Town and County will need to find ways to better support neighborhoods in this process in order to achieve this goal. Additional details on how to achieve the Firewise Certification here. The steps to achieving your Firewise USA certification can be found here.

Conduct a study that considers the feasibility, costs, benefits, and finance options for undergrounding electric power lines for Corte Madera neighborhoods in the WUI to supplement increased efforts initiated through Senate Bill No. 901 and the Marin Wildfire Prevention Authority (MWPA). Recent catastrophic wildfires triggered by damaged or downed power lines have led utility companies like Pacific Gas & Electric Co. (PG&E) to use new strategies to reduce fire risk. One strategy includes implementing Public Safety Power Shutoffs (PSPS) - regional power shut offs for residents - during extreme weather events when conditions are predicted that may contribute to increased fire behavior or threaten electrical utilities. Another strategy, which can reduce power line-induced fire ignitions in some cases and enhance the resilience of utility infrastructure over the long-term, includes working with PG&E to put power lines underground (a process known as "undergrounding"). Due to the widespread and dynamic nature of wildfires, undergrounding is not a catchall solution, but a tool in the broader resilience toolbox. For example, a wildfire could ignite outside of the Town's boundaries and still directly impact Corte Madera despite the Town having spent the time, money, and resources on undergrounding all utilities within its jurisdiction. For more information on undergrounding in Corte Madera, see pages 101 - 102.

As supported by the outcomes of the undergrounding feasibility study, send a formal request to PG&E to underground electrical utilities for Corte Madera neighborhoods in the WUI. PG&E owns and maintains public electrical facilities in the Town of Corte Madera, therefore the Town is committed to working with PG&E to fully explore options for safeguarding electrical infrastructure in strategic hillside neighborhoods to ensure the safety and wellbeing of Corte Madera residents.

Case Study: Boulder County, Colorado

Boulder County has been recognized nationally for their innovation in reducing community wildfire risk. The Boulder County Community Wildfire Protection Plan identifies best practices for integrating wildfire hazard rating systems into regional planning efforts to encourage homeowner action on fuel hazard reduction.[128] Lessons from these efforts that could be applied in Corte Madera include:

- A great deal of money, time, and effort is needed to collect, analyze, and display all the key information included in most wildfire hazard rating systems.
- Rating systems need a simple and cost effective way to be updated.
- Results of scoring systems should be made available to neighbors.
- Peer pressure is an effective motivator for residents living in the WUI.
- Homeowners who take the recommended actions need to see a corresponding change in their score

The Central Marin Fire Department is using a similar approach to assess wildfire risk and tracking which homes are in compliance with the WUI codes and regulations. For more information, see the Boulder Community Wildfire Protection Plan.

Understanding "Undergrounding"

Following another record-breaking year of wildfires across the State, policymakers, experts, and local decision-makers face challenging and complex decisions about how to continue to reduce their risk to increasingly bigger, hotter, and more severe wildfires. For more information on the changing risk of wildfires in California, including the role of climate change, see page 29. And for more information on how Corte Madera is addressing that increased risk, including participation in the Marin Wildfire Prevention Authority, see page 97. Due to this increased risk of wildfire, some communities across the state are advocating for state utility providers to remove power lines from utility poles and bury them underground (also known as "undergrounding") to achieve a variety of benefits, including in some cases, a reduction in the potential for wildfire ignitions.

In order to understand whether or not "undergrounding" is a good fit for Corte Madera, a feasibility study is required to determine the potential feasibility, costs, benefits, and finance options.

The PG&E Story

The Town of Corte Madera does not own or maintain public electrical facilities and is heavily reliant on Pacific Gas & Electric Co. (PG&E), the State's largest utility, to ensure the safety of its equipment to protect our community. PG&E is responsible for ~107,000 miles of distribution lines (81,000 miles of which are above ground) and 18,000 miles of transmission lines across the state.[129] Due to PG&E equipment-ignited wildfires during 2014-2017[130] (including the Camp Fire, the deadliest in California history[131,132]) and reports of negligence, mismanagement, and profit prioritization, additional state oversight was formalized in 2018.[133] On September 21, 2018, Senate Bill 901 was adopted to address and reduce the risk of catastrophic wildfire across the state, dedicating $1 billion to the efforts. SB 901 also requires that all electrical companies (including PG&E) submit Utility Wildfire Mitigation Plans to the California Public Utilities Commission (CPUC) - a governor appointed commission that regulates privately owned electric, natural gas, telecommunications, water, rail transit, and passenger transportation companies.[134] In January 2019, PG&E filed for bankruptcy due to the liabilities for damage caused by the Camp Fire.[135] As the company resumed service and settled its liabilities in court, it has been using controversial Public Safety Power Shutoffs (PSPS) - temporary power shutoffs in response to severe weather or extreme wildfire risk (also known as Red Flag Days) - to reduce the chance of their utility equipment starting a wildfire. You can learn more about PG&E's Community Wildfire Safety Program and Wildfire Mitigation Plan for 2021 here.

"Undergrounding" in Corte Madera

In addition to these recent and significant on-going regulations and initiatives happening at the state and energy sector levels, Town residents have expressed further desire to explore additional wildfire mitigation measures and have specifically identified electrical undergrounding as a pri-

ority to further study. Residents of Corte Madera have expressed concern that PG&E equipment poses a significant risk to their homes, property, and lives. In addition, residents indicate that they believe PG&E has fallen short in their responsibility to manage and maintain vegetation around their equipment, particularly on Christmas Tree Hill. In order to understand whether or not undergrounding is a good fit for Corte Madera, a feasibility study will be conducted to determine the potential feasibility, costs, and finance options of the process. For additional information on the Town and County efforts to reduce wildfire risk, including the Marin Wildfire Prevention Authority, see page 97.

Due to the dynamic nature of wildfires, undergrounding is not a catchall solution, but a tool in the broader resilience toolbox.

The Benefits and Limitations of Undergrounding

Undergrounding can prove effective in reducing wildfire ignition sources in strategic areas, which has led to some municipalities across the state to push for the process to happen in their own communities. In some cases, it can also provide more reliability during storms, produce longer lifetimes for the equipment, require lower maintenance costs, and be more aesthetically pleasing.

Due to the widespread and dynamic nature of wildfires, undergrounding is not a catchall solution, but a tool in the broader resilience toolbox. It can be cost-prohibitive for municipalities and residents to complete. In addition, it can be a slow and time-consuming process, is not possible to do in all locations due to complex topography or geology, does not eliminate all regional wildfire ignition sources, can incur new hazards that are expensive and difficult to repair. Estimates include a range of $5 million to $10 million per mile to underground utilities depending on access, density of the built environment, the topography of the landscape where lines exist, and the number of powerlines involved.[136] Historical data shows that only 8% of total wildfires across the state have been caused by downed powerlines and that wildfires rarely ignite due to malfunctioning power equipment in residential communities.[137] One example is particularly stark. Coffey Park - a residential area of Santa Rosa destroyed by the Tubbs Fire in 2017 - had undergrounded electrical and gas utilities at the time that the fire started. Yet the fire ignited on private property in Calistoga due to a private electrical equipment malfunction, highlighting the dynamic nature of wildfires and potential limitations of undergrounding. Underground utilities lines are still prone to damage from lightning strikes, flooding, earthquakes, and accidents (e.g., excavation from a third party).[138] In addition, these repairs can be difficult, expensive, and time-consuming to address.

The feasibility study, which will be completed in the coming months, will provide the Town and its residents with a deeper understanding of the potential feasibility, costs, benefits, and finance options for potential undergrounding at strategic areas in the Corte Madera hillsides. For more information, see page 99.

Redefine the Town's wildfire risk based on changing climate conditions. The fire hazard severity zones for Corte Madera, as designated by CalFire, are not an accurate depiction of the real and changing risk of wildfires in Corte Madera. According to the most up-to-date and localized information available at the County level, wildfire hazard severity designations may be more extreme than the designations currently defined by the State. The County recently completed the process of updating its Community Wildfire Protection Plan (CWPP) (January 4, 2021) with County data and modeling that more accurately reflects the fire hazard severity designations for the Town. Consider petitioning CalFire to redesignate the fire hazard severity zones based on the best available models and science to accurately reflect the fire risk for the Town. In addition, consider a formalized operational agreement to ensure that the Town is a direct partner with CalFire for fire protection services if and where necessary.

Streamline the process for enforcing the Town's WUI building codes and regulations with particular attention to rental properties and absentee homeowners. Enforcing defensible space, vegetation management, and home hardening policies is difficult, time-consuming, and expensive. This is particularly true for the dozens of vacant and rental properties located in hillside neighborhoods. Often, these homes have overgrown vegetation and are out of compliance with the Town's WUI codes. Coordinated through the Central Marin Fire Authority, defensible space inspectors plan to inspect all single family homes located in the hillside neighborhoods in the Town by the end of 2021. As a part of this process, the Town should find additional mechanisms to streamline the process for enforcing its WUI codes and regulations (particularly for vacant and rental properties) so that timely corrective actions are taken.[140]

Work with regional partners to implement an effective monitoring system to enforce WUI-specific policies, zoning laws, codes, and regulations. This includes supporting the Marin Wildfire Prevention Authority (MWPA) to utilize the CalFire ArcGIS Collector App to inventory structures that do not comply with fire safe practices and codes. In addition, the MWPA should consider developing (or pitching or identifying) a mobile data collection tool that can be integrated with the CalFire "Collector App" that allows residents to upload images of defensible space, vegetation management, or home hardening improvements from their phones. Not only would this streamline the monitoring and enforcement process for hillside homes in the WUI, it would reduce expenses for the Town, and ensure compliance from hillside residents.

Work with regional partners to coordinate with real estate companies, the private sector, insurance companies, and the State to create a certificate that improves resale value and insurability for homes that have complied with WUI regulations, FireSafe practices, and codes. Currently, homeowners are cited if they are out of compliance with regards to the Town's WUI codes and regulations but there is no incentive program to encourage or recognize these investments. The Town could create a certification program for individual homeowners who comply with Corte Madera WUI codes, rules, and regulations. This work can be coordinated with home assessments already taking place through the CalFire Collector App. A certification process could help reduce wildfire risk for the entire neighborhood, increase marketability for homes in the WUI that are for sale, or increase insurability for homes. For example, in 2014, Boulder County created a public/private partnership to support property owners prepare for future wildfires by conducting individual site assessments. A customized report was provided to homeowners to identify priority risk reduction actions, financial rewards were offered to complete the necessary work, and follow-up inspections confirmed the work was completed.[139]

The Rapidly Changing Wildfire Insurance Market

Across California, increasingly devastating wildfires are dramatically altering the insurability of homes. In 2018 alone, the California Department of Insurance recorded $9 billion in lost property claims for homes lost to wildfire.[141] Additional sources indicate that in 14 months, "multiple wildfires and a mudslide killed more than 150 people, destroyed more than 30,000 homes and businesses, bankrupted California's biggest utility and sparked more than $30 billion in insurance claims, forcing at least one insurer to go under."[142] Prior to 2017, standard homeowner insurance policies generally provided insurance coverage to homeowners living in the WUI. After incurring massive financial losses due to property claims, following the Camp, Tubbs, and Mendocino Complex fires, private insurers are reevaluating the market and their liabilities.

As climate change continues to exacerbate wildfire risk across the State, governments and residents are reeling from drop offs in coverage and are being required to reevaluate how they will identify coverage for their homes and businesses. In 2019 alone, "insurers dropped 235,274 policies in California, a 61% increase from 2018."[143] In addition, premiums have continued to increase since 2015. In addition, lawmakers instituted a one year moratorium on insurance non-renewals in 2019 resulting in a temporary solution. Residents unable to recoup losses from other private insurers turn to the last-resort state insurer, FAIR California. Enrollments in the FAIR plan has increased by 225% since 2019. As the wildfire insurance market transforms across the state, lawmakers are giving this outdated mechanism increased attention over the last few years and continue to revise and address its shortcomings. The insurance landscape is changing quickly and will require continuous monitoring in order to make sure Town residents are covered in the case of a catastrophic wildfire. In some cases, completing expensive home hardening and wildfire risk reduction work did not guarantee that California residents living in fire-prone areas would qualify for wildfire insurance.

Support regional partners to scale up landscape-level wildfire mitigation work, especially in and near lands surrounding the Town boundaries. Several regional partners are in the process of scaling up their fuel hazard reduction work across the County but need support to adequately meet the challenge. For example, Marin Municipal Water District owns ~21,500 acres of wildland but only clears around 30 acres per year. Marin County Open Space District owns ~16,000 of wildland but only manages around 10% of lands for wildfire a year.[144] Regional partners should collaborate closely with the County, FIRESafe Marin, municipalities, and the MWPA through various channels including CWPP meetings, annual work plans, and plan updates to implement landscape-scale wildfire mitigation. By considering opportunities to share resources, equipment, and crews with local and County entities, wildfire risk reduction could happen more efficiently and effectively.

Update the Town's WUI codes and regulations to include the "0-5' non-combustible zone" or "Zone Zero" rule. Despite having some of the most aggressive WUI codes in the nation, there are additional regulations that can reduce wildfire risk for the Town. In alignment with the state's fire codes, the "0-5' non-combustible zone" or "Zone Zero" policy is intended to restrict all combustible materials within 5 feet of any residential or commercial structure (including storage, debris, building materials, stacked materials, vegetation). The MWPA will serve an important role updating codes and regulations, but the Town also needs to ensure that they have the staff, resources, and time to educate homeowners and ensure compliance.

Seek opportunities to add wildfire home retrofit upgrades into other home financing mechanisms like those focused on energy efficiency. Home retrofit upgrades that improve resilience to wildfires can be cost prohibitive. Seeking opportunities to find additional financing mechanisms using existing examples (e.g., financing mechanisms that support energy efficiency) could support residents who face barriers to conducting home hardening upgrades. Reducing the risk of ignition to individual homes in the can WUI reduce the risk of wildfire to the Town overall.

Expand the goat and sheep grazing program as a fuel reduction strategy. Using goats and sheep annually to reduce the amount of vegetation in the hillsides surrounding the Town has been an effective fuel reduction strategy. Expanding this program would continue to build on the great private-public partnerships that support this work as well as decrease the risk of wildfire to the Town as a whole. This process could include completing the maps that identify priority locations to support grazing as a fuel reduction strategy, continuing outreach to local landowners that would qualify, and expanding regional partnerships to continue to grow the program.

Cultivate public-private partnerships (e.g., tax incentives) to support local and regional forest waste management businesses that help reduce fire risk. Forest products (e.g., wood and wood waste) sourced from harvested trees or forest biomass can provide a variety of important and valuable services including creating electricity or generating heat. Developing innovative mechanisms that encourage and support businesses that utilize forest products harvested in wildfire risk reduction efforts could provide a variety of benefits to the Town and region.

Policy Consideration: Redefine the Town's Wildfire Risk and Expand the WUI

Corte Madera residents must currently abide by Town,[145] County,[146] and State[147] WUI codes, most of which are based on the International Code Council.[148] The Town's codes, which can be referenced here, are updated every 3 years and the most recent update was adopted in 2020. According to data from CalFIRE, Corte Madera is entirely located in a Local Responsibility Area (LRA), therefore, the State has no responsibility for fire protection or mitigation work within the Town boundaries. However, in 2008 the Town of Corte Madera adopted Ordinance No. 904 expanding the VHFHSZ, pursuant to Government Code Section 51182, designating several areas within the Town as a Wildland-Urban Interface Zone based on local findings.[149] **According to the most up-to-date and localized information available at the County level, wildfire hazard severity designations are more extreme than the designations currently defined by the State.** The County recently completed the process of updating its Community Wildfire Protection Plan (CWPP) with County data and modeling that more accurately reflects the fire hazard severity designations for the Town. This information will also need to be a central part of updates to the Marin County Comprehensive (or General) Plan and the Hazard Mitigation Plan.

Expanding the WUI zone and reassessing the wildfire hazard severity ratings based on new data will better represent the Town's actual wildfire risk, increase the number of residents required to abide by Town WUI codes, and increase the Town's competitiveness for funding necessary to support the Town's adaptation and resilience efforts.

Specifically, extending the boundaries of areas subject to wildfire regulations in the Town will expand the number of residents required to complete vegetation management, defensible space, and home hardening work on their properties. These designations will help decision-makers better understand, assess, and develop adaptation approaches to addressing the potential impacts of wildfire for hillside neighborhoods and require additional tools, resources, and staff to enforce compliance with the codes. In coordination with the County and Town efforts to quantify wildfire risk for the Town, a thorough review is also needed on CalFire's approach to mapping and designating wildfire hazard severity risk zones for Corte Madera.

EVACUATION

As wildfires grow hotter, bigger, less predictable, and more severe due to climate change, communities are grappling with challenges of ensuring the health and safety of their residents. Evacuation planning is a crucial step in this process, and requires regional collaboration, continuous investment, and the integration of best practices from communities who have experienced catastrophic wildfires across the state. For Corte Madera, that risk is real and ever increasing.

The three hillside neighborhoods - Christmas Tree Hill, Granada Hill, and Chapman Hill - all present unique challenges in regards to evacuation. Many homes are particularly vulnerable to wildfire due to hazardous fuel conditions and limited access to major streets and evacuation routes. Hillside streets typically are winding and, in many cases, are quite narrow with as little as 12 feet of paved width before accounting for vegetation, parking, and other encroachments. In some cases, the hillside transportation network is supplemented by paths and stairways; however, existing pedestrian paths are limited, and not all paths are ADA-compliant.

In addition, there are broader regional evacuation concerns that pose additional challenges for hillside residents. Not only are there key evacuation choke points,[150] public transit systems are not effectively integrated into evacuation preparedness protocols and chains of command.[151] These challenges are particularly acute for residents who live considerable distances from main evacuation routes.

Enhance wayfinding (e.g., new signs for roads and paths, maps, and stair lighting) in hillside neighborhoods to support effective evacuations. Chapman Hill and Granada Hill neighborhoods both lack adequate paths, signs, and lighting necessary for residents to evacuate from a wildfire by walking or biking as a last resort. Christmas Tree Hill contains several pedestrian paths and stairways that provide connections for people who are able to walk up and down the hill; however, the connections with stairways are not ADA-compliant, and some paths with steep slopes also present accessibility challenges. Wayfinding signs should include consistent, well-lit, and easy to read evacuation instructions and maps.

Enhance hillside transportation network capacity and connections where possible. To enable safe and quick movement of people, the network of streets and off-street paths must be robust and, provide multiple downhill, overhill, and multimodal access and egress. Every resident should have the ability to get away from threats and authorities and emergency personnel should have access to respond to emergencies. It is critical that key evacuation choke points are addressed in the Town, Marin County, and the North Bay region, including those in Christmas Tree Hill, Chapman Hill, Granada Hill, and Sausalito Avenue (aka Hidden Valley).[152] To see specific choke points in the hillside neighborhoods, reference pages 111 - 116.

Identify and support Neighborhood Response Groups (NRGs) to increase community and neighborhood cohesion so communities can do more to help themselves during and after fires. NRGs are essential community support networks that already dedicate a significant amount of time and energy to supporting wildfire preparedness in the Town. The Town could enhance collaboration with the NRGs to make sure they have the tools, knowledge, and resources to support each other during an emergency. This includes providing evacuation training and drills using large-scale, unpredictable, and challenging scenarios and hosting "build an emergency kit" day and other events where community members can come together, learn about resilience, and build an emergency preparedness kit, and more.[153]

Figure 4.1. Regional crews conduct vegetation management work on narrow Corte Madera roadways. One lane roads in and out of neighborhoods present significant challenges during an evacuation. © Central Marin Fire Authority and FIRESafe Marin

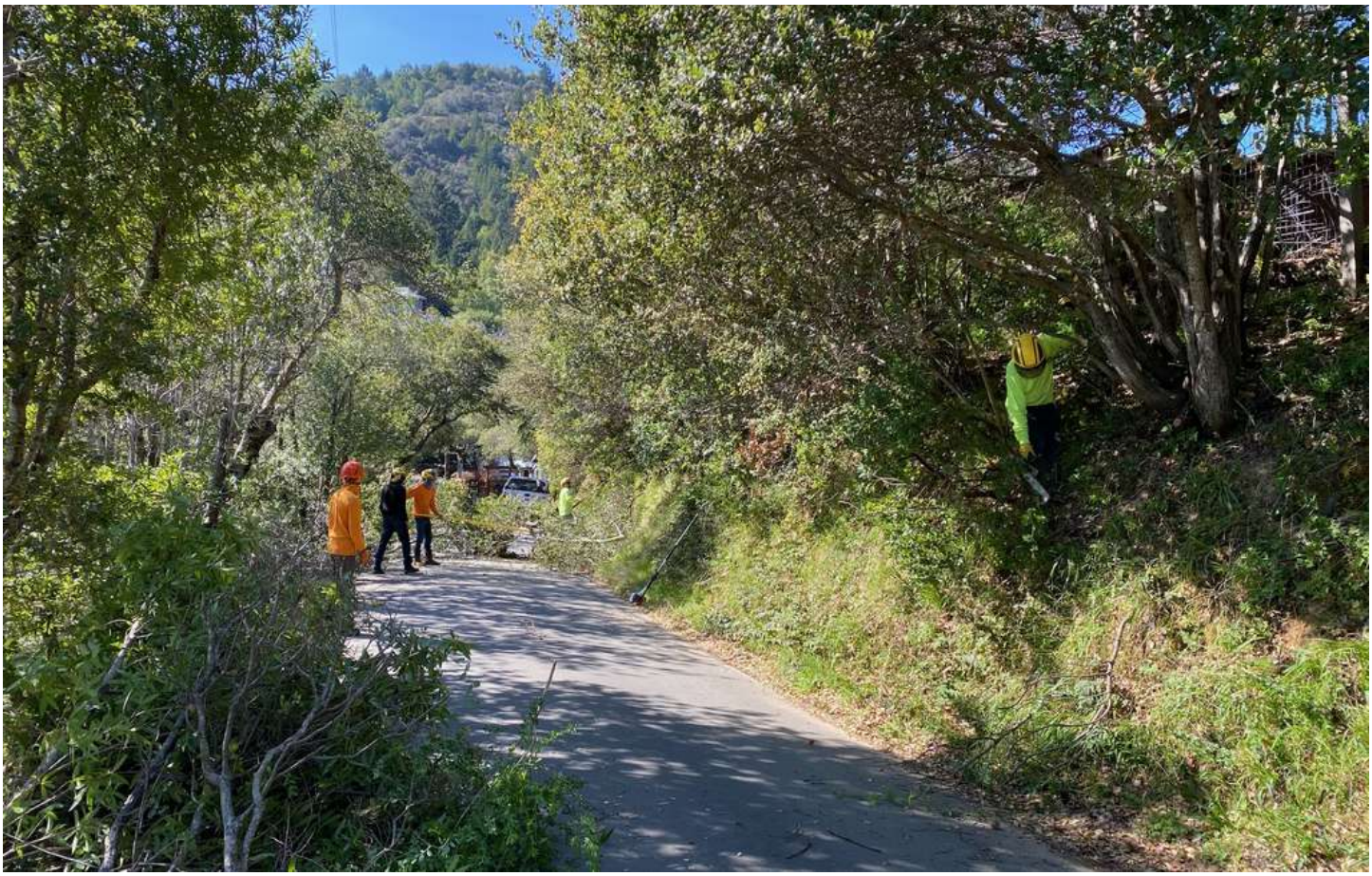


Figure 4.2. Town Staff conduct vegetation management work on narrow Corte Madera roadways. One lane roads in and out of neighborhoods present significant challenges during an evacuation. © Central Marin Fire Authority

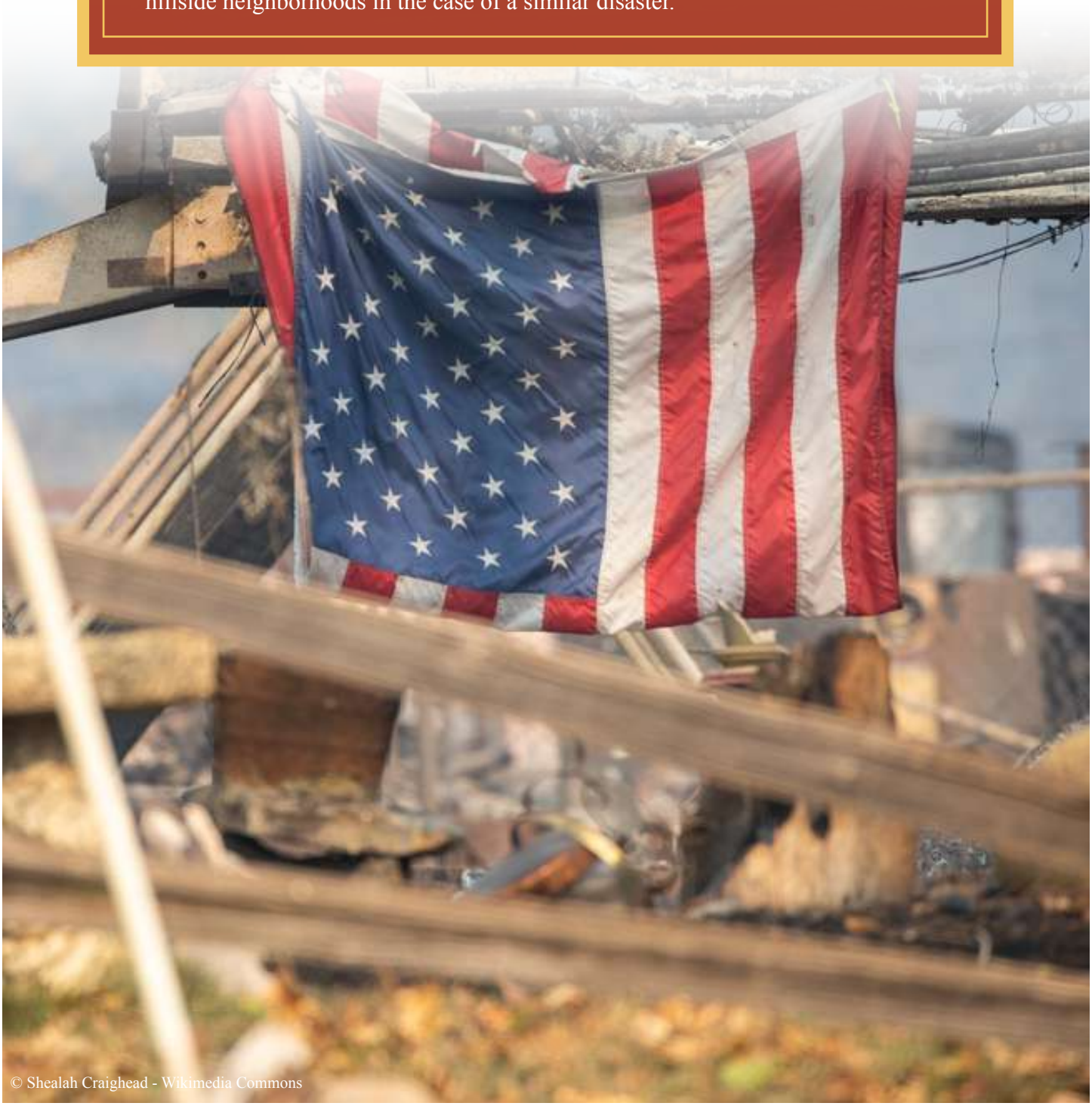
Enhance traffic congestion controls and parking enforcement along evacuation routes. In order to improve access and egress in the hillside neighborhoods, policies and enforcement need to accompany strategic investments in the hillside transportation infrastructure. For example, law enforcement could expand patrol efforts and the ticketing of cars that are parked illegally on specified streets. Additional no-parking zones could be created and painted on hillside streets to ensure compliance.

Develop policies to encourage evacuation preparedness and early evacuation (for example, at the warning stage) for residents in the most vulnerable neighborhoods. Using additional tools that support community evacuation preparedness and early evacuation may be necessary to ensure the most vulnerable neighborhoods are prepared in the case of a catastrophic wildfire.

Consider policies that further restrict development in the WUI. The first step in reducing wildfire risk is to limit development directly in harm's way. The Town's hillside neighborhoods already have low-density zoning designation that require large lot sizes and limit subdivision of land that effectively reduces densities in these areas. Due to that designation, there is very little opportunity to continue to develop land in the hillside neighborhoods. Reducing the expansion of Accessory Dwelling Units (ADU's), limiting the overall size of structures, and reducing on-street parking in the WUI may help reduce the number of people in highly vulnerable areas and help make evacuations more efficient. It may also be possible to develop policies for responsible expansion of ADUs.

Case Study: Paradise, California

On November 8, 2018, the Camp Fire - which became one of the deadliest fires in California history - burned the majority of homes in the Town of Paradise, killing 85 people. As a part of their official Recovery Plan (2019), the Town of Paradise indicated the need to address key choke points, enhance roadway widths, and ensure that all local roads can serve as either a primary or secondary ingress or egress route. In addition, the Town indicated a need to setback trees and eliminate utility poles that can burn and block egress on private and public roads.[154] To the extent possible, Corte Madera should begin this work to ensure it can evacuate residents safely from hillside neighborhoods in the case of a similar disaster.



© Shealah Craighead - Wikimedia Commons

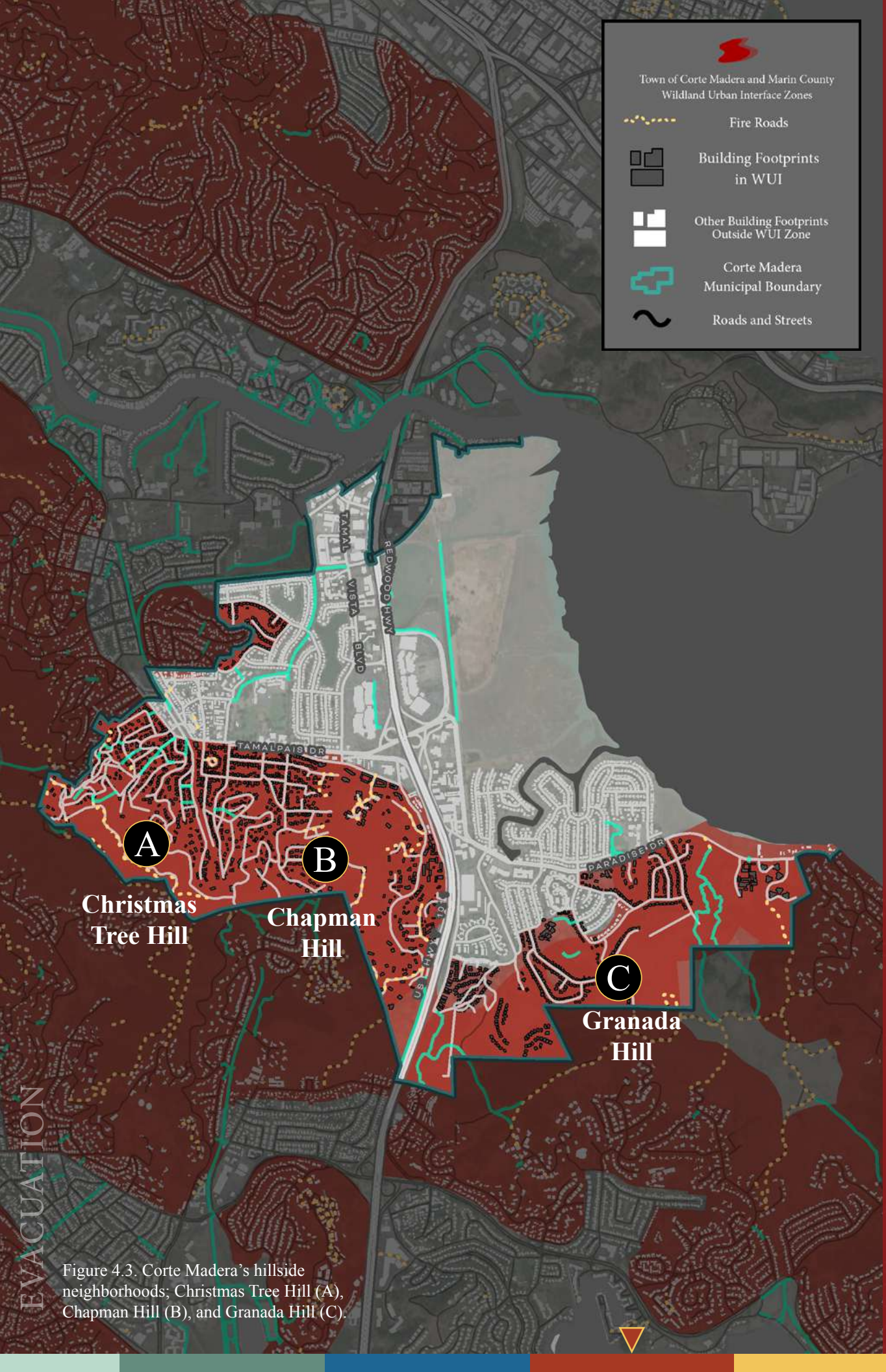


Figure 4.3. Corte Madera's hillside neighborhoods; Christmas Tree Hill (A), Chapman Hill (B), and Granada Hill (C).

Investing in Corte Madera's Transportation Infrastructure

The three hillside neighborhoods - Christmas Tree Hill (A), Chapman Hill (B), and Granada Hill (C) in Figure 4.3 - all present unique emergency response challenges, especially access and egress to and from homes near the top of the hills and away from main roadways. Within each neighborhood, streets are typically winding and, in many cases, quite narrow. There are streets with as little as 12 feet of paved width that are further narrowed by vegetation, parking, and other encroachments. Frequently, there are only one to two roads and paths connecting the neighborhoods to major roadways. There are fire roads that lead up and over the hills to neighboring jurisdictions; however, these dirt roads are steep and require improvements to accommodate private vehicles safely during an emergency. In some cases, the hillside road network is supplemented by steps, lanes, or paths; however, the existing pedestrian paths are limited and few, if any, are not ADA-compliant. Bicycle facilities are very limited and public transit agencies and systems are not effectively integrated into evacuation preparedness protocols, chains of command, and regional planning efforts. Investing in transportation infrastructure changes (e.g., road widening, additional pullouts, road resurfacing) and policy changes will be important to ensure residents can evacuate safely in the case of a major wildfire.

The project team analyzed the three hillside transportation networks examining roadway widths and street connectivity. The team then evaluated adaptation alternatives based on six key metrics: 1) mode(s) of access/egress, 2) number of primary two-way roads 3) households with vehicular access/egress, 4) downhill access/egress, the to town), 5) uphill access/egress points over hills and 6) infrastructure cost.

A. Christmas Tree Hill

The roadways on Christmas Tree Hill are the most constrained of the three hillsides, with most streets less than 20 feet wide. The most constrained segments (those less than 15 feet wide), include much of Summit Drive, upper sections of Redwood Avenue, the section of Ardmore Avenue that connects to Marina Vista Avenue, Sunrise Lane, Portola Way, and California Lane. These narrow streets limit connectivity and roadway capacity. The neighborhood does contain several pedestrian paths and stairways that provide connections for people who are able to walk up- and downhill; however, these connections are not ADA-compliant and paths with steep slopes also present additional challenges to resident accessibility.

B. Chapman Hill

The roadways on Chapman Hill range in width: some streets are more than 20 feet wide while others are 15 and 20 feet wide, and a few are less than 15 feet. The majority of the streets that are more than 20 feet wide are located at the bottom of Chapman Hill. Buena Vista Avenue, Sausalito Street, the lower section of Chapman Drive, and the upper section of Montecito Drive also have widths greater than 20ft. The most common range of street width is 15 - 20 feet. These streets offer substantial clearance for emergency vehicles; however, they may not be as reliable due to potential obstacles that hinder seamless two-way operations. Chapman Hill Streets that are less than 15 feet wide include Prospect Lane,Templeton Court, and Alta Way, which create chokepoints for people traveling between upper Chapman Drive and Sausalito Street. Besides hilltop paths that connect to nearby fire roads, stairways, and neighboring Mill Valley streets, few pedestrian connections exist.

C. Granada Hill

Of the three hillsides, Granada Hill roadways provide the widest connections, with a majority of streets that are more than 20 feet wide. The hill's most narrow street is a connection to Granada Park and is the only street less than 15 feet wide. Unlike what can be found in Christmas Tree and Chapman Hills, all buildings along this narrow roadway have access to alternate street connections such as Prince Royal Drive. There is also far less vegetation of concern on Granada Hill in comparison to other neighborhoods, yet their wildfire risk remains high; many roadways are steep and some only offer one way in and out of an area.

The following actions are recommended starting points for investments that would improve the ability of hillside residents to evacuate before and during emergencies. These investments must be reinforced by policy-based actions, such as removing on-street parking on critical street segments, as well as infrastructure investments, such as strategically adding new connections. For more information on additional recommendations, see pages 107 - 110. For more information on the GIS methods used to create these maps, see Appendix D.

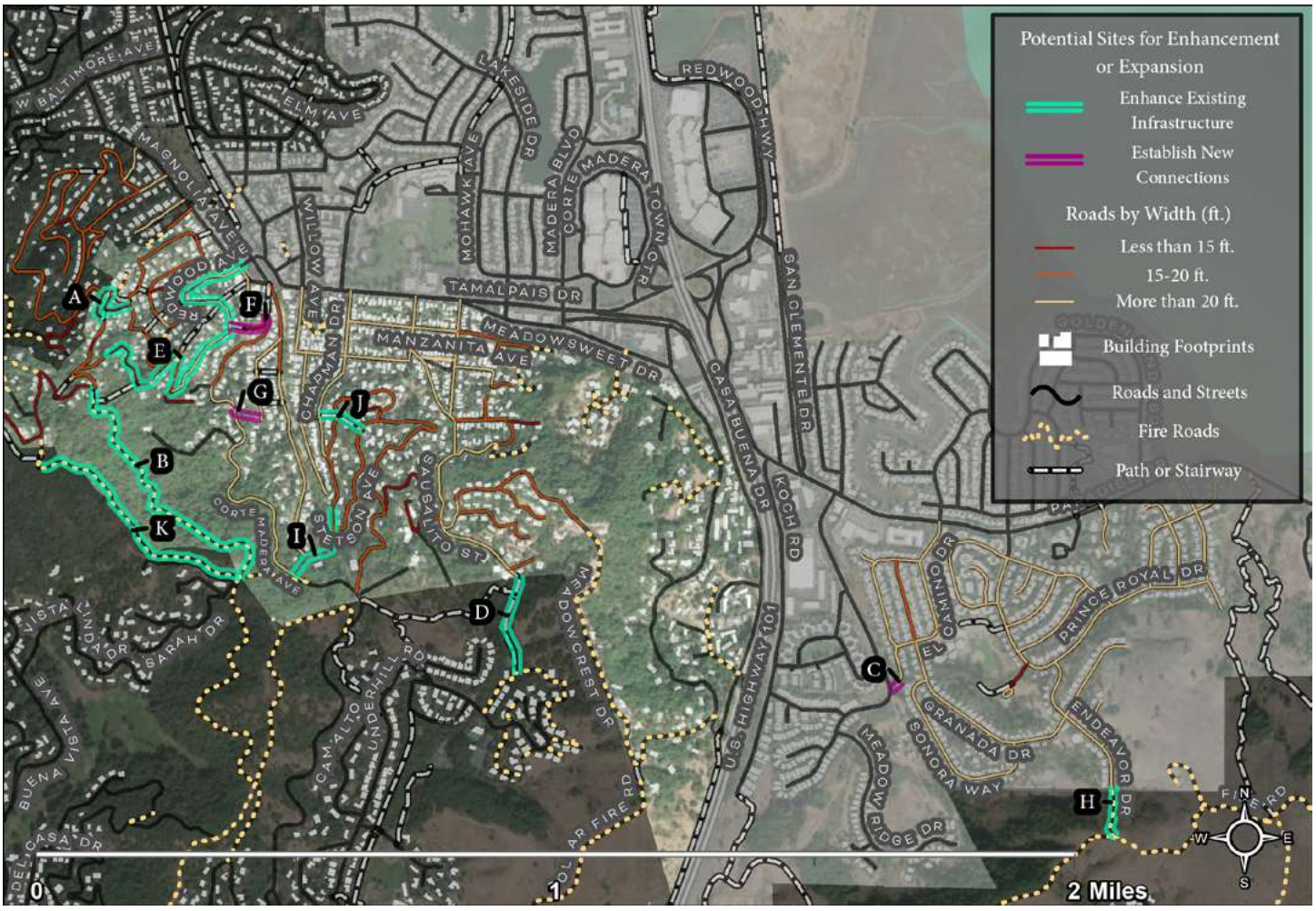


Figure 4.4. Potential infrastructure improvements in Corte Madera's hillside neighborhoods. Letters indicated on the map reference the following actions (A - K) in the following pages.

Priority Actions

A Improve and widen portions of Summit Drive. Summit Drive is one of the most constrained roadways in the entire Town. Proposed improvements include street widening, regrading, and constructing a pullout in strategic areas along portions of Summit Drive, which will enhance this roadway and improve vehicular access/egress to 49 households.

Neighborhood: Christmas Tree Hill

Preliminary Probable Cost: ~$1,000,000 - $1,500,000

B Connect and Improve Lower Summit Fire Road. Enhancing the connection from Lower Summit fire road to the roadway network on Christmas Tree Hill would provide enhanced connectivity to 41 households during an emergency evacuation event. Further community engagement with Central Marin Fire Department, Marin County Parks & Open Space, and the public is needed to determine whether this proposed concept should be designed to accommodate private vehicles or just emergency vehicles during an evacuation or critical event. This connection will require regrading of the existing fire road, improved traffic control devices, right of way acquisition and potentially wayfinding signage.

Neighborhood: Christmas Tree Hill

Preliminary Probable Cost: $400,000 - $1,000,000

C Enhance the connection between El Camino Drive and Madera Del Presidio Drive. Currently, a small fire lane with a paved walking trail exists between these two streets. Additional improvements to this fire lane would improve emergency access for first responders, serve as a potential egress route for residents during emergency evacuations, and provide additional recreational benefits and dedicated space for biking and walking.
Neighborhood: Granada Hill
Preliminary Probable Cost: $150,000 - $250,000

D Connect Sausalito Street to Mill Valley (via the Coach Fire Road). Enhancing the connection between Sausalito Drive and Mill Valley via Coach Fire road would expand access for first responders and emergency vehicles. This connection could potentially provide enhanced access to 80 households from the south. with access to a new primary vehicle uphill route. Further community engagement with Central Marin Fire Department, Marin County Parks & Open Space, Mill Valley Fire Department, Mill Valley Public Works and the public is needed to determine whether this proposed concept should be designed to accommodate private vehicles or just emergency vehicles during an evacuation or critical event. Improvements could involve regrading, resurfacing, traffic control devices, and potentially wayfinding signage.

Neighborhood: Chapman Hill
Preliminary Probable Cost: $300,000 - $700,000

E Widen Redwood Avenue where feasible on Christmas Tree Hill. This roadway enhancement would widen the road between Summit Drive and Morningside Drive. It provides vehicular access/egress for 35 households. Similarly, the lowest portion of Redwood Avenue between Corte Madera Avenue and Crescent Road serves as the critical artery for ingress/egress for private vehicles. Although this portion of roadway is wider than most of the roads on CTH, there are still opportunities to further enhance the roadway to improve access during evacuations.

Neighborhood: Christmas Tree Hill
Preliminary Probable Cost: $1,000,000 - $1,500,000

Multiple - Improve the Town-maintained Steps, Lanes, and Paths on Christmas Tree Hill. Beyond structural improvements, enhancements could include potential addition of signage (including clear evacuation information, maps, and QR codes), and the installation of stair lighting and other wayfinding improvements. Given several of the stair segments are privately maintained, the Town would look to the Christmas Tree Hill Neighborhood Response Group or other community volunteers to lead improvements on those segments, but Public Works would assist in streamlining that process to the extent feasible.

Neighborhood: Christmas Tree Hill
Preliminary Probable Cost: $150,000 - $300,000

Multiple - Develop additional strategic pullouts on Christmas Tree Hill. There are several chokepoints on Christmas Tree Hill that would benefit from additional strategic pullouts. Right of way, topography, and road elevations present challenges for transportation projects on Christmas Tree Hill, therefore more planning and engineering work will need to be done to identify strategic locations that would improve access/egress for residents and would likely involve retaining walls in most situations.
Neighborhood: Christmas Tree Hill
Preliminary Probable Cost: $250,000 - $300,000 per pullout

Important Actions That Require Additional Feasibility Analysis

F Enhance California Lane to connect Redwood Avenue with Corte Madera Avenue. Given the limited evacuation routes for private vehicles on Christmas Tree Hill, identifying possible new connections was prioritized as part of the assessment process. Early on, it became apparent that the potential new connection points were lacking due to right of way, topography and other challenges and despite California Lane having all of those constraints, it still appears to be worth further consideration and analysis. This potential connection would likely be utilized during emergency evacuations only and would provide 69 households with access to an additional primary vehicular access/egress route. Currently, California Lane exists as a private street that provides vehicular connectivity between approximately 8 households to Corte Madera Avenue but also has a staircase that connects uphill to Redwood Avenue. Enhancing this connection would require expanding the existing driveway and converting the existing stairway into a street that meets reasonable engineering standards. It would likely involve substantial regrading and retaining walls.
Neighborhood: Christmas Tree Hill
Preliminary Probable Cost: $25,000 - $50,000 (feasibility study only)

G Establish evacuation route between Grove Avenue and Corte Madera Avenue. A connection between Grove Avenue to Corte Madera Avenue would provide a new primary vehicular access/egress route to about 25 households during emergency evacuations. The Town would need to consider property acquisition or an easement and its associated costs to create an effective connection.
Neighborhood: Chapman Hill
Preliminary Probable Cost: $10,000 - $20,000 (feasibility study only)

H Evaluate Improving Endeavor Fire Road on Granada Hill. Improving Endeavor Fire Road, would enhance emergency access/egress, increase the number of routes permitting two-way operation, and add an additional uphill connection. About 129 households would benefit from access to this new vehicular route and the cost would be relatively low.
Neighborhood: Granada Hill
Preliminary Probable Cost: $10,000 - $20,000 (feasibility study only)

I Assess additional strategic pullouts on Chapman Hill. On upper Chapman Drive near Corte Madera Avenue, the road width is narrow, which makes two-way vehicular traffic challenging. Given this roadway provides evacuation to Corte Madera Avenue it should be considered for strategic pullouts to improve the two-way flow of vehicles, which would allow for emergency vehicle to enter the neighborhood as private vehicles are evacuating in an emergency. Right of way, topography, and road elevations present challenges for transportation projects along this stretch and therefore more planning and engineering work will need to be done to identify strategic locations for these pullouts and would likely involve retaining walls in most situations.
Neighborhood: Chapman Hill
Preliminary Probable Cost: $250,000 - $350,000

J Further Evaluate Improving Tainter Steps. In 2020 and in coordination with the Town's Bicycle and Pedestrian Advisory Committee and Beautification Committee, Public Works initiated efforts to evaluate how to renovate these steps which were originally constructed in the early 1900s. Due to their age, a Historic Resource Evaluation Report was initiated to understand their historical significance and the constraints that could be associated with future repairs and improvement. The condition of the stairs are "fair" in most areas, but there are several localized areas that require reconstruction due to cracking and/or uplifting by tree roots. Further analysis on these stairs should be pursued to better understand the costs associated with improving these stairs and bringing them up to a reasonable functionality standard.
Neighborhood: Chapman Hill
Preliminary Probable Cost: $10,000 - $20,000 (feasibility study only)

Additional Identified Actions for Future Consideration

Though the remaining actions may have a lower cost-to-benefit ratio relative to those in the higher priority tiers, these transportation network enhancements and expansions should be considered. These include:

K Improve Middle Summit Fire Road on Christmas Tree Hill. Coordination with Marin County Open Space and Central Marin Fire will help to determine the potential needs, feasibility, cost, and value of enhancing the road to allow for use during emergencies.
Neighborhood: Christmas Tree Hill

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PROTECTION

Fire protection is essential to ensuring the safety of Corte Maderans. First responders in the Town and County are dedicated and reliable specialists with a long history of supporting the region during emergencies. Yet, the impacts of climate change presents new and unexpected challenges for fire protection across the region. Wildfires are getting hotter, bigger, more severe, and less predictable. Adapting to these changes requires continuous monitoring, regional collaboration, and science-informed decision-making that incorporates best practices across the state. Limited funding, lack of staff and capacity, and antiquated policies at the state level are not commensurate with the increasingly extreme risk of wildfire. Often, local governments must rely on local knowledge and regional support to ensure that communities can adapt in this rapidly changing landscape and protect its residents. As evidenced by catastrophic wildfires across California, residents can't rely solely on first responders to ensure that they are safe.

In addition, regional pressures continue to change the landscape for first responders across the region. As the population continues to grow in the region, the Town will need to continue to invest in its fire protection funding. The Central Marin Fire Department requires continuous monitoring and investment to make sure that it can meet fire protection demands. It will be important to scale up fire protection efforts in a way that both understands and addresses increased climate-driven wildfire risk due as well as regional development demands.

Town and County governments can no longer rely on business as usual. Regional, innovative, and long-term commitments are essential.

The actions identified on this page are not specific to the Town and should be viewed broadly as options for Town, Central Marin Fire Department, and the Marin Wildfire Prevention Authority. ***It is ultimately up to the Town and its regional partners to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented. The local or regional organization, agency, or department responsible for implementing any action will need to be determined on a case-by-case basis.***

Work with regional partners to monitor and maintain appropriate staffing levels commensurate with the current and projected emergency response environment due to climate change. As the region continues to grow, more strain is put on our local resources to make sure that our communities and first responders have the staff, capacity, and tools to keep our communities safe. In addition, as wildfires continue to grow in size, severity, and duration, planning needs to reflect the increasingly extreme environment firefighters are being tasked with managing.

Support investment in new equipment and technologies for fire protection. As wildfires continue to grow in size, severity, and duration across the state, Town and regional planning must continue to invest in the technology and equipment that keep our firefighters, first responders, and community safe.

Assess the viability of building wildfire resilience stations in the WUI that have the tools necessary for first responders or trained members of the NRG's to contribute to fire suppression efforts when needed. Communities like Oakland Hills have started providing their neighborhood response groups with the resources, tools, and knowledge to fight fires if first responders are delayed, blocked, or unavailable. This includes placing fire resistant sheds throughout the neighborhoods with the tools (hoses and tools) to access fire hydrants.

Support regional partners to deploy more fire detection cameras in priority areas as necessary. Six fire detection cameras already monitor fire starts in the region. There are also larger camera networks that help identify wildfires when they start. For example, the Alert Wildfire Network, which is a consortium of three universities - The University of Nevada Reno (UNR), University of California San Diego (UCSD), and the University of Oregon (UO) - provides access to their network of fire and tools to improve fire ignitions, scale up fire resources and response, and monitor fire behavior.

Support reginoal partners to inventory and map vegetation on hillsides with a specific focus on improving hillside stability in the case of extreme rainfall and seasonal creek erosion. The topography of the hills surrounding the Town of Corte Madera could prevent unique challenges during an extreme precipitation event, particularly post-wildfire. Hydrophobic soils and the loss of vegetation that stabilizes hillsides due to wildfire can create large land and mudslides that can impact homes, businesses, and the safety of residents. Identifying and mapping areas that may be particularly vulnerable to landslides and mudslides following a wildfire will support decision-making and planning if necessary.

Support regional partners to develop a formal collaboration mechanism between private property owners (and Homeowners Associations) and large landowners to enhance wildfire protection, preparedness, and recovery efforts. Fostering collaboration locally and regionally will continue to enhance the resilience of the Town to prevent, protect, and prepare for wildfires.

Pre-Disaster Recovery Planning - Taking Actions Now To Support Rebuilding Post-Wildfire

As the State of California experiences another year marked by record wildfires, the Town of Corte Madera has an important opportunity to learn from the experiences of other communities. Investing in existing and new resilience programs, policies, and projects that support evacuation and reduce wildfire risk over the next ten years will significantly enhance the Town's ability to respond to, and protect its residents from wildfire. **The Town and its regional partners should create the framework now that will help it rebuild better if a wildfire were to occur.**

Adaptation planning requires that we look at all possible scenarios when considering the impacts of disasters on our communities. As fires continue to break records in size, frequency, and severity across the State, it would be short-sighted to overlook the real, immediate, and severe threat to the health and safety of Corte Maderans. Following any disaster (like a catastrophic wildfire), residents are eager to rebuild and restart their lives and it is no time to be deciding where, when, and how to rebuild. Community preparedness and pre-disaster recovery planning decisions should be made in advance and consider community and landscape needs.

In addition, decision-makers should consider short, intermediate, and long-term implications for disaster recovery. The Federal Emergency Management Agency (FEMA), provides several resources that support multiple scales of rebuilding (the National Response Framework and the National Disaster Recovery Framework).[155] Determining how best to support the long-term wellbeing of the community, how to limit rebuilding in places that are at risk, how to balance property rights with community safety, and how to make the best and most efficient use of tax dollars are all things that should be done before a disaster. In addition to utilizing federal programs and resources, we also have an opportunity to learn from the best practices and lessons emerging from around the State as municipalities rebuild from devastating events that have changed their communities forever.

Example Pre-Disaster Recovery Planning Actions

- **Fund, develop, and adopt a pre-disaster recovery plan.** Some communities, like Douglas County, Colorado, are investing in pre-disaster recovery plans. In 2015, the county adopted its first plan, designed to "establish the county's comprehensive framework for managing recovery efforts following a major disaster."[156] Not only does this set the framework and foundation for tough decisions before a disaster occurs, it strengthens community partnerships, and maximizes the opportunity to enhance local resilience and risk reduction efforts into all aspects of the community's planning.

- **Consider a "three strike" rule that only allows residents to use recovery funds to rebuild their homes two times before being bought out.** In some places, like Santa Rosa, California, decision-makers have considered policies and codes that limit the number of times a resident can rebuild using tax dollars or recovery funds after a wildfire before they are no longer competitive for that funding.

- **Implement a buy-back program that buys land in particularly dangerous areas prone to wildfire to prevent residents from rebuilding there.** Decision-makers in Santa Rosa are considering innovative approaches to rebuilding. Certain geographic areas are considered so dangerous and prone to recurring catastrophic wildfire that some decision-makers are weighing the actual cost of purchasing that land with the long-term cost of defending the homes. Not only are leaders calling for programs that compensate property owners to not rebuild, they are also encouraging economic pressures that disincentivize them from building in these dangerous areas in the first place.

- **Rebuild utility infrastructure that is safer, more sustainable, and more resilient.** Many communities across California are coordinating with regional utilities to underground all utility lines to reduce wildfire ignitions. Undergrounding utilities can be extremely expensive, especially in areas that are already built. But undergrounding utility or telecommunications infrastructure while rebuilding can limit the risk of those lines being damaged or causing wildfires during extreme weather events and enhance the resilience of the Town. The Town of Paradise created a formalized agreement with PG&E to directly underground all utility lines in order to reduce wildfire risk for the community.

- **Require residents to rebuild in accordance with Town WUI codes.** Paradise, CA developed fire resistant design standards that exceeded State, County, and Town WUI requirements. They also formalized a plan to ensure the Town can enforce defensible space codes. Examples of fire resistant design standards include: requiring gutters to be non-combustible (gutters clog with dry vegetation and fuel fires); banning the use of flammable building materials (e.g., retaining walls made from railroad ties); requiring homes to be built with sprinklers, have at least double-paned windows; and have fire-resistant siding; and, requiring homeowners to clear 100' of defensible space around homes including a "0-5' non-combustible zone" rule (including no mulch, flammable plants, non-pressure treated decks and wooden fences). In the case of the "0-5' non-combustible rule," this enables the Town to "stipulate how the local government might enforce the requirement, which the state code does not do. It also allows Paradise to add nuance to the code."[157]

- **Ensure every neighborhood has multiple access and egress routes that meet best practice standards for evacuation.** To rebuild, Paradise established a policy that requires two means of access/egress for long dead-end streets and established standards for a safe length/number of homes per street. In addition, they are identifying and building additional road segments that are missing in the transportation network in order to improve road circulation and evacuation options. This also includes limiting long dead-end streets/driveways for individual homes.

- **Require fuel break transitions for homes or neighborhoods.** Not only can landscape-scale fuel breaks between the forest and neighborhoods be extremely important for firefighters as they seek to protect a home, but additional defensible space and safety measures can also improve their safety and willingness to fight a fire in a neighborhood at risk of burning.

EDUCATION AND COLLABORATION

Actively engaging with and educating Corte Madera residents living in the hillside neighborhoods is essential to the health and safety of all Corte Maderans. Living in the Wildland Urban Interface is a great responsibility. It requires the knowledge, capacity, and resources in order to ensure that your home, the homes of those around you, and the lives of first responders are safe during an emergency.

Supporting the Town's regional partners to enhance wildfire preparedness education for Corte Maderan residents is essential. Ensuring that hillside residents have access to, engage with, and integrate best practices for wildfire preparedness, defensible space, home hardening, and vegetation management are a central component in reducing wildfire risk for the Town. It is equally important that all Corte Maderans understand where to get reliable, clear, and locally-specific information related to wildfires, evacuation protocols, and other procedures.

The following education-focused actions are intended to clarify Corte Madera's role in supporting regional wildfire preparedness education efforts that provide residents the tools, education, and resources necessary to understand the roles and responsibilities of living in the WUI.

Coordinate with FIRESafe Marin to integrate climate change and wildfire projections into all current educational materials and programs. Defining the role that climate change plays in exacerbating wildfire risk is key to understanding what is at stake as well as implementing actions that support adaptation and resilience efforts. For example, this information would be essential to include in all local and regional educational materials in order to use the best available science and best practices for supporting individual homeowners in their efforts to reduce their risk to wildfires.

Support regional partners (e.g., FIRESafe Marin, MWPA, etc.) in their efforts to effectively educate residents about defensible space, vegetation management, and home hardening efforts. In order to ensure an efficient, effective, and consistent approach to wildfire risk reduction for the Town, strong regulations must be balanced by consistent, clear, and reliable education and outreach with Town residents. This includes consistent messaging using workshops, webinars, forums, door-to-door site visits, educational materials, and more. According to the Marin County Civil Grand Jury Report, the most effective method of educating residents about wildfire preparedness was in neighborhoods on the ground from person to person by education specialists (not firefighters).[158]

Coordinate with FIRESafe Marin to enhance community outreach and education programs about the impacts of wildfires and smoke on physical and mental health. Wildfires not only directly impact our physical health and safety, they also impact our mental health. In addition, the impacts of smoke can be long-lasting, particularly for frontline community members. Supporting and coordinating with regional education partners like FIRESafe Marin (as well as the MWPA) is an important step in ensuring that Corte Madera residents understand and prepare for the impacts of smoke and wildfires on their physical and mental health.

Support regional partners in their efforts to update all planning documents, budgets, and programs to include climate change projections (with a special focus on increased wildfire risk and drought). Wildfire science and modeling is changing drastically due to a new understanding about how climate change is exacerbating the size, severity, duration, and seasonality of wildfires. These changes will impact the way that local and regional fire departments operate, plan, and make decisions.

Support community outreach and education efforts focused on Town WUI policies, codes, and regulations. Education remains one of the cornerstones of community preparedness. Supporting the local and regional entities to find innovative, equitable, and locally-specific ways to reach all residents is key to ensuring ALL Corte Maderans are prepared in the case of a wildfire. This includes identifying and institutionalizing equitable approaches to community engagement that consider linguistic, racial, ethnic, socioeconomic, educational, and political factors that increase the sensitivity of frontline community members to climate change.

5 central corte madera


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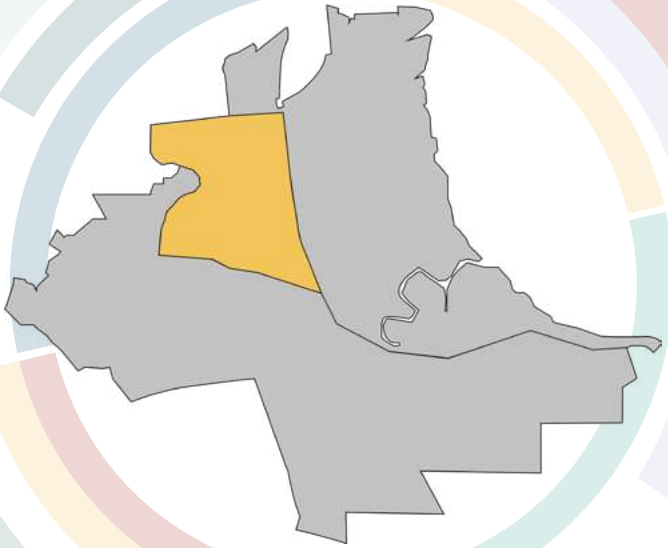


central corte madera

BY THE NUMBERS

7
The number of parks located in central Corte Madera.

2
The number of fire stations in central Corte Madera.

34
The number of water pump stations located throughout Corte Madera.

242
The number of hotel rooms located in central Corte Madera.

41.4
The total miles of pipes in the stormwater system in Corte Madera.

121
The total number of retail stores located in the malls in central Corte Madera.

6,315
The total number of living units in central Corte Madera.

Central Corte Madera contains an array of valuable single and multi-family residences, businesses, public safety facilities, critical public infrastructure and a multi-modal transportation network. Two Central Corte Madera shopping centers, Town Center and The Village at Corte Madera, are critical to the economic health and vitality of the Town, providing much of the Town's sales tax income. In fact, sales tax revenue accounts for about 20% of the Town's annual net revenue (based on 2016-17 revenue calculations).[159,160] Inland flooding from extreme precipitation events is the biggest exposure for this area, though it is also at risk of coastal flooding, wildfire, and other secondary climate impacts. Stormwater runoff has been a particular problem in some areas of the Town due to climate-induced increases in extreme precipitation, undersized storm drain pipes, inadequate drainage systems, poor inlet conditions, the lack of sufficient gradient for runoff, and land subsidence, which increase the vulnerability of low-lying areas to flooding and pooling.[161]

In specific areas, the stormwater network is already experiencing deficiencies during extreme precipitation events. High tides can exacerbate flooding by limiting drainage into the Bay. The steep hills surrounding Corte Madera to the south and west contribute to flooding by funneling water into the central portions of town. Corte Madera Creek, which drains the Ross Valley Watershed, and San Clemente Creek, a tidal slough draining runoff into San Francisco Bay, also contributes to flooding within the Town. In response to flooding conditions along San Clemente Creek, many residents have raised and reinforced the foundations of their homes when remodeling.

Standing or pooling water is not the only hazard in this area; people, buildings, and other assets are vulnerable to water damage. One way to reduce these risks is to redesign how the town builds. In 1986 the Corte Madera Town Council established the Flood Control Board, which is responsible for advising the Town Council on all matters affecting flooding and flood protection in Corte Madera.[162] Ordinances addressing flood damage prevention in the Town of Corte Madera are contained in Chapter 16, Protection of Flood Hazard Areas, of the Town's Municipal Code. For example, most individual development projects are required to complete a detailed hydrologic study prior to Town issuance of development permits. These studies aim to identify downstream areas that experience localized flooding, detail potential impacts that proposed projects could create on these areas, and identify both on-site and off-site mitigation measures that would be required to prevent these impacts.[163]

Flooding can also create pollution from combined sewer overflows[164] and roadway surface runoff to fresh and marine water systems, potentially introducing toxins to the food chain and water supply. Further, flood-related transportation disruptions can cause significant hardship to both Corte Madera and surrounding communities.

Central Corte Madera Focus Areas

The actions highlighted in this report represent a subset of a broader suite of adaptation actions that scored highly based on their potential effectiveness, efficiency, and feasibility for the Town. These actions (and the full suite of actions in Appendix B) provides the Town with a list of many of the most appropriate options to consider. ***It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented. The local or regional organization, agency, or department responsible for implementing any action will need to be determined on a case-by-case basis.*** Adaptation actions for central Corte Madera are divided into two primary focus areas:

COLLABORATION - (pages 127 - 128)
PREVENTION - (pages 129 - 134)

COLLABORATION

Central Corte Madera is located at the base of Mount Tamalpais and near the mouth of Corte Madera Creek. The steep hills surrounding Corte Madera to the south and west contribute to flooding by funneling water into the central portions of town. Corte Madera Creek, which drains the Ross Valley Watershed, and San Clemente Creek, a tidal slough draining runoff into San Francisco Bay, also contributes to flooding within the Town. In response to flooding conditions along San Clemente Creek, many residents have raised and reinforced the foundations of their homes when remodeling.

While the Town itself can do a lot to reduce local flooding, it can not tackle this issue on its own. As the recent Marin County Civil Grand Jury report on adaptation states, "Marin needs stronger collaboration among county, cities, towns, and agencies" to adapt to climate change,[165] and this need for collaboration is readily apparent in the Central portions of Town.

While there has been on-going project planning for Corte Madera creek that recognizes the need for multi-jurisdictional collaboration, more can be done to successfully reduce flooding in the area.[166] Collaboration can extend beyond preparing for extreme precipitation events to enhancing partnerships to better understand and monitor groundwater, limit coastal flooding, and make efficient use of emergency management investments. The Town already benefits from a Joint Powers Authority for both police and fire protection, and collaboration will be critical in both better understanding the complex set of climate and extreme weather risks for the area and developing effective solutions. Collaboration between the Town, businesses, residents, and workers require effort, but can drastically improve the success of any adaptation actions in the region.

Monitor groundwater levels, and consider associated impacts in current and proposed designs for development. While there have been lots of geotechnical borings for development, there has yet to be a systematic monitoring system for tracking groundwater levels in the Town. SFEI is participating in a California Resilience Grant project to better understand groundwater levels around the Bay. Marin County is one of four counties participating in the study and the Town of Corte Madera should consider partnering with SFEI on this project.

Support efforts of other organizations and academic institutions to conduct studies of the impact combined riverine and coastal flooding and increased precipitation has on flood risk and vulnerability. Precipitation in the region is likely to remain extremely variable. Where that precipitation falls will largely determine where the flood waters go and who is affected. It will take detailed hydraulic modeling to better understand how the system will work with more extreme precipitation events and how different interventions can reduce or limit those impacts.

Study the combined impact of projected precipitation events, sea level rise, groundwater intrusion, and other flood events for the Town. Engineering approaches to mitigating SLR-driven overland flooding usually do not address groundwater inundation, so assessment of this risk is an essential step in planning for the full impacts of climate change at local and regional scales.[169] Detailed groundwater monitoring efforts coupled with improved understanding of the relationship between SLR, coastal aquifers, and stormwater systems will help the Town adapt to changing conditions.

Continue to collaborate with partner agencies and municipalities to align green infrastructure projects and regulations for watersheds across jurisdictions to reduce impervious hard surfaces and require integration of green infrastructure techniques into site design. Working collaboratively to reduce impervious surfaces can effectively reduce the amount of stormwater runoff that flows into the Town flood control system. Working collaboratively with other jurisdictions to align green infrastructure requirements makes localized action more effective at reducing flood risk.

Collaborating to Limit Stormwater Pollution

The Marin County Department of Public Works/Flood Control District administers the Marin County Stormwater Pollution Prevention Program (MCSTOPPP). This is a collaborative effort by municipalities and unincorporated areas whose watersheds drain to San Francisco and San Pablo Bay. Formed in 1993, MCSTOPPP provides measures to dictate compliance with state and federal regulations, reduce or prevent stormwater pollution, and protect water quality in creeks and marshes.[167] Corte Madera has its own Urban Runoff Pollution Prevention ordinances that incorporate best management practices.[168]

PREVENTION

Corte Madera currently faces important decisions on how to most effectively invest money into retrofitting existing infrastructure or building new infrastructure to accommodate stormwater runoff and future risks associated with climate change. Taken holistically, the stormwater drainage system is a combination of natural assets (trees, detention ponds, creeks and canals) and hard infrastructure (storm drains, pipes, and pumps) throughout the Town. Since severe flooding closed roads and inundated storefronts in 1982, the Corte Madera has invested more than $30 million to improve the stormwater system.[170]

There are a number of interrelated concerns tied to stormwater in the central portion of the Town that need to be addressed for the community to successfully prepare for climate change. This includes better accommodating the extreme precipitation events that are affecting the town more and more frequently, to understanding how rising groundwater will affect hydrologic conditions across the Town. As a bayfront community, groundwater levels in the Town fluctuate over time due to variations in rainfall, water levels in nearby lagoons and ponds, and tides. Geotechnical investigations and borings done throughout the community indicate that groundwater levels are generally only five to 10 feet below the surface and can be as shallow as four feet after heavy rains.[171] When groundwater levels are high, it can seep into structures through foundations causing property damage. Geologic or hydrologic studies could identify where shallow coastal aquifers and groundwater are located as well as areas that have the potential for temporary and/or long term underground water storage. The first step in ensuring the effectiveness of a stormwater system is to decrease peak water flows. Green infrastructure offers a suite of cost-effective solutions that can help improve the Town's resilience by managing flows and floods. Additional prevention can be done at the individual parcel level through investments in not only green infrastructure, but also by elevating buildings, roadways, and critical infrastructure above flood levels. Strategic siting of infrastructure (such as new higher density housing or new businesses) can help prevent flooding and limit impacts.

Promote regional efforts to analyze feasibility and effectiveness of additional green infrastructure on commercial and residential properties in mitigating stormwater runoff. Green infrastructure can reduce the strain on stormwater infrastructure by reducing the amount of water needed to be pumped to the Bay during high precipitation events. In order to determine the efficacy of additional green infrastructure, the Town needs to analyze current capacity and potential sites for additional infrastructure (*see Figure 5.1*). While green infrastructure cannot solve all of Corte Madera's flooding woes on its own, it is an effective flood solution when coupled with improved traditional stormwater infrastructure.

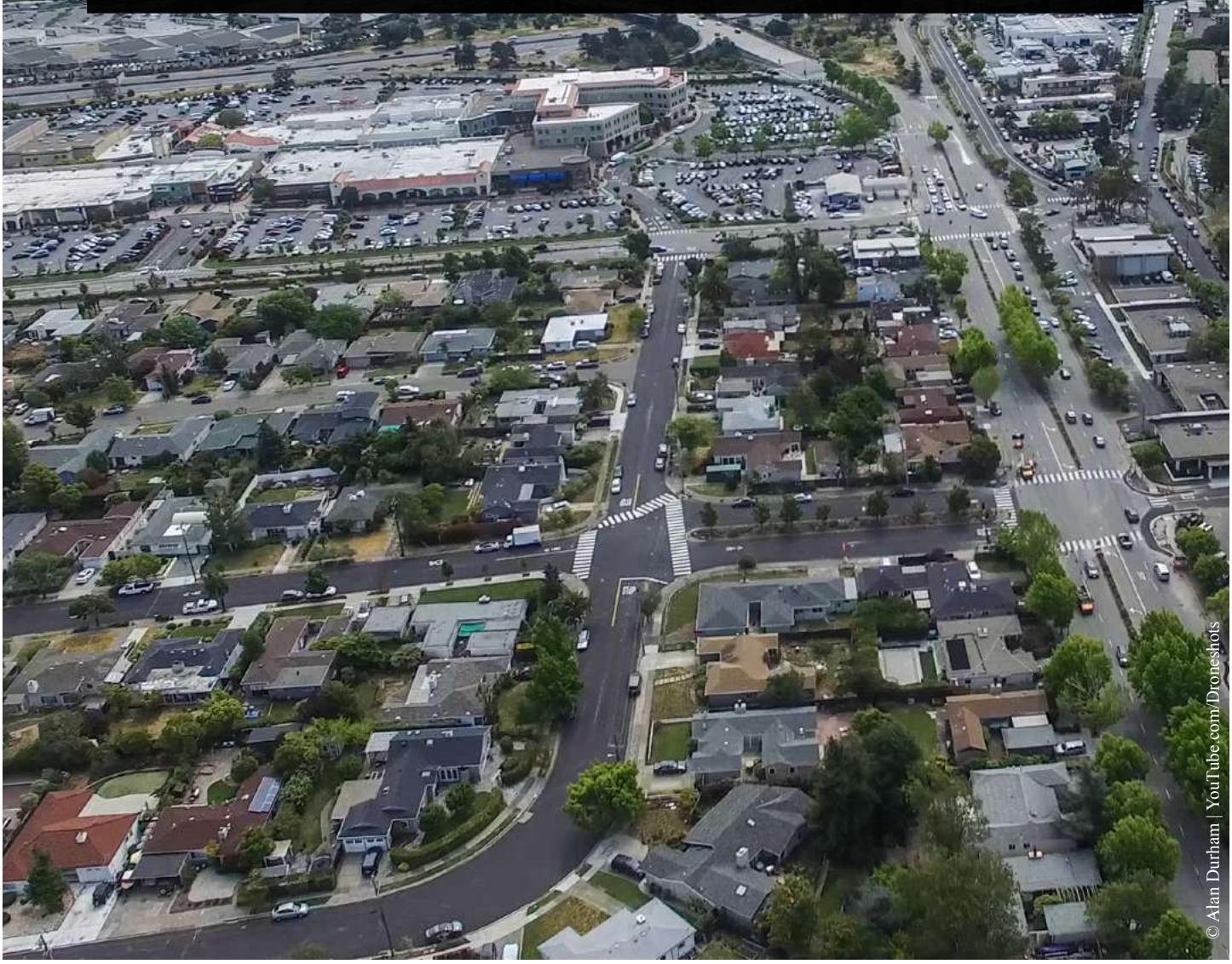
Figure 5.1. Suitable areas within Corte Madera for green infrastructure (permeable pavement, vegetated swales, or bioretention).
Source: Kass et al, 2011

Address flooding issues on Casa Buena Drive. Subject to flooding during extreme precipitation events, Casa Buena Drive is a significant surface street for the town, connecting residential areas and small businesses to Tamalpais Drive. The first step to ensure the safety of residents and access to this section of town, is upgrading the storm drain system along the roadway to ensure that it has the capacity to handle the larger precipitation events already occurring almost annually (~$200,000). Over the longer-term, the drive should be added to a list of important roadways to consider elevating to ensure functionality during extreme weather events, especially as sea levels rise (~$500,000).

Case Study: Norfolk, Virginia

In 2016, Norfolk finished its Vision 2100 plan, which makes resilience part of its brand, billing itself as "the coastal community of the future." The words in its preface set the tone for the plan, stating that climate change is "not ... a dilemma, [it's] an opportunity — an opportunity to reimagine the city for the 22nd century."[172]

Fundamental to Norfolk's approach is a concept called Resilient Zoning. Part of this approach allows developers to choose specific design elements from a menu of features in order to reach project approval. The Resilient Zoning concept uses a "resilience quotient," a points-based matrix that allows developers to choose from a menu of building features — ranging from green roofs to backup power systems — to reach a threshold required for project approval.[173] Norfolk's Resilient Zoning also includes a more complex initiative (though still much cheaper than armoring the coastline). This new initiative revised the zoning code to require a three-foot "freeboard" (elevation of the ground floor above grade) and pervious parking surfaces in the most flood-prone areas. It also incentivizes high-density development in more flood-safe upland areas by streamlining the permit and approval processes.

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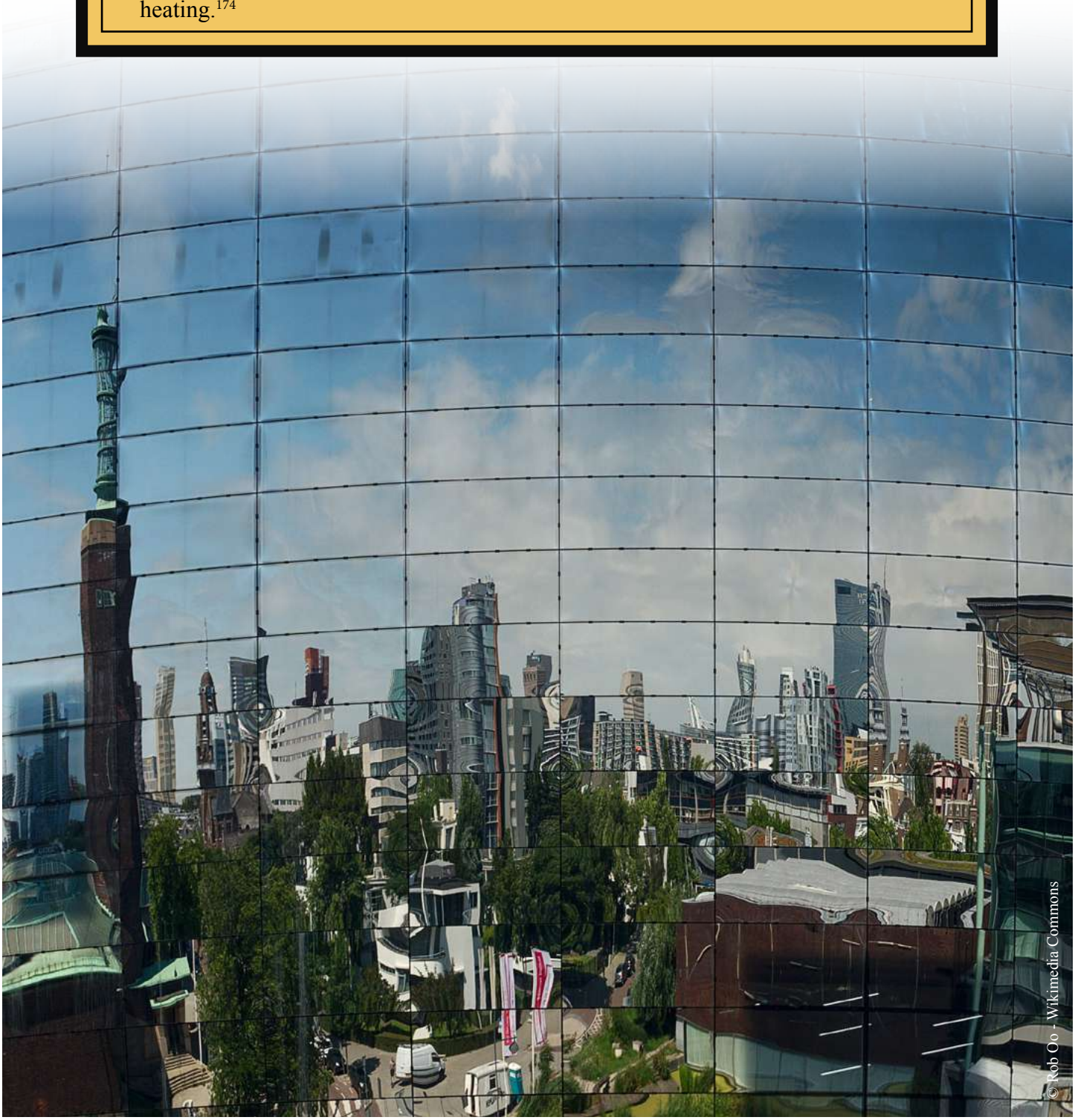
Case Study: Rotterdam, The Netherlands

One of Rotterdam's 'climate-proofing' measures includes the use of rooftop greenery. The City's many flat roofs are a resource for making buildings more climate resilient, healthier, and more attractive by covering them with soil and vegetation. These green roofs absorb rainwater and downpours have less impact on the city's storm sewers and drainage system. The green roofs, together with tree-lined infiltration zones along streets, help limit heat stress by making the city shadier and cooler. Green roofs also help insulate buildings, reducing the need for air conditioning or heating.[174]



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Provide policy incentives to property owners by streamlining permitting for green infrastructure and stormwater projects that adhere to a stricter set of requirements. Reducing the time and effort required to adhere to existing requirements incentivizes property owners to not only comply with the green infrastructure requirements, but to voluntarily implement them.

Develop a "Homeowners and Small Business Guide to Stormwater Management" to educate home and small business owners on regulations, and highlight the role that engaged residents can play to assist with community-based stormwater management. Providing homeowners and small business owners a consolidated guide on current stormwater regulations and best practices can aid in compliance. Simply informing residents and business owners of their responsibility and the role they play in reducing stormwater runoff can potentially aid in the success of reducing runoff.

Update the Storm Drainage Master Plan to include an assessment of current infrastructure and its ability to handle projected extreme precipitation and sea level rise that identifies deficiencies and deferred maintenance needs for our stormwater and flood control network. It is time to invest in updating the Storm Drainage Master Plan and to specifically include an analysis of the stormwater and flood control system infrastructure capacity to accommodate increasing sea levels and runoff from heavy precipitation events. Despite major investments in the last 20 years, climate-driven heavy precipitation and stormwater continues to disrupt homes, businesses, and transportation networks. The updated Storm Drainage Master Plan will include an analysis of the Town's detention and retention basins, pumping infrastructure, pips, and the storm drain network; it will also provide current and recommended capacities that consider climate projections.

The plan aims to identify a combination of nature-based and, where necessary, hard infrastructure solutions to upgrade the existing flood control system's capacity to handle the compounding, near- and long term impacts of larger flood events and higher sea levels. Potential strategies include:

- Analyzing current stormwater system capacity.
- Identifying desired flood protection levels in 25, 50, and 100 years.
- Identifying appropriate green, nature-based, and non-structural approaches to flood mitigation
- Upsizing pumps to effectively manage increased precipitation, runoff water levels, and water pressure.
- Assessing whether dredging projects can achieve desired future flood protection levels.

Investigate and track the flood-reduction benefits of Low Impact Development (LID) standards and the potential to improve by adjusting requirements or enforcing compliance among property-owners. Understanding the impact of LID requirements and the rate of compliance among commercial and residential properties can help the Town understand the potential effectiveness of adjusting requirements or increasing enforcement of existing requirements in order to reduce the amount of stormwater runoff.

6 conclusion

Adapting to climate change is a process - not the outcome of a single project. With the completion of this Adaptation Assessment, the Town of Corte Madera and the community have taken the next step in the journey to build resilience. Climate adaptation is, and must continue to be, a conscious process where actions are developed, refined, implemented, monitored over time, and adjusted as necessary.

Resilience requires a variety of things: 1) robust and redundant systems that can withstand more intense or extreme weather events (or other stressors); 2) holistic and inclusive planning that not only considers, but incorporates, all community members in the development of effective actions; 3) monitoring and flexibility to respond to changing conditions and information over time; 4) persistence and dedication. As a key aspect of this larger climate adaptation process, this assessment creates a roadmap that can guide the Town's investments and choices over time.

There are a number of essential first steps and near-term investments that have the potential to significantly enhance community resilience. Across the assessment's four focus areas (Town-wide, Hillside, Shoreline, Central) and associated actions, there are common themes and initial investments that are clear priorities for the community.

- **Outreach/Education**
  Whether it is working with the Neighborhood Resource Groups to enhance homeowner preparedness and home hardening efforts, initiating a program to discuss long-term shoreline resilience, or ensuring that all community members have access to and understand emergency preparedness and evacuation protocols, education is a key facet of action in each focus area. Enhancing and supporting on-going community outreach and education efforts, including incorporating discussion of climate change and deepening engagement for all community members, have a variety of benefits. These actions help ensure that Corte Maderans understand the real and serious threats facing the community, help the community be better prepared for those threats, and enhance the development of community- and neighborhood-level solutions that enhance resilience.

- **Collaboration**
  Climate change exposures and impacts are not limited to the Town's boundaries, creating challenging, multi-faceted issues that require collaboration. Key opportunities for collaboration include: 1) working with neighboring jurisdictions and academic institutions to study the combined impact of projected precipitation, sea level rise, groundwater intrusion, and other flood events for the Town; 2) forming a multi-jurisdictional group to explore adaptation options for the marsh; and 3) working closely with the Marin County Parks and Open Space, the Fire District, and Marin Wildfire Prevention Authority to consider the feasibility and value of improving and opening fire roads for first responder access and evacuation. These collaborations will include investments in conversations to develop and implement effective solutions that take into account all stakeholders and their concerns. These collaborations also create a strong foundation for efficient implementation of actions.

- **Infrastructure Investments**
  Strategic infrastructure investments can enhance community preparedness and safety as well as everyday quality of life. Some essential early investments include: 1) elevating Lucky Drive to reduce the risk of flooding during king tides and extreme weather events; 2) Improving portions of Summit Drive on Christmas Tree Hill for use during emergency evacuations and improving Hill Path lane and stairs on Christmas Tree Hill; and 3) augmenting community centers and school facilities to become Resilience Hubs that can serve as evacuation centers, cooling centers, and charging stations, during extreme heat or extreme weather events. These investments are not inexpensive, but if pursued and strategically implemented using a mix of Town funds and outside grants, these projects are feasible and can make a real difference in community resilience.

- **Planning and Policies**
  Policies and plans are critical components of the Town's holistic approach to building resilience. They can limit or reduce current risks, lay the foundation for future actions, distribute costs, and complement infrastructure investments. An essential first step for the Town to explore is the augmentation of existing policies, (or, as necessary, the creation of new policies) to protect residents and guide future investments. Early consideration should go to policies and plans that: 1) explore a regional approach to meeting housing development goals that locates new housing areas within the County that are less vulnerable to climate hazards; 2) streamline the process for enforcing the Town's WUI building codes and regulations with particular attention to rental properties and absentee homeowners; 3) update the Stormwater Master Plan, including an analysis of current capacity and future needs under changing conditions; and 4) consider providing regulatory assistance to property owners by streamlining zoning regulations and the development permitting process to encourage the resilience of homes and property. *To learn about potential funding streams available to support this work, see Appendix A.*

Adapting to climate change is a process - not the outcome of a single project. With the completion of this Adaptation Assessment, the Town of Corte Madera and the community have taken the next step in the journey to build resilience. Climate adaptation is, and must continue to be, a conscious process where actions are developed, refined, implemented, monitored over time, and adjusted as necessary.

Corte Madera is on the forefront of developing actions to enhance resilience, as demonstrated by the development of this proactive Adaptation Assessment. The Town is dedicated to working with other communities, the county, and local, regional, and state organizations to develop efficient, effective, and feasible solutions that reduce risk and enhance resilience. Leading is not always easy, and it requires weighing trade-offs and making difficult decisions about the best use of funding and investments to support the community's goals. In some cases, this will mean trying new innovative solutions, learning from trial and error, and exploring different alternatives.

In 30-50 years, under the pressures of a changing climate, Corte Madera will look different than it does today. Actions taken now will determine if the Town is able to meet the goals detailed in this assessment. The Town is committed to preserving its identity and "small-town feel" by investing in the resilience of the people, infrastructure, and ecosystems that make the community what it is today and ensuring that Corte Madera has a thriving, vibrant, and resilient future.


7
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8
appendices

APPENDIX A | FUNDING OPPORTUNITIES

There is an ever-changing landscape of funding opportunities that can be used to fund and pay for actions to enhance the resilience of the community. Some of these funding opportunities are long-term or annual funds that are likely to be available for a long-time and can be tapped into for specific programs, projects, or initiatives if/when those projects meet the needs of the funding opportunities. Others funding opportunities, may be only available at a particular time as the focus of funder and program change over time and would need to be applied to or utilized within that limited window of availability. Finally, there are likely funding opportunities not on this list that will emerge as Corte Madera continues to explore opportunities to enhance resilience. Building partnerships with regional collaborators may allow the Town to take advantage of being at the forefront of adaptation in the region to explore and secure funding for pilot projects that are new, innovative, or creative cutting-edge solutions.

The list provided below is not intended to be exhaustive or comprehensive. It is designed to highlight a few of the potentially most relevant and promising funding opportunities available currently to support the Town's adaptation efforts. The Town is not looking to rely solely on these external sources to fund adaptation activities but can use these programs to reduce costs or supplement internal funding resources.

General Disaster, Climate Change Mitigation, and Infrastructure Improvement

- **FEMA Building Resilience Infrastructure and Communities (BRIC) Program** - FEMA Building Resilient Infrastructure and Communities (BRIC) program accepted applications through January 29, 2021 from states, territories, and tribes for the available $500 million. The BRIC program focuses on pre-disaster mitigation and resilient infrastructure — helping communities break away from reliance on post-disaster funding sources. Corte Madera submitted an application to support elevating Lucky Drive. For additional information, check out American Flood Coalition's **blog article**.

- **California Climate Investments** - A program focused on broad sustainability initiatives with planned information sessions for FY 2021 and beyond based on California Cap and Trade funds. Local governments are eligible to receive funds for climate pollution reduction, waste prevention, forest management, sustainable transportation initiatives, wetlands and watershed restoration, and a variety of other sustainability initiatives. Interested departments and officials should contact info@caclimateinvestments.ca.gov.

- **AB-296 - Cooley Climate Change Innovation Fund** - State Funds from the Climate Innovation Grant Program to be administered by the Strategic Growth Council for the development and research of new innovations and technologies that either reduce emissions or address impacts caused by climate change.

- **Transit and Intercity Rail Capital Program (TIRCP)** - Administered by CALTRANS, this program was created by Senate Bill 862 to provide grants from the Greenhouse Gas Reduction Fund to fund transformative capital improvements that will modernize California's intercity, commuter, and urban rail systems, as well as bus, ferry, and other programs that reduce greenhouse gases, vehicle miles traveled, and congestion. These funds are supported out through 2030 and could be applicable to renovations along the 101 corridor and coastal areas with proper project planning.

- **State of California Coastal Conservancy Climate Ready Program** - Although currently on hold, the Climate Ready Program has in the past supported a broad range of efforts to aid in the increased resilience and adaptive capacity of human and natural systems to address risks posed by climate change, including both issues related to sea level rise and coastal erosion as well as various post-wildfire related risk factors to water systems and natural infrastructure.

- **Affordable Housing and Sustainable Communities Program** - Administered by the California Strategic Growth Council and funded through California Climate Investments, this program provides funding for the planning and implementation of various sustainability projects that focus on urban densification, sprawl reduction, active

transportation system improvements, air pollution reduction, transit ridership, and service connectivity. Many of these goals are synergistic with current wildfire and flood risk mitigation plans.

- **Proposition 68 San Francisco Bay Area Conservancy Program Climate Adaptation Funds** - Administered through the Coastal Conservancy, this funding opportunity aims to fund projects that plan, develop, or implement actions to help natural and human communities adapt to the impacts of climate change. Eligible projects include those that improve a community's ability to adapt to unfavorable climate change impacts; improve wildlife corridors and habitat; develop future recreational opportunities and facilities; improve landscape resilience; and other related human-environmental beneficial outcomes. Natural infrastructure projects with multiple benefits will be prioritized, and sea level rise adaptation projects are eligible. Note: Tidal Wetlands restoration projects are not supported through this grant but are supported through other programs.

- **California Hazard Mitigation Grant Program** via FEMA Hazard Mitigation Grants - Funding for hazard mitigation projects including but not limited to projects which mitigate flood and drought conditions, hazard mitigation planning, dry floodproofing of historic residential structures, structural retrofitting of existing buildings, wildfire mitigation, and other mitigation construction. Is administered through the FEMA Hazard Mitigation Assistance Grants program.

- **Climate Adaptation Finance and Investment in California** - This general guide to finance and investment in the state provides a conceptual framework for employees and constituents thinking about funding climate and infrastructure projects.

- **California Grants Portal** - General resource for regularly updated funding opportunities in the state of California.

Forest Health, Wildfire Risk Mitigation, and Wildfire Recovery Resources

- **Marin Wildfire Prevention Authority** - Initiated in 2020 after being approved by voters, the Marine Wildfire Prevention Authority pools money and resources to support wildfire protection efforts across the country with individual jurisdictions receiving funding to support their wildfire risk reduction and educational efforts. The authority is also working on establishing a grant program to provide additional funding.

- **CALFIRE Urban and Community Forestry Grant Programs** - Although current funding cycles are unclear, in the past this program has provided support for a variety of activities related to Urban Forest Expansion and Management, Urban Wood and Biomass Utilization, and forest improvement that could be dovetailed to mitigation efforts in hillside neighborhoods.

- **CALFIRE Forest Health Grants** - Administered through the Department of Forestry and Fire Protection, this program funds projects that: 1)Proactively restore forest health and conserve working forests; 2)Protect upper watersheds; 3)Promote the long-term storage for carbon in forests; 4) Minimize the loss of forest carbon from large, intense wildfires; and 5_ Further the goals of the California Forest Carbon Plan, California National and Working Lands Implementation Plan, and California's Global Warming Solutions Act of 2006. In Corte Madera's case, this could serve efforts to mitigate nearby fire risks in forests outside of the city boundary, provide a basis for regional partnerships, and potentially provide a basis for marsh afforestation efforts in coastal areas.

- **Town of Paradise Long-Term Community Recovery Plan** (2019) - See this report for a selection of wildfire-focused, infrastructure, and general rebuilding money sources (page 34 onwards). In addition, it provides a near-comprehensive research on long-term recovery tactics and rough cost-estimates associated with each.

Sea-Level Rise, Inland Flooding, and Water Management Resources

- **FEMA Flood Mitigation Assistance (FMA) Program** - FEMA's flood mitigation assistance grant program accepts applications from states, territories, and tribes. In 2021, available funding was $160 million. Municipal governments can expect to see information on how to apply through their states. The FMA grant program is attractive to communities with properties vulnerable to repetitive losses from flooding. The program funds projects that integrate floodplain restoration solutions and/or enhance the durability of structures insured under the National Flood Insurance Program (NFIP).

- **Floodplain Management Protection and Risk Awareness Program** - This program aims to support local agency efforts to prepare for flooding events by providing financial assistance for stormwater, mudslide, and other flash-flood related projects operating with the goal of flood risk reduction. Priority is given to economically disadvantaged communities and multi-benefit (e.g., natural infrastructure-based) projects.

- **The California Wildlife Conservation Board Habitat Enhancement and Restoration Program** - This ongoing funding source provides assistance for the restoration and enhancement of fish and wildlife resources, including coastal and tidal habitat restoration efforts.

- **Flood Funding Finder** - A non-profit coalition of professionals and researchers working on solutions to flooding and seal level rise. Provides information and links to a rolling set of funding opportunities for various stakeholders.

APPENDIX B | ADAPTATION ACTIONS

This appendix provides a list of potential actions the Town of Corte Madera can consider for future adaptation and resilience efforts. Actions are divided into sections, similar to the body of the Assessment (Town-wide, Shoreline, Hillside, Central) and categories defined within each section. Based on the evaluation process adapted from USAID (see Appendix C), the actions in this appendix all scored in the highest tier for their potential effectiveness, efficiency, and feasibility. The numbering of actions listed in the appendix is meant to serve as a coding system and make it easier to find actions. It does not represent priority or order of implementation.

It is important to note that actions listed in this appendix can be: complementary, directly dependent on the implementation of another action (before or after), implemented in conjunction (or sequentially) with other actions, or mutually exclusive of one another (implementing one action negates the effectiveness or ability to implement another action). Some of the listed actions have been taken directly (or generally summarized) from local and regional plans (e.g., Community Wildfire Protection Plan, Town of Corte Madera General Plan 2009) and should be updated accordingly as adaptation planning and implementation processes progress. In addition, the list of actions provided is not necessarily the full suite of actions that are appropriate for the Town. Instead, this list provides the Town with a suite of many of the most appropriate options at this point in time to consider when working to achieve the community's goals. As industry and best practices evolve, it is likely that additional actions will be considered (and some removed from consideration) as adaptation planning progresses. ***It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented. The local or regional organization, agency, or department responsible for implementing any action will need to be determined on a case-by-case basis.***

Each action is formatted as follows.

Action Code #: [Town-wide (T), Shoreline (S), Hillside (H), Central (C) - Grouping Initials - #]: **ACTION (in bold).** Plus 1- 3 sentences to describe the action context or more details.

- **Type of action:** Project/Policy/Program
- **Example Partners**: Potential additional partners that the Town will need to coordinate with. Some actions will require a lead and additional partners to successfully implement the action.
- **Planning Cost Range**: *Low (<$25k), Medium ($25k-$100k), High ($100k-$1 million), Very High ($1-$5 million), Extremely High (>$5 million)*. These are potential planning cost ranges that are likely to change as actions are refined and improved prior to implementation.
- **Timeframe for Implementation:** *Near-term (<5 years), Medium-term (5-20 years), Long-term (>20 years)*. While the majority of actions in the Assessment focus on the near-term, thought it may not be feasible or realistic to implement them within that time frame due to shifts in priority or capacity. A few actions have specific timeframes of effectiveness, but others can be implemented if or when deemed necessary.

Note: This is a working list of adaptation actions. It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented.

town-wide

HEALTH AND WELLNESS

T-HW-1: Ensure all Town buildings have smoke and particulate filtration systems, especially dedicated emergency evacuation shelters and resilience hubs. Ensuring that buildings and resilience hubs in Corte Madera have effective smoke and particulate filtration systems is key to ensuring the health and well-being of residents, especially during an emergency. Additional actions include deploying low-cost particulate matter sensors in relevant Town locations that provide data for indoor and outdoor levels in real-time. Resilience hubs can also incorporate solar and battery storage systems to provide a reliable center for cooling, water, power, and communications during power outages and reduce utility costs during daily operations.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Public Works, Building contractors, building owners and facility managers
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-HW-2: Support regional healthcare providers as they develop climate change-related mental health and trauma treatment measures and incorporate them as appropriate into existing town plans, trainings, programs, and policies. Extreme weather events can have significant impacts on mental health, and this connection is often challenging to integrate into regional planning efforts. Yet it is critical that this issue receives dedicated attention and resources. Example organizations include the Psychological First Aid (PFA), Skills for Psychological Recovery (SPR), or the Good Grief Network.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Parks and Recreation, Health Care Climate Council
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-HW-3: Continue to prioritize implementation of green and sustainable adaptation strategies across the Town's built environment. This action would provide the framework for understanding, defining, and planning green infrastructure. Continuing to invest in green infrastructure will not only enhance resilience, but also add to resident well-being and quality of life. This includes coordinating with regional partners to identify and prioritize protecting, restoring, and planting genetically appropriate vegetation suited for projected climate conditions.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Parks and Recreation Department, ReScape California, Marin Master Gardeners, California Native Plant Society, UC Merced, Marin Municipal Water District Wildfire Task Force
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-HW-4: Work with or support community organizations, especially environmental justice, LatinX, and other community organizations as they identify gaps in frontline community resilience planning and further engage frontline community members in wildfire risk, evacuation, and resilience work. Collaborating with regional organizations dedicated to engaging and supporting frontline communities are key to building trust and ensuring the health, safety, and well-being of all residents.

- **Type of Action:** Project
- **Example Partners:** Town of Corte Madera Human Resources' (i.e., Employee Assistance Program), Promotores de Salud, the California Association of Community Health Workers, Corte Madera Parks and Recreation Programming
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-HW-5: Complete an equity impact evaluation for climate action and adaptation planning and implementation processes. Historic and current systems of oppression (including racial segregation and racism, poverty, income inequality, lack of living wage jobs, gaps in educational opportunities and attainment, concentrated neighborhood disinvestment, political disenfranchisement, and low social capital) result in social and biological factors that increase the vulnerability of some community members to climate change. Conducting an equity impact evaluation for development and redevelopment plans will provide Town staff and leadership with the tools to ensure that community members are not adversely impacted by these planning efforts.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Planning Department, NAACP, Marin Community Foundation, Community Action Marin, Marin County (i.e., Marin County Office of Equity), Neighboring Municipal Partners, Marin Promise Partnership
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-HW-6: Conduct and map urban tree canopy cover evaluation for specified areas (e.g., commercial district, Highway 101 corridor) to identify urban heat islands. Urban heat islands - developed areas that experience significantly warmer temperatures due to the built environment - can impact the health, safety, and wellbeing of community members. Temperature fluctuations can differ drastically between urban and rural areas due to a large concentration of buildings, roads, and other structures that absorb heat. Understanding if and where Corte Madera currently experiences elevated temperatures due to the heat island effect as well as how climate change may exacerbate those areas will inform decision-making and the implementation of strategies that reduce its impacts.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Parks and Recreation Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-HW-7: Support and participate in the development of a regional and local drought contingency plan. As droughts increase in severity and duration across the State, working with local and regional partners to develop a drought contingency plan that includes Corte Madera will support better planning and informed decision-making.

- **Type of Action:** Project
- **Example Partners:** Marin Municipal Water District (MMWD)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-HW-8: Work with regional and local health agencies to evaluate extreme heat warning thresholds and protocols and incorporate enhanced extreme heat preparedness into local operations. While not historically an issue, extreme heat is an emerging threat, especially for older residents, outdoor workers, and other frontline community members. Incorporating plans for extreme heat into Town operations can help ensure that it is prepared to deal with extreme heat events that will become more frequent in the future.

- **Type of Action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-HW-9: Support regional partners in education and outreach efforts focused on water conservation measures for Town residents. Supporting water conservation outreach and education measures may be particularly important during periods of drought. In addition, campaigns should consider the support of individual rainwater harvesting, water storage, and other water conservation techniques including water reuse, water use, and irrigation efficiency.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Public Works Department, Marin Municipal Water District (MMWD)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-HW-10: Distribute low-cost smoke filtration systems to strategic locations (e.g., emergency evacuation shelters or homes) and provide guidance on how to use them.

- **Type of Action:** Project
- **Example Partners:** Central Marin Fire Department, CalFire
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-HW-11: Identify opportunities to enhance the role of the state-wide Low-Income Home Energy Assistance Program (LIHEAP) in Corte Madera.

- **Type of Action:** Program
- **Example Partners:** Administration for Children and Families (ACF)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-HW-12: Review, integrate, and prioritize improvements recommended in the Town bike-ped infrastructure/plan into the capital improvements plan.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Public Works, Corte Madera Planning Department, Transportation Authority of Marin (TAM), CalTrans, Town of Corte Madera's Bicycle Pedestrian Advisory Committee (BP AC), Marin County Bicycle Coalition, Walk Bike Marin, Federal Nonmotorized Transportation Pilot Program (NTPP)
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-HW-13: Consider opportunities to protect space for biking and walking (Class IV Bikeways) when making street infrastructure or roadway painting/striping improvements as outlined in the Corte Madera Bike/Ped Plan.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Public Works, Corte Madera Planning Department, Transportation Authority of Marin (TAM), CalTrans
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-HW-14: Integrate air quality and smoke tools (e.g., Bay Area Air Quality Management District and EPA Smoke Ready Program) into operations planning.

- **Type of Action:** Program
- **Example Partners:** Environmental Protection Agency (EPA)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-HW-15: Establish a Town-wide Heat Alert Program (HAP) when weather forecasts predict heat waves or extreme heat days. In addition, consider conducting a town-wide exercise to determine gaps in the Town's response to extreme heat events.

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, Bay Area Air Quality Management District, EPA, Corte Madera Planning Department, Neighborhood Response Groups (NRG's)
- **Planning Cost Range:** Low (< $25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-HW-16: Develop a tree and shade master plan with a particular focus on climate resilient tree species. Consider impacts of new tree species on allergies or asthma.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Parks and Recreation Department, California Native Plant Society, Marin Master Gardeners
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

Note: This is a working list of adaptation actions. It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented.

T-HW-17: Develop a town-focused disease vector control plan in which both existing and emerging vectors (due to climate change) are discussed.

- **Type of Action:** Project
- **Example Partners:** Mosquito and Vector Control Association of California
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-HW-18: Consider developing a tax-exempt Corte Madera Climate Resilience Fund designed to support the health and well-being of those impacted by climate change in the Town with a particular focus on frontline community members. Consider unique financing mechanisms to support this fund.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-HW-19: Ensure post-fire mental health and trauma assessment and treatment measures for all first responders and workers.

- **Type of Action:** Project
- **Example Partners:** Central Marin Fire Department, Marin Health and Human Services, Marin County Behavioral Health and Recovery Services, Healthy Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-HW-20: Promote the California Low-Income Home Energy Assistance Program (LIHEAP) and Low-Income Weatherization Program (LIWP) to ensure all residents, especially low-income residents, have access to and understand what resources are available.

- **Type of Action:** Program
- **Example Partners:** California Department of Community Services and Development, Community Action Marin, California Human Development
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-HW-21: Develop a drought-resistant and wildfire-resistant landscaping certification program for homeowners in Corte Madera.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Parks and Recreation Department, ReScape California, VScape California, CAL FIRE, Fire Safe Marin, National Fire Prevention Association, disastersafety.org
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-HW-22: Establish relationships with representatives from the CDC about the Community Assessment for Public Health Emergency Response (CASPER) program in preparation for extreme weather events or natural disasters.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, Centers for Disease Control and Prevention (CDC)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-HW-23: Collaborate with local and regional partners to support business resilience through emergency preparedness education, training, and resources.

- **Type of Action:** Program
- **Implementation Lead:** Corte Madera Planning Department
- **Example Partners:** Corte Madera Chamber of Commerce, Local Businesses, Marin County Chambers of Commerce
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-HW-24: Work with local, county, regional, and state partners to develop a vector-borne and zoonotic diseases (VBZD) surveillance system to improve prediction of epidemics and prevent incidents leading to epidemics. Evaluate and scale programs as needed.

- **Type of Action:** Program
- **Example Partners:** VectorServ, ArboNET, MosquitoNET, National Notifiable Disease Surveillance System (NNDSS), National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), California Department of Public Health, Marin/ Sonoma Mosquito and Vector Control District, Marin County Office of Emergency Services, Marin County Community Development Agency (CDA), Federal Emergency Management Agency (FEMA)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

EMERGENCY PREPAREDNESS

T-EP-1: Support updates (if necessary) to ensure that the Town and County emergency response plans reflect equitable approaches to emergency preparedness and fully address the needs of ALL residents (e.g., hearing/seeing impaired, aging, etc.). Ensuring that emergency response plans for the Town and County reflect best practices and consider all community members is critical for making sure nobody is left behind. This includes proactively empowering frontline community members to access and understand neighborhood evacuation route maps (e.g., consider access to the internet and modern approaches to sharing information for QR codes being developed with CalFire Collector App).

- **Type of Action:** Program
- **Implementation Lead:** Central Marin Fire Department
- **Example Partners:** Marin County Sheriff's Office, Central Marin Police Authority, Marin County, Neighboring Municipal Partners, Marin Health and Human Services, Marin County Disability Access Program, Marin Center for Independent Living,

Lifehouse, Deaf and Disabled Telecommunications Program, California Public Utilities Commission

- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-2: Require that climate projections and the impacts associated with them are included in all Town planning documents, policies, programs, and ordinances as they are reviewed or updated. Ensuring that all Town plans are consistent, reflect the best available data and knowledge for regional climate projections, and support the Town's efforts to reduce climate change and extreme weather impacts is essential. It is also critical that updated climate projections are used to inform capital improvement projects (e.g., new or upgraded roads) which should meet design standards that incorporate flood risk, landslides, and sea level rise projections.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Planning Department, Corte Madera Public Works Department, Corte Madera Parks and Recreation Department, SFEI, Central Marin Fire Department, Ready Marin
- **Planning Cost Range:** Medium ($25k-100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-3: Educate all community members about evacuation protocols, maps, and procedures for emergency preparedness and evacuation. The Town needs to more proactively identify and address gaps in their communication and messaging when it comes to evacuation. This includes consistent messaging around Alert Marin and the nationally recognized *Ready, Set, Go program*, participating in and integrating the regional collaboration and current evacuation mapping work into Town materials and presentations, coordinating with County evacuation notification partners (Central Marin Fire and Sheriff's Office) and working with FIRESafe Marin to make sure that residents have access to and are engaging in their wildfire preparedness and evacuation programs. This includes putting people on the ground in neighborhoods to engage with residents directly. In 2018, the Central Marin Fire Authority conducted a public evacuation drill in which only 18% of residents participated. A recent report also indicated that residents in Marin County were presented with inconsistent information specific to wildfire preparedness and this message "failed to reach most citizens, especially parents of young children", prompting a call by the Marin County Civil Grand Jury to better educate, inform, and engage the public about emergency preparedness in the case of a catastrophic wildfire.

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, FIRESafe Marin, FireWise USA Program, Ready Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-4: Assess housing and zoning laws to identify how they may impact frontline community members negatively before, during, or after a disaster. Historic and current laws or practices may impact the resilience of frontline community members to climate change. Assessing current housing and zoning laws for potential discriminatory practices will ensure that

future development and redevelopment policies will support ALL community members before, during, and after a disaster. This includes particular attention to renters and residents of multi-family housing units.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Planning Department, NAACP, Marin Community Foundation, Community Action Marin, Marin County, Neighboring Municipal Partners
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-5: Coordinate regularly with surrounding municipalities and Marin County to enhance evacuation and emergency management protocols, agreements, and processes. Good pre-disaster planning requires continuous engagement and coordination with regional partners. This includes defining roles, creating formal agreements, reviewing and improving communication mechanisms, refining protocols, and institutionalizing future projections for risk in regional planning efforts.

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, Marin County Sheriff's Office, Central Marin Police Authority, Corte Madera Public Works, Cal EMA, FIRESafe Marin, CalFire
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-6: Identity opportunities to expand access to emergency and evacuation notices via multiple sources, including voice, text, siren, radio, and outdoor broadcasts. In the 2018 Camp Fire in Paradise, California, all communications went down for residents due to telecommunications infrastructure being destroyed in the fire. This disaster highlighted many flaws in an antiquated notification system that many communities (including Corte Madera) rely on. Recently, the California Public Utilities Commission ordered wireless communication service providers to develop resilience plans and investments in their networks (including generators that run 72 hours following an emergency) in order to make sure users have access to communications and notifications during an emergency. The Town should also identify opportunities to increase engagement and subscription of Town residents to key evacuation notification systems (e.g., *Alert Marin*). This includes considering a mandatory alert notification system or creating an opt-out system.

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, Marin County Sheriff's Office, Central Marin Police Authority, Corte Madera Public Works, Cal EMA, FIRESafe Marin, CalFire, Ready Marin
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-7: Integrate protocols, systems, and planning best practices for managing the impacts of evacuation, emergency response, and health care during a global pandemic from federal emergency response agencies (e.g., Red Cross and FEMA). There is no denying that the COVID-19 pandemic has changed the way communities, schools, and organizations operate. It is unlikely to be the last such sweeping health crisis that changes how we deal with emergency

response during a pandemic. Currently, new protocols are being written and tested by groups like FEMA and the Red Cross to address this issue, such as how best to protect evacuees and use hotels instead of communal shelters to house. These protocols incorporate the 5 C's - Communication, coordination, cooperation, collaboration, and connection, and ensure that we break down agency and jurisdictional silos and integrate public health planning into emergency operations. Corte Madera can learn from these experiences and should incorporate key findings and recommendations into its emergency plans and protocols.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Planning Department, Central Marin Fire Department, Red Cross, FEMA
- **Planning Cost Range:** Low (< $25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-8: Ensure that emergency staging locations and temporary evacuation refuge areas are not situated in areas subject to temporary or permanent flooding or in high-risk wildfire zones. Reviewing evacuation protocols and plans to ensure that temporary refuge or staging locations will not be located areas vulnerable to flooding or wildfire based on current climate change projections will support informed decision-making at the local and regional levels. Updates will be necessary as better data will become available. In addition, consider enhanced planning and/or building permit requirements for backup generators or other emergency equipment for critical services such as food stores, pharmacy, and fueling stations, among others.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Planning Department, Governor's Office of Emergency Services (Cal OES), FEMA
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-9: Work with regional partners to identify gaps in current wages and working conditions for all first responders and workers who are participating in fire protection. Due to the high cost of living, retaining emergency responders that live in Corte Madera can be a challenge. Consider identifying opportunities to create affordable housing options for first responders and their families in Town. Ensuring emergency responders are able to live and thrive in the Town will ensure the long-term safety of the community.

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, Marin County
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-10: Identify opportunities to enhance the capacity of Town and school facilities to become Resilience Hubs, evacuation centers, cooling centers, and charging stations, during extreme heat or weather events. The Town has already applied for grants to help make the new Town Hall expansion a Resilience Hub for the community. The building will be earthquake resistant, provide shelter for people during extreme weather events, provide resources and information for residents on emergency management and preparedness, power for public uses during power outages, and provide other public services.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Planning Department, Corte Madera Public Works, Community Services Block Grant Agencies, California Environmental Protection Agency (CalEPA)
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EP-11: Ensure that all regional and Town transportation plans reflect updated evacuation routes, strategies, and data.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Planning Department, Corte Madera Public Works, Central Marin Fire Department, Marin County Sheriff's Office, Central Marin Police Authority
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-12: Coordinate regularly with regional, state, and federal emergency response agencies (e.g., Red Cross) to identify protocols, systems, and plans for managing the impacts of an evacuation during a global pandemic.

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, Red Cross, Marin County Sheriff's Office, Central Marin Police Authority, Corte Madera Public Works, Cal EMA, FIRESafe Marin, CalFire
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-13: Coordinate with regional health care facilities to ensure effective care to all town residents and regional travelers during an emergency.

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, Marin County Sheriff's Office, Central Marin Police Authority, Corte Madera Public Works, Cal EMA, FIRESafe Marin, CalFire
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-14: Develop and implement a coordinated Town-wide communications strategy focused on emergency preparedness, risk, and response. Consider using the messaging that "Evacuation is a right."

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, Central Marin Fire Department, Marin County Sheriff's Office, Central Marin Police Authority, Corte Madera Public Works, Cal EMA, FIRESafe Marin, CalFire
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-15: Ensure that emergency staging locations and temporary evacuation refuge areas are not situated in areas subject to temporary or permanent flooding or in high-risk wildfire zones. Reviewing evacuation protocols and plans to ensure that temporary refuge or staging locations will not be located areas vulnerable to flooding or wildfire based on current climate change projections will support informed decision-making at the local and regional levels. Updates will be necessary as better data will become available.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Planning Department, Governor's Office of Emergency Services (Cal OES), FEMA
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-16: Identify and designate critical roads that must remain open during emergencies and develop procedures to ensure those roads can remain open.

- **Type of Action:** Project
- **Example Partners:** Central Marin Fire Department, Corte Madera Planning Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-17: Identify and apply for emergency funding streams (e.g., Red Cross) that can be applied to reduce the costs of managing evacuations during natural disasters and public health crises (e.g., non-congregate housing in hotels, motels with delivered meals).

- **Type of Action:** Project
- **Example Partners:** Central Marin Planning Department, Governor's Office of Emergency Services (Cal OES)
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-18: Identify gaps in current communication pathways with frontline community members during planned (e.g., PSPS events) or unplanned power outages (with particular attention to those with developmental or physical disabilities).

- **Type of Action:** Project
- **Example Partners:** California Public Utilities Commission, Central Marin Fire Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-19: Identify frontline community members most at risk from extreme weather events using the best available tools (e.g., California Heat Assessment Tool) and science.

- **Type of Action:** Project
- **Example Partners:** California Natural Resources Agency, National Centers for Environmental Information, Environmental Defense Fund, Neighborhood Response Groups (NRG's)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-20: Identify opportunities to support residents in constructing or retrofitting Clean Air Rooms in their homes to combat excess wildfire smoke, especially for residents with limited mobility or during a pandemic.

- **Type of Action:** Project
- **Example Partners:** Central Marin Fire Department, Marin Health and Human Services
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-21: Consider requiring Town staff to participate in an equity-focused emergency management training or seminar.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, Marin Community Foundation, Community Action Marin, Marin County (i.e., Marin County Office of Equity), Neighboring Municipal Partners, Marin Promise Partnership
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-22: Consult with disability specialists to ensure that plans and protocols provide adequate access and function for people with disabilities.

- **Type of Action:** Project
- **Example Partners:** Marin Health and Human Services, Marin County Disability Access Program, Marin Center for Independent Living, Lifehouse, Deaf and Disabled Telecommunications Program, California Public Utilities Commission
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-23: Ensure frontline community members are able to access neighborhood evacuation route maps (e.g., consider access to the internet and modern approaches to sharing information for QR codes being developed with CalFire Collector App).

- **Type of Action:** Project
- **Example Partners:** Central Marin Fire Department, Marin County Sheriff's Office, Central Marin Police Authority, CalFire, Marin County, California Public Utilities Commission, Neighboring Municipal Partners
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-24: Incorporate local and regional knowledge of evacuation choke points into Town plans, policies, maps, and programs.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Public Works, Corte Madera Planning Department, CalTrans, Marin County, Neighborhood Response Groups (NRG's)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

Note: This is a working list of adaptation actions. It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented.

T-EP-25: Complete detailed Town evacuation planning maps and distribute to the Neighborhood Response Groups that include localized community refuge areas (that are not in locations vulnerable to climate hazards).

- **Type of Action:** Project
- **Example Partners:** Central Marin Fire Department, Corte Madera Planning Department, Neighborhood Response Groups (NRG's), FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA)
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-26: Assess the hi-lo siren system protocol and chain of command to ensure that it is reliable, has redundancies, and is effective.

- **Type of Action:** Project
- **Example Partners:** Central Marin Fire Department, Marin Sheriff's Department, Marin County, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA)
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-27: Update evacuation and emergency plans and be sure to consider ways in which non-related climate stressors would impact evacuation planning (e.g., pandemics, earthquakes, terrorist attacks, etc.).

- **Type of Action:** Project
- **Example Partners:** Marin Sheriff's Department, Marin County, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA), FEMA
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-28: Identify incentives to improve the sign-up response for key evacuation notification systems (e.g., Alert Marin). *Alert Marin*, the County's primary emergency notification system is voluntary, resulting in low subscription to, and engagement from Town residents. In order to ensure that residents have access to the best available information, the Town should find innovative ways to ensure maximum participation. This could also include supporting the County in creating an opt-out alert notification system (automatically signing up residents to the notification system based on contact information from other critical resident databases), finding unique outreach campaigns to increase engagement and subscriptions, or finding mechanisms to inform more residents about the importance of this system.

- **Type of Action:** Project
- **Example Partners:** Marin Sheriff's Department, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA), Corte Madera Planning Department, Neighborhood Response Groups (NRG's)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-29: Monitor regional, state, and federal programs and policies that might guide entities within city boundaries in undertaking climate adaptation projects (e.g., revisions of the Coastal Construction Manual by FEMA).

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, Corte Madera Public Works, Marin County, FEMA, FIRESafe Marin
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-30: Actively pursue financing and funding opportunities to fund short- and long-term adaptation implementation projects (e.g., ensure the Town has the appropriate planning documents to leverage FEMA mitigation funding).

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, FEMA, Wildlife Conservation Society
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-31: Consider incentives and/or programs for important service facilities to assess power needs, ensure adequate back-up generation capacity (that consider climate projections during extreme heat days), and install off-grid distributed alternative energy systems with islanding capabilities.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, Medical Center of Marin, Marin Health Medical Center, Marin Urgent Care Medical Center
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-32: Continue to monitor staffing levels and ensure they are commensurate with the current and projected emergency response environment (with special consideration for wildfire, flooding, landslides, etc.).

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, Marin County
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-33: Ensure that any new development that is approved by the Town, including new construction on vacant land, the Town, County, and State is able to provide adequate emergency response to that location.

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, Corte Madera Planning Department
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-34: Identify gaps in current firefighter training, equipment, facilities, and other infrastructure necessary to successfully and safely meet the increasingly (climate change exacerbating fire risk) complicated and challenging emergency response environment.

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA)
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-35: Implement new technologies that improve firefighter safety, situational awareness, and emergency response effectiveness (e.g., drones to assess fire risk).

- **Type of Action:** Project
- **Example Partners:** Central Marin Fire Department, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-36: Identify current gaps in education on evacuation routes and protocol for ALL community members (e.g., frontline community members without vehicle access) and create an annual evacuation drill plan.

- **Type of Action:** Project
- **Example Partners:** Central Marin Fire Department, Corte Madera Planning Department, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-37: Expand outreach in preparation for Public Safety Power Shutoffs (PSPS).

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA)
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-38: Identify and collaboratively address gaps in health-related emergency management and evacuation coordination efforts.

- **Type of Action:** Program
- **Example Partners:** Marin Health and Human Services, Marin County Hospital, Health Centers, Senior Living Facilities, Community Service Centers, CalBRACE, and California Department of Public Health
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-EP-39: Support regional (or county-wide) vulnerability assessment for the healthcare system (including dialysis clinics and pharmacies) and its ability to handle climate hazards (including non-climate hazards that may exacerbate risk). Consider formalized agreements (MOU's) with hospitals and clinics to address emergency protocols, preparedness, and bed

availability. Also consider agreements with large suppliers of critical emergency supplies and general necessities to ensure a steady supply and adequate stockpile. Consider mutual aid agreements with surrounding municipalities and the County (and designate lead agencies for) bulk ordering of critical emergency supplies. Consider ways in which global pandemics, earthquakes, or other non-related climate stressors impact these supply chains.

- **Type of Action:** Program
- **Example Partners:** Central Marin Fire Department, Marin Health and Human Services, Marin County Hospital, Health Centers, Senior Living Facilities, Community Service Centers, CalBRACE, and California Department of Public Health
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-40: Develop formalized agreements (MOU's) with transportation partners to support effective emergency evacuation protocol.

- **Type of Action:** Policy
- **Example Partners:** CalTrans, Transportation Authority of Marin (TAM), Marin Transit, Golden Gate Bridge District,
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-41: Coordinate with important community assets (schools, businesses, etc.) to ensure staff, personnel, and community members understand the ramifications of, and are planning for, extreme weather events and emergencies.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, Marin County Schools Emergency Services, Governor's Office of Emergency Services (Cal OES), FEMA's Youth Preparedness Programs, Red Cross, California Department of Education
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EP-42: Develop formalized agreements (MOU's) with hotels, AirBnBs and other vacation rental services, and other commercial spaces to designate them as Red Cross facilities in the case of an emergency. Consider incentives (e.g., tax incentives) for hotels and other commercial entities to become Red Cross facilities in the case of an emergency in Corte Madera or the surrounding region.

- **Type of Action:** Policy
- **Example Partners:** Airbnb, Vrbo, Marin Chambers of Commerce
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

Note: This is a working list of adaptation actions. It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented.

RESILIENT INFRASTRUCTURE

T-RI-1: Advocate for and work with regional utilities to enhance the preparedness, protection, and resilience of water, energy, and telecommunications infrastructure. The infrastructure we rely on is far more than just our roads, ferries, trains, and planes. We rely on telecommunications, water, and energy systems, all of which have their own unique challenges and characteristics when it comes to climate resilience. Each partner operates differently, and each partner plays a key role in supporting the Town. For example, Corte Madera obtains its drinking water from the Marin Municipal Water District (MMWD) which services ~190,000 customers within 147 square miles along the eastern corridor of Marin County from seven local reservoirs. If a fire were to happen in the hills North and West of the Town, silting, erosion, and landslides would inevitably impact the water quality throughout the watershed. In addition, there are areas of the Town in which there is minimal water supply (Casa Buena Drive) or no water mains at all constructed (Meadow Valley).

- **Type of Action:** Program
- **Example Partners:** Corte Madera Public Works, Pacific Gas and Electric (PG&E), Marin Municipal Water District (MMWD), Telecommunications Network Carriers (Verizon, T-Mobile, AT&T, etc.), Internet Providers, Marin County, Corte Madera Planning Department, Marin Clean Energy, Community Development Agency, Marin Builders Association, Marin Energy Watch Partnership
- **Planning Cost Range:** Very High ($1 million-$5 million)
- **Timeframe for Implementation:** Medium (5-20 years)

T-RI-2: Invest in and expand bike infrastructure and e-bike policies and programs. Corte Madera has a strong culture of outdoor recreation, including bicycling. While the hillside neighborhoods don't seem the most hospitable to bicycling, the rapid and accelerating adoption of e-bikes (bicycles with an electric assist motor) offers mobility choices that could prove crucial in emergencies while providing additional benefits. Corte Madera should consider policies to support the use of e-bikes such as designating charging stations to subsidize adoption.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, Corte Madera Public Works, Transportation Authority of Marin (TAM), CalTrans, Town of Corte Madera's Bicycle Pedestrian Advisory Committee (BP AC), Marin County Bicycle Coalition, Walk Bike Marin
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-RI-3: Explore a regional approach to meeting housing development goals that locates new housing areas within the County that are less vulnerable to climate hazards. One way to reduce climate risk is to limit exposure by building in areas that are less prone to damage from extreme weather events.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-RI-4: Ensure that transit agencies are involved in the Town's evacuation preparedness planning, comprehensive safety protocols, and emergency command structure. Regional transit representatives are key partners in the chain of command responsible for planning and implementing emergency evacuation. According to the Marin County Civil Grand Jury Report on Wildfire Preparedness, Marin Transit is the only transit provider represented in the Marin Emergency Operations Center (EOC). In addition, key regional partners are not included in these discussions (including Golden Gate Transit emergency managers, SMART representatives, Whistlestop, Marin Airporter and ferry operators). Proper communication and close collaboration would enable the County and Town to evacuate residents as quickly and as safely as possible.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Planning Department, Corte Madera Public Works, Transportation Authority Marin (TAM), Marin Transit
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-RI-5: Support a county-wide study (or support the potential upcoming CalTrans and FIRESafe Marin grant) to assess whether the core transportation network and critical infrastructure are protected, being used appropriately for evacuation, and have the appropriate capacity to support evacuations. Understanding and addressing local choke points that hinder effective evacuations are critical, but supporting regional-focused planning efforts will ensure that the core transportation network and critical infrastructure are protected and support effective evacuations for residents of Corte Madera. For more information on the limited roadway network, see the Our Transportation Story section on page 56.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Public Works, Transportation Authority of Marin (TAM), Marin Transit, Neighboring Municipal Partners
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-RI-6: Enhance the capacity and resilience of the transportation network with multimodal and local access improvements. Rather than solely accommodating vehicles, the Town should cultivate strategies that increase community members' ability to regularly utilize pedestrian pathways, bikeways, and transit, including improving and expanding multimodal infrastructure. Potential local infrastructure enhancements that support evacuations can be referenced on page 109. Lastly, the Town should also work with regional agencies to incorporate statewide and regional transportation goals and land use plans to produce a cohesive multimodal adaptation approach.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Public Works, CalTrans, Transportation Authority of Marin (TAM)
- **Planning Cost Range:** Extremely High (> $5 million)
- **Timeframe for Implementation:** Near-term (<5 years)

T-RI-7: Improve transportation infrastructure to streamline traffic flow in case of an emergency evacuation. This includes updating traffic control centers, solar powered signs, and optimizing merge conditions and signals that can operate reliably during PSPS and emergency events. Preserving and improving the transportation network will require time, resources, and planning. The Marin Wildfire Protection Authority (MWPA) will publish an evacuation study that will assess Town and County evacuation connections including a focus on transportation infrastructure, roadways, and traffic control centers in 2021. As appropriate, recommendations from this effort should be integrated into all existing local and county plans, including the General Plan, the Capital Improvement Plan, and the Hazard Mitigation Plan, among others.

- **Type of Action:** Program
- **Example Partners:** Caltrans, Department of Transportation
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-RI-8: Improve transportation network capacity with multimodal and local access improvements, rather than sole accommodation of vehicles, using strategies that combine statewide and regional transportation goals and land use plans to produce a cohesive multimodal adaptation approach.

- **Type of Action:** Program
- **Example Partners:** Caltrans
- **Planning Cost Range:** Very High ($1 million-$5 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-RI-9: Require that future transportation infrastructure projects consider current and future flood risk and align the projected lifespan of the project with best available science.

- **Type of Action:** Policy
- **Example Partners:** Corte Madera Planning Department, Corte Madera Public Works
- **Planning Cost Range:** Low (< $25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-RI-10: Support the on-going work by Marin County to assess the (local and regional) transportation network to anticipate travel interruptions delays due to temporary and chronic flooding using hydrologic models and sea level rise projections, and consider alternative routes given available capacity on roadways, rail, and ferries.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Public Works, Marin County, Transportation Authority of Marin (TAM), Marin Transit, Neighboring Municipal Partners
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-RI-11: Design comprehensive safety protocols for public transit evacuation and leverage adaptability and flexibility of right-sized vehicles. Consider additional challenges to evacuation from non-climate related stressors (e.g., pandemics).

- **Type of Action:** Program
- **Example Partners:** Transportation Authority of Marin (TAM), Marin Transit, Neighboring Municipal Partners

- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-RI-12: Require that publicly funded projects maximize energy efficiency, water conservation, and limit taxpayer investments in vulnerable areas of the Town (e.g., vulnerable coastal neighborhoods or hillside communities).

- **Type of Action:** Policy
- **Example Partners:** Corte Madera Public Works Department, Corte Madera Planning Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-RI-13: Develop formalized agreements (e.g., MOU's) with HOA's and other entities to prepare for maintenance of roadways after an emergency event (e.g., wildfires in the WUI or flooding in Town), specifically those that cut across municipal districts.

- **Type of Action:** Policy
- **Example Partners:** Corte Madera Public Works, Neighboring Municipalities, Marin County
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-RI-14: Develop formalized agreements (e.g., MOU's) with water treatment providers (e.g., Marin Municipal Water District) to determine Corte Madera's post-fire response and plan. Base decisions off of higher water treatment cost scenarios for pre- and post-wildfire.

- **Type of Action:** Policy
- **Example Partners:** Corte Madera Public Works, Neighboring Municipalities, Marin County
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-RI-15: Promote climate-resilient native species seed bank and seedling production locally to provide appropriate species for reforestation and restoration post-wildfire.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Parks and Recreation Department, UC Davis, California Native Plant Society
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

EDUCATION AND COLLABORATION

T-EC-1: Develop a climate awareness communications program and campaign that helps community members understand potential risks, solutions, and opportunities to address climate impacts. Community awareness is a foundation for community action. Although the climate crisis is an immediate and urgent issue, it is complex and requires a dedicated effort to build broad awareness and support for adaptation efforts.

- **Type of Action:** Program
- **Example Partners:** Marin Climate & Energy Partnership

- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EC-2: Identify additional staff and/or resources to focus on education and the implementation and monitoring of the Climate Adaptation Assessment. Corte Madera is a small town with a limited number of staff members who often have a wide range of duties. The Town could benefit from having an adaptation and resilience coordinator to help coordinate across departments, guide the implementation, monitoring, and tracking of the resilience actions identified in this assessment, and support education efforts happening across the community. In accordance with recommendations by the Marin County Civil Grand Jury, this coordinator could work directly with other regional agencies in order to better coordinate efforts.

- **Type of Action:** Policy
- **Example Partners:** Corte Madera Planning Department, Corte Madera Department of Public Works
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

T-EC-3: Publish a guide or online portal of actions that commercial and residential property owners can take to make their homes and buildings more resilient to climate change. Supporting commercial and residential property owners to make their homes and businesses more resilient by providing resources, tools, and knowledge is an effective and efficient way to enhance resilience across the Town.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, Marin County, FEMA's Youth Preparedness Programs
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-4: Build the capacity of community groups to increase their engagement in climate change adaptation related activities. Community support for the Town's climate change adaptation and resilience efforts are crucial to their success. Town staff and community organizations play an important role in capacity building and community engagement. Engagement activities include supporting young people in climate adaptation through school education initiatives and involving community groups in the monitoring of trigger/threshold level indicators to determine when adaptation actions should be implemented.

- **Type of Action:** Program
- **Example Partners:** Community groups
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-5: Accelerate Corte Madera's greenhouse gas emission reduction efforts as outlined in the Climate Action Plan.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Climate Action Committee, Corte Madera Public Works Department, Corte Madera Parks and Recreation Department, Corte Madera Planning Commission, Marin Climate & Energy Partnership, Marin Municipal Water District (MMWD), Transportation Authority Marin (TAM), Metropolitan Transportation

Commission, Bay Area Air Quality Management District, Central Marin Sanitation Agency (CMSA), Marin Sanitary Service, Marin Hazardous and Solid Waste Joint Powers Authority, Schools, Community Centers, PG&E Solar Choice, MCE Deep Green, MCE Local Sol
- **Planning Cost Range:** Extremely High (>$5 million)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-6: Engage youth in the Town's climate adaptation work through school education initiatives.
- **Type of Action:** Program
- **Example Partners:** Schools, Youth Groups, FEMA's Youth Preparedness Programs
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-7: Involve community groups and schools in monitoring trigger/threshold level indicators to determine when adaptation actions should be implemented.
- **Type of Action:** Program
- **Example Partners:** Corte Madera Climate Action Committee, Corte Madera Public Works, Corte Madera Parks and Recreation Department, Corte Madera Planning Department, Corte Madera Planning Commission
- **Planning Cost Range:** Medium ($25-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-8: Implement a public outreach program to increase the public awareness of coastal flooding, stormwater management, and drought management issues and techniques for residents to mitigate those challenges on their property.
- **Type of Action:** Program
- **Implementation Lead:** Corte Madera Public Works Department
- **Example Partners:** Bay Area Stormwater Management Agencies Association (BASMAA)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-9: Consider incorporating climate change adaptation and resilience planning into the next iteration of the Town's General Plan.
- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, Corte Madera Public Works
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-EC-10: Update climate adaptation assessment to include monitoring and evaluation metrics that evaluate the efficacy of the climate change resilience actions.
- **Type of Action:** Project
- **Example Partners:** Corte Madera Public Works, Corte Madera Planning Department, SFEI, Bay Area Climate Adaptation Network (BayCAN)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-11: Modify the standard Town Council Agenda process and/or report template to require inclusion of a statement about how the proposed project or program supports or addresses the Adaptation Assessment goals.

- **Type of Action:** Project
- **Example Partners:** Town Council
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-12: Develop outreach campaigns and materials to encourage residents to plant climate resilient tree species.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Parks and Recreation Department, California Native Plant Society, ReScape California
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

T-EC-13: Educate frontline community members and their caregivers (e.g., aging, elderly, ill) to detect signs and symptoms of, and to prevent heat-related illness. Emphasize the importance of immediate medical assistance for heat-related illness.

- **Type of Action:** Program
- **Example Partners:** Marin Health and Human Services
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-14: Facilitate or support interagency cooperation on ecological conservation efforts with a focus on the impacts of climate change on sensitive ecosystems.

- **Type of Action:** Program
- **Example Partners:** University of California, SFEI, Marin County, Climate Readiness Collaborative
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-15: Encourage and facilitate regional and state oversight, support, and coordination for Corte Madera climate change adaptation initiatives.

- **Type of Action:** Program
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-16: Formalize partnerships with regional partners (e.g., the University of California and their Climate Stewards Program) to support climate literacy in the Town and County.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, University of California
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-17: Coordinate with regional partners to study the impact of climate change on ecosystem resilience, invasive species, ecosystem functions and values in areas impacted by disease, fire suppression, and other ecosystem stressors.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Parks and Recreation Department, Marin Municipal Water District (MMWD), University of California, Sierra Nevada Watershed Improvement Program
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

T-EC-18: Coordinate with regional partners to identify opportunities to restore ecosystem resilience, functions and values in areas impacted by disease, invasive species, fire suppression, climate change, and other ecosystem stressors.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Parks and Recreation Department, Marin Municipal Water District (MMWD), University of California, Sierra Nevada Watershed Improvement Program
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

shoreline

ACCOMMODATION

S-A-1: Partner with the community to enhance understanding of sea level rise science, projections, and associated vulnerabilities. Work towards a community-wide consensus on which sea level rise projections should be adopted for future Town efforts. This action could include: community discussions and workshops to explore sea level rise data and probabilistic projections; enhanced collaboration with regional and state entities working on sea level rise; identification of appropriate risk aversion levels based on facility type; and identification of thresholds for action.

- **Type of Action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-A-2: Conduct a comprehensive, finished floor elevation inventory of buildings within current and future flood risk areas. This inventory can help the Town make the most informed decisions on where and when to invest resources most effectively by not relying solely on the bare-earth elevation data to determine at-risk structures or areas for future investments.

- **Type of Action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** High ($100k-$1million)

- **Timeframe for Implementation:** Near-term (<5 years)

S-A-3: Encourage more resilient and adaptive building types for all new commercial and residential developments. Explore modifying existing regulations and development standards to encourage more resilient structures (such as modification to height, lot coverage, and floor area requirements, or design review processes), and providing design criteria for modifications to landscaping, parking and transitions in height that would ensure consistent aesthetic approaches to community adaptation. This action would include the need to continue to review and revise regulations and design standards to ensure they match with state and federal requirements and guidelines and account for and minimize the impacts of coastal flooding.

- **Type of Action:** Policy
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-A-4: Encourage or require additional freeboard above base flood elevation for new construction or significant remodels of critical facilities. Encouraging or requiring additional freeboard for new structures in flood hazard areas (e.g., 3 feet above base flood elevation) can help reduce vulnerability to flooding for critical facilities in these areas. Other non-critical buildings could also be encouraged to elevate their structures.

- **Type of Action:** Policy
- **Example Partners:** Corte Madera Planning Department, Corte Madera Public Works
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-A-5: Provide regulatory assistance to property owners by streamlining zoning regulations and the development permitting process to enhance the resilience of homes and property. Reducing the amount of time, effort, and cost needed to fill out, review, and approve permits related to hazard preparedness can greatly improve compliance, and ultimately the resilience, of homes and properties in the flood hazard zone. The Town could explore modifying regulatory processes for design review, approval of variances, and other requirements when proposed projects increase the resilience of the property.

- **Type of Action:** Policy
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-A-6: Model the impacts of new transportation projects on hydrological processes, as new hydrologic dynamics from increased storm surge and spring runoff may require the need to redesign bridges and road drainage systems.

- **Type of Action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-A-7: Identify thresholds for maximum flood depth or frequency of flooding at which roads will need to be elevated, relocated, temporarily closed, or abandoned. This action could include a community survey to understand the point(s) (water depth and frequency/duration of flooding) at which flooding is perceived to be chronic and causing inconvenience. Identifying these thresholds, and monitoring the occurrence of these incidents, can help the Town prioritize future transportation projects and determine the necessary next steps in adapting to flood hazards.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Public Works, Neighborhood Response Groups, Homeowner Associations
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-A-8: Require the consideration of base flood elevation (BFE), any additional building code standards, and flood-risk zones when planning future transportation routes or existing transportation upgrades.

- **Type of Action:** Policy
- **Example Partners:** Corte Madera Public Works, Transportation Authority of Marin (TAM)
- **Planning Cost Range:** Low (<$25)
- **Timeframe for Implementation:** Near-term (<5 years)

S-A-9: Establish and adopt a Corte Madera Coastal Resilience Overlay (CRO) Zone. Develop enhanced incentives or regulations for this zone and review those requirements every 5 years to determine if updates or amendments are necessary based on best available science and effectiveness at achieving desired goals.

- **Type of Action:** Policy
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-A-10: Develop a "Homeowners Guide to Coastal Flood Preparedness" to help property owners navigate the regulatory system and funding opportunities to elevate or otherwise retrofit homes to meet regulatory standards.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Planning Department, The Nature Conservancy (TNC), National Association of Counties, Climate Readiness Collaborative, Shore Up Marin, CA Natural Resources Agency, BCDC
- **Planning Cost Range:** Low (<$25)
- **Timeframe for Implementation:** Near-term (<5 years)

S-A-11: Encourage or require homeowners to consult with approved permitting agencies/organizations before undergoing any development or redevelopment to discuss property-specific adaptation strategies.

- **Type of Action:** Program
- **Example Partners:** TBD

- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-A-12: Develop a program to provide property protection assistance to qualified homeowners and improve compliance with flood protection requirements on their property.

- **Type of Action:** Project
- **Example Partners:** Corte Madera Public Works, Corte Madera Planning Department
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-A-13: Extend NFIP V-Zone (areas subject to additional damage from wave action in the 100-year floodplain) requirement standards to the A-Zone (100-year floodplain). These zones are currently defined by FEMA and have slightly different requirements for building types and materials. Extending more stringent requirements would not affect FEMA compliance in these zones.

- **Type of Action:** Policy
- **Example Partners:** TBD
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-A-14: Explore opportunity to participate in FEMA's Cooperating Technical Partners Program to keep the Town's Flood Insurance Rate Maps (FIRM) up-to-date and to reflect current conditions, future conditions, and total water level projections.

- **Type of Action:** Program
- **Example Partners:** FEMA, flood insurance companies
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-A-15: Develop a Town resource webpage that explains and promotes the benefits of raising homes and provides financial and design options and strategies.

- **Type of Action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-A-16: Implement a public outreach program to increase public awareness and education on flooding and stormwater information for property owners, potential buyers, and residents living in the flood plain and coastal inundation areas.

- **Type of Action:** Program
- **Example Partners:** Bay Area Stormwater Management Agencies Association
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-A-17: Actively participate in any future planning discussions around the establishment of home elevation assistance programs, specifically regarding the success of the Marin County Department of Public Works pilot program. It is essential that equity for all residents in need of support for home elevation is considered and implemented in planning any possible assistance programs. Education around any future program is essential for supporting all residents in need.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, Marin County
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-A-18: Coordinate with local/state/national agencies to create a certificate (online and hard copy) that improves resale property value and insurability for homes that have complied with flood-prevention regulations (LID stormwater management requirements, flood proofing), community rating standards, and building codes.

- **Type of Action:** Program
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-A-19: Develop or update long-term public works plan for critical facilities to address current and future flood risk.

- **Type of Action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($2k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

PROTECT

S-P-1: Remain up to date on scientific studies, local and state policies and regulations, and relevant reports that increase and refine the body of knowledge regarding sea level rise affecting Corte Madera and the innovative responses that are available to address it. Our combined scientific knowledge of changing climate conditions, including rates of sea level rise, is constantly evolving. Staying abreast of those changes and the local, regional, and state level responses, guidance, and best practices can inform how Corte Madera chooses to respond and the actions it decides to take.

- **Type of Action:** Program
- **Example Partners:** TBD
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-P-2: Participate in collaborative regional efforts to establish agreement on sea level rise models, risk, and actions necessary to protect people and the natural and built environment from rising sea levels. This action could take a variety of forms but would connect with on-going regional efforts and help building consensus on rates of sea level rise and ideal elevations to plan for will help ensure consistency across the region.

- **Type of Action:** Program

- **Example Partners:** Marin County, BCDC, Towns, California Department of Fish and Wildlife
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-P-3: Support the establishment of a multi-jurisdictional planning board for marsh conservation and coastal adaptation planning efforts. The marshlands are not within the Town's jurisdiction and will require extensive collaboration and planning to determine feasible and effective solutions for combating sea level rise and protecting and conserving essential marshlands and habitat.

- **Type of Action:** Program
- **Example Partners:** Marin Audubon Society, CA Fish and Wildlife Department, Golden Gate Bridge District
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-P-4: Engage with community members to create a shared understanding of risk and to allow for residents to participate in the co-development of solutions to these challenges. The collaborative process allows for residents to provide valuable input and perspectives to the complex challenges and risks the shoreline neighborhoods face. Co-development of solutions provides the opportunity for residents to be a part of the process of selecting, evaluating, and refining possible solutions to these challenges and participating in the future analysis of adaptation alternatives.

- **Type of Action:** Program
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-P-5: Require that future transportation infrastructure projects consider flood risk over the projected lifespan of the project. Future flood projections are essential for maintaining resilient roads and transportation infrastructure. While roads can still function with minimal flooding, understanding flood vulnerability over the lifespan over the project can help to reduce road closures, maintenance costs, and any disruption to essential travel. This action entails a policy change and does not include cost estimate of actual transportation infrastructure changes, as those would be determined on a project-by-project basis.

- **Type of Action:** Policy
- **Example Partners:** Transportation Authority of Marin (TAM)
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-P-6: Identify key ecosystem functions and species at risk from current and future coastal flooding in the area. The natural systems within and around Corte Madera are essential to the health and vitality of the town. The Town can work with local and regional partners to identify critical ecosystem services and species currently at risk from climate change, as well as those species and habitats that are threatened by future changes. Understanding the areas and species

that will require additional protections can help the Town plan for and prioritize the health of natural systems.

- **Type of Action:** Project
- **Example Partners:** Marin Audubon Society, CA Fish and Wildlife Department, SFEI
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-P-7: Advocate with state and federal resource agencies for new policies that make living shoreline projects more feasible by recognizing the long-term habitat and biodiversity benefits. Permitting projects in sensitive habitat areas can be difficult and get tied up in the process. Advocating for increased feasibility (but still requiring adequate environmental impact studies) for these projects can help move these projects forward and prioritize nature-based solutions over hard infrastructure where necessary and effective.

- **Type of Action:** Project
- **Example Partners:** CA Natural Resources Agency
- **Planning Cost Range:** Medium ($25-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-P-8: Work with regional partners to identify priority areas of degraded ecosystems to restore for structure and function, as it improves resilience to future climate change impacts. Consider assisted migration of species around existing barriers if relevant.

- **Type of Action:** Project
- **Example Partners:** SFEI, Bay Area Climate Adaptation Network (BayCAN)
- **Planning Cost Range:** Medium ($2k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-P-9: Establish a sea level rise monitoring program and identify leading indicators and decision points/thresholds needed to protect infrastructure.

- **Type of Action:** Program
- **Example Partners:** Corte Madera Planning Department, Corte Madera Public Works, Climate Adaptation Knowledge Exchange, NOAA Office for Coastal Management, Alliance of Regional Collaboratives for Climate Adaptation
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-P-10: Construct or enhance shoreline infrastructure to protect vulnerable built and natural shoreline segments and habitat from waves and prevent further erosion (e.g., coarse beaches, riprap, nature-based shoreline infrastructure). This action potential involves nature-based solutions that can protect the built and natural environments along the shoreline and marsh edge. Shorelines can be stabilized with coarse beach material or oyster shell low-crested berms, for example, to help dissipate wave energy at the marsh edge, reduce landward erosion of marsh habitat, and reduce impacts to homes and other critical infrastructure. Utilizing nature-based solutions can help protect infrastructure in the medium-term as well as increase the transition zone that can support landward marsh migration and create additional habitat for marsh species.

- **Type of Action:** Project

- **Example Partners:** Corte Madera Public Works, Marin Audubon Society, CA Department of Fish and Wildlife, California State Coastal Conservancy, State of California Resources Agency, National Oceanic and Atmospheric Administration (NOAA), The Nature Conservancy, Center for Ecosystem Management and Restoration, California Coastal Commission, Army Corps of Engineers, United States Geological Survey (USGS), Local Government Commission, California Sea Grant Commission
- **Planning Cost Range:** High ($100k - $1 million)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-P-11: Consider fortifying or elevating existing shoreline flood protection infrastructure (e.g., levee, flood barrier, or sheet pile wall) or construct new infrastructure to protect residents and critical resources. While earthen levees and residential seawalls currently protect much of central and coastal Corte Madera, as sea levels rise, it may be necessary to fortify and elevate existing levees to protect areas and infrastructure behind from higher water and flood damage. Any new (or enhanced) flood protection infrastructure requires further study and community discussion.

- **Type of Action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** Extremely High (> $5 million)
- **Timeframe for Implementation:** Medium-term (5-20 years)

S-P-12: Identify monitoring and evaluation metrics and criteria for existing and proposed shoreline protection infrastructure and establish a plan to assess impacts of and future need for existing shoreline protection infrastructure. Established metrics for monitoring and evaluating shoreline protection infrastructure can help the Town assure that different adaptation measures are adequately protecting infrastructure and not causing unwanted impacts to surrounding areas. Having a plan in place before infrastructure is constructed can help minimize potential negative impacts in the future and establish a process for determining if adaptation actions are successful as is or need to be reevaluated.

- **Type of Action:** Program
- **Example Partners:** BCDC
- **Planning Cost Range:** High ($100k - $1 million)
- **Timeframe for Implementation:** Near-term (<5 years)

LONG-TERM SHORELINE PLANNING

S-LT-1: Initiate an outreach and education campaign focused on community awareness and involvement in long-term shoreline planning.

- **Type of Action:** Project and Program
- **Example Partners:** BCDC
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

S-LT-2: Foster the community conversation around long-term impacts of sea level rise on property, infrastructure, and ecosystems. Beginning the conversation with residents and homeowners is essential to informing individuals on current and future risks of sea level rise as

well as explaining the different adaptation solutions and pathways that can be taken in the near-, medium-, and long-term. In many instances, longer-term solutions require actions that can be taken now, such as feasibility studies and cost-benefit analyses.

- **Type of Action:** Program
- **Example Partners:** TBD
- **Planning Cost Range:** Low (<$25k)
- **Timeframe for Implementation:** Near-term (<5 years)

the hillsides

WILDFIRE RISK MITIGATION

H-M-1: Support the Central Marin Fire Department to conduct individual home assessments for all homes located in the hillside. Corte Madera can play an important role in supporting Central Marin Fire's efforts by reducing wildfire risk and improving consistent messaging for evacuation and fuel hazard reduction efforts in the hillside neighborhoods. Individual site assessments are an important part of understanding, defining, and improving compliance across the Town. The Wildfire Hazard Mitigation Specialist, an employee of Central Marin Fire but funded through the Marin Wildfire Prevention Authority, will be responsible for overseeing the county-wide home assessments, identifying homes that are not in compliance, and encouraging local action. Defensible space evaluators are hired through the Marin County Fire's seasonal firefighter program. For more information on the MWPA, see page 96.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, Marin County Fire Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-2: Support 100% of Corte Madera hillside neighborhoods in the WUI to become Firewise Recognized Communities. The Firewise Recognition Program is an innovative national program that supports local wildfire preparedness goals by recognizing communities for working together on vegetation management, defensible space, and home hardening measures. While the program motivates residents to comply with local WUI codes and supports regional efforts to reduce wildfire risk, these efforts can be time-consuming and expensive to implement. Marin county leads California in the number of recognized Firewise sites (with more than 30) and leads the nation in growth of this important program - a testament to the hard work of local communities. Certifying 100% of hillside neighborhoods by 2022, will better prepare Corte Madera for wildfires. The Town and County will need to find ways to better support neighborhoods in this process in

order to achieve this goal. Additional details on how to achieve the Firewise Certification here. The steps to achieving your Firewise USA certification can be found here.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, Corte Madera Planning Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, CalFire
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-3: Conduct a study that considers the feasibility, costs, benefits, and finance options for undergrounding electric power lines for Corte Madera neighborhoods in the WUI to supplement increased efforts initiated through Senate Bill No. 901 and the Marin Wildfire Prevention Authority (MWPA). Recent catastrophic wildfires triggered by damaged or downed power lines have led utility companies like Pacific Gas & Electric Co. (PG&E) to use new strategies to reduce fire risk. One strategy includes implementing Public Safety Power Shutoffs (PSPS) - regional power shut offs for residents - during extreme weather events when conditions are predicted that may contribute to increased fire behavior or threaten electrical utilities. Another strategy, which can reduce power line-induced fire ignitions in some cases and enhance the resilience of utility infrastructure over the long-term, includes working with PG&E to put power lines underground (a process known as "undergrounding"). Due to the widespread and dynamic nature of wildfires, undergrounding is not a catchall solution, but a tool in the broader resilience toolbox. For example, a wildfire could ignite outside of the Town's boundaries and still directly impact Corte Madera despite the Town having spent the time, money, and resources on undergrounding all utilities within its jurisdiction. For more information on undergrounding in Corte Madera, see pages 99 - 100.

- **Type of action:** Project
- **Example Partners:** Pacific Gas & Electric (PG&E), Neighborhood Response Groups (NRG's), Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), CalFire
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-4: As supported by the outcomes of the undergrounding feasibility study, send a formal request to PG&E to underground electrical utilities for Corte Madera neighborhoods in the WUI. PG&E owns and maintains public electrical facilities in the Town of Corte Madera, therefore the Town is committed to working with PG&E to fully explore options for safeguarding electrical infrastructure in strategic hillside neighborhoods to ensure the safety and wellbeing of Corte Madera residents.

- **Type of action:** Project
- **Example Partners:** Pacific Gas & Electric (PG&E), Neighborhood Response Groups (NRG's), Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), CalFire
- **Planning Cost Range:** Low (< $ 25k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-5: Redefine the Town's wildfire risk based on changing climate conditions. The fire hazard severity zones for Corte Madera, as designated by CalFire, are not an accurate depiction of the real and changing risk of wildfires in Corte Madera. According to the most up-to-date and localized information available at the County level, wildfire hazard severity designations may be more extreme than the designations currently defined by the State. The County recently completed the process of updating its Community Wildfire Protection Plan (CWPP) (January 4, 2021) with County data and modeling that more accurately reflects the fire hazard severity designations for the Town. Consider petitioning CalFire to redesignate the fire hazard severity zones based on the best available models and science to accurately reflect the fire risk for the Town. In addition, consider a formalized operational agreement to ensure that the Town is a direct partner with CalFire for fire protection services if and where necessary.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, CalFire, FIRESafe Marin, CalFire, Marin Wildfire Prevention Authority (MWPA)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-M-6: Streamline the process for enforcing the Town's WUI building codes and regulations with particular attention to rental properties and absentee homeowners. Enforcing defensible space, vegetation management, and home hardening policies is difficult, time-consuming, and expensive. This is particularly true for the dozens of vacant and rental properties located in hillside neighborhoods. Often, these homes have overgrown vegetation and are out of compliance with the Town's WUI codes. Coordinated through the Central Marin Fire Authority, defensible space inspectors plan to inspect all single-family homes located in the hillside neighborhoods in the Town by the end of 2021. As a part of this process, the Town should find additional mechanisms to streamline the process for enforcing its WUI codes and regulations (particularly for vacant and rental properties) so that timely corrective actions are taken.

- **Type of action:** Policy
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), Corte Madera Planning Department, FIRESafe Marin, CalFire
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-7: Work with regional partners to implement an effective monitoring system to enforce WUI-specific policies, zoning laws, codes, and regulations. This includes supporting the Marin Wildfire Prevention Authority (MWPA) to utilize the CalFire ArcGIS Collector App to inventory structures that do not comply with fire safe practices and codes. In addition, the MWPA should consider developing (or pitching or identifying) a mobile data collection tool that can be integrated with the CalFire "Collector App" that allows residents to upload images of defensible space, vegetation management, or home hardening improvements from their phones. Not only would this streamline the monitoring and enforcement process for hillside homes in the WUI, it would reduce expenses for the Town, and ensure compliance from hillside residents.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, CalFire

- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-8: Work with regional partners to coordinate with real estate companies, the private sector, insurance companies, and the State to create a certificate that improves resale value and insurability for homes that have complied with WUI regulations, FireSafe practices, and codes. Currently, homeowners are cited if they are out of compliance with regards to the Town's WUI codes and regulations but there is no incentive program to encourage or recognize these investments. The Town could create a certification program for individual homeowners who comply with Corte Madera WUI codes, rules, and regulations. This work can be coordinated with home assessments already taking place through the CalFire Collector App. A certification process could help reduce wildfire risk for the entire neighborhood, increase marketability for homes in the WUI that are for sale, or increase insurability for homes. For example, in 2014, Boulder County created a public/private partnership to support property owners prepare for future wildfires by conducting individual site assessments. A customized report was provided to homeowners to identify priority risk reduction actions, financial rewards were offered to complete the necessary work, and follow-up inspections confirmed the work was completed.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, Real Estate Companies, Insurance Companies, CalFire, Corte Madera Planning Department, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-M-9: Support regional partners to scale up landscape-level wildfire mitigation work, especially in and near lands surrounding the Town boundaries. Several regional partners are in the process of scaling up their fuel hazard reduction work across the County but need support to adequately meet the challenge. For example, Marin Municipal Water District owns ~21,500 acres of wildland but only clears around 30 acres per year. Marin County Open Space District owns ~16,000 of wildland but only manages around 10% of lands for wildfire a year. Regional partners should collaborate closely with the County, FIRESafe Marin, municipalities, and the MWPA through various channels including CWPP meetings, annual work plans, and plan updates to implement landscape-scale wildfire mitigation. By considering opportunities to share resources, equipment, and crews with local and County entities, wildfire risk reduction could happen more efficiently and effectively.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), Corte Madera Planning Department, FIRESafe Marin, CalFire
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-M-10: Update the Town's WUI codes and regulations to include the "0-5' non-combustible zone" or "Zone Zero" rule. Despite having some of the most aggressive WUI codes in the nation, there are additional regulations that can reduce wildfire risk for the Town. In alignment with the state's fire codes, the "0-5' non-combustible zone" or "Zone Zero" policy is

intended to restrict all combustible materials within 5 feet of any residential or commercial structure (including storage, debris, building materials, stacked materials, vegetation). The MWPA will serve an important role updating codes and regulations, but the Town also needs to ensure that they have the staff, resources, and time to educate homeowners and ensure compliance.

- **Type of action:** Policy
- **Example Partners:** Central Marin Fire Department, Corte Madera Planning Department, FIRESafe Marin, CalFire, Marin Wildfire Prevention Authority (MWPA)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-M-11: Seek opportunities to add wildfire home retrofit upgrades into other home financing mechanisms like those focused on energy efficiency. Home retrofit upgrades that improve resilience to wildfires can be cost prohibitive. Seeking opportunities to find additional financing mechanisms using existing examples (e.g., financing mechanisms that support energy efficiency) could support residents who face barriers to conducting home hardening upgrades. Reducing the risk of ignition to individual homes in the can WUI reduce the risk of wildfire to the Town overall.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-12: Expand the goat and sheep grazing program as a fuel reduction strategy. Using goats and sheep annually to reduce the amount of vegetation in the hillsides surrounding the Town has been an effective fuel reduction strategy. Expanding this program would continue to build on the great private-public partnerships that support this work as well as decrease the risk of wildfire to the Town as a whole. This process could include completing the maps that identify priority locations to support grazing as a fuel reduction strategy, continuing outreach to local landowners that would qualify, and expanding regional partnerships to continue to grow the program.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, Marin County Parks and Open Space District, Ross Valley School District, Corte Madera Parks and Recreation Department, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA), local landowners and livestock handlers
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-13: Cultivate public-private partnerships (e.g., tax incentives) to support local and regional forest waste management businesses that help reduce fire risk. Forest products (e.g., wood and wood waste) sourced from harvested trees or forest biomass can provide a variety of important and valuable services including creating electricity or generating heat. Developing innovative mechanisms that encourage and support businesses that utilize forest products harvested in wildfire risk reduction efforts could provide a variety of benefits to the Town and region.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, Marin County Fire District, Marin Wildfire Prevention Authority (MWPA), Corte Madera Planning Department, FIRESafe Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-14: Redefine the Town's Wildfire Risk and Expand the WUI. Corte Madera residents must currently abide by Town, County, and State WUI codes, most of which are based on the International Code Council. The Town's codes, which can be referenced here, are updated every 3 years and the most recent update was adopted in 2020. According to data from CalFIRE, Corte Madera is entirely located in a Local Responsibility Area (LRA), therefore, the State has no responsibility for fire protection or mitigation work within the Town boundaries. However, in 2008 the Town of Corte Madera adopted Ordinance No. 904 expanding the VHFHSZ, pursuant to Government Code Section 51182, designating several areas within the Town as a Wildland-Urban Interface Zone (WUI) based on local findings. According to the most up-to-date and localized information available at the County level, wildfire hazard severity designations are more extreme than the designations currently defined by the State. The County recently completed the process of updating its Community Wildfire Protection Plan (CWPP) with County data and modeling that more accurately reflects the fire hazard severity designations for the Town. This information will also need to be a central part of updates to the Marin County Comprehensive (or General) Plan and the Hazard Mitigation Plan. Expanding the WUI zone and reassessing the wildfire hazard severity ratings based on new data will better represent the Town's actual wildfire risk, increase the number of residents required to abide by Town WUI codes, and increase the Town's competitiveness for funding necessary to support the Town's adaptation and resilience efforts. Specifically, extending the boundaries of areas subject to wildfire regulations in the Town will expand the number of residents required to complete vegetation management, defensible space, and home hardening work on their properties. These designations will help decision-makers better understand, assess, and develop adaptation approaches to addressing the potential impacts of wildfire for hillside neighborhoods and require additional tools, resources, and staff to enforce compliance with the codes. In coordination with the County and Town efforts to quantify wildfire risk for the Town, a thorough review is also needed on CalFire's approach to mapping and designating wildfire hazard severity risk zones for Corte Madera.

- **Type of action:** Policy
- **Example Partners:** Central Marin Fire Department, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-M-15: Adopt a policy that requires home sellers in the WUI to demonstrate compliance with the Town's WUI codes before listing the home for sale.

- **Type of action:** Policy
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin

- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-16: Coordinate with MLS listing database, real estate companies, the private sector, insurance companies, and state to create a certificate (online and hard copy) that improves resale value and insurability for homes that have complied with WUI regulations (defensible space, vegetation maintenance and hazard fuel reduction, and home hardening), FireSafe practices, and codes.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, MLS Listing Service, Local and Regional Real Estate Agents, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-17: Develop a policy that requires home sellers in the WUI to disclose insurability of their home for wildfire.

- **Type of action:** Policy
- **Example Partners:** Central Marin Fire Department, MLS Listing Service, Local and Regional Real Estate Agents, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-18: Support the Town Resilience Coordinator and/or Wildfire Hazard Mitigation Specialist to coordinate all of the wildfire risk reduction activities for Corte Madera.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), CalFire, Corte Madera Public Works, Corte Madera Parks and Recreation Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-19: Enhance Town's strategic approach to reducing vegetation in hillside neighborhoods and along key evacuation routes. The Town's vegetation management program is essential in reducing wildfire risk for Town residents. In addition to supporting the Town's Resilience Coordinator, the Town should consider hiring additional staff or finding alternative ways to employ temporary staff to scale up its efforts to manage vegetation on Town property in the hillside neighborhoods and along key evacuation routes.

- **Type of action:** Project
- **Example Partners:** Marin Wildfire Prevention Authority (MWPA), Central Marin Fire Department, Corte Madera Planning Department, CalFire, Marin Municipal Water District (MMWD), Corte Madera Parks and Recreation Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-20: Enhance essential fuel reduction programs (e.g., chipper program) for residents in the hillside neighborhoods. This can include actions such as identifying and applying for more grants to support chipper programs as an incentive for individual homeowner hazard fuel reduction work.

- **Type of action:** Project
- **Example Partners:** Corte Madera Parks and Recreation Department, Marin Wildfire Prevention Authority (MWPA), Central Marin Fire Department, Corte Madera Planning Department, CalFire, Corte Madera Public Works
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-21: Enhance work to maintain fire fuel breaks (shaded, wide area, ridge top) at strategic points on lands within the Town's jurisdiction. This includes developing an MOU with Marin County and other partners to finance the creation of transition zones between residential areas and open space areas.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, Marin County Open Space, Corte Madera Parks and Recreation Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, CalFire
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-22: Identify and apply for grant opportunities that leverage MWPA funding that specifically aids seniors and other frontline community members to complete defensible space, hazard fuel reduction, and vegetation management work on residential properties.

- **Type of action:** Project
- **Example Partners:** Marin Wildfire Prevention Authority (MWPA), Central Marin Fire Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-23: Coordinate with regional partners to continue to collect, analyze, and maintain an accessible online GIS portal to store and share multi-agency fire risk hazard and severity zone maps and data.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, Marin County Fire District, Marin Wildfire Prevention Authority (MWPA), Corte Madera Planning Department, FIRESafe Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-M-24: Cultivate public-private partnerships (e.g., tax incentives) to support local and regional forest waste management businesses that help reduce fire risk.

- **Type of action:** Program

- **Example Partners:** Central Marin Fire Department, Marin County Fire District, Marin Wildfire Prevention Authority (MWPA), Corte Madera Planning Department, FIRESafe Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

EVACUATION

H-Ev-1: Enhance wayfinding (e.g., new signs for roads and paths, maps, and stair lighting) in hillside neighborhoods to support effective evacuations. Chapman Hill and Granada Hill neighborhoods both lack adequate paths, signs, and lighting necessary for residents to evacuate from a wildfire by walking or biking as a last resort. Christmas Tree Hill contains several pedestrian paths and stairways that provide connections for people who are able to walk up and down the hill; however, the connections with stairways are not ADA-compliant, and some paths with steep slopes also present accessibility challenges. Wayfinding signs should include consistent, well-lit, and easy to read evacuation instructions and maps.

- **Type of action:** Project
- **Example Partners:** Corte Madera Public Works, Neighborhood Response Groups (NRG's), Corte Madera Planning Department
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-Ev-2: Enhance hillside transportation network capacity and connections where possible. To enable safe and quick movement of people, the network of streets and off-street paths must be robust and, provide multiple downhill, overhill, and multimodal access and egress. Every resident should have the ability to get away from threats and authorities and emergency personnel should have access to respond to emergencies. It is critical that key evacuation choke points are addressed in the Town, Marin County, and the North Bay region, including those in Christmas Tree Hill, Chapman Hill, Granada Hill, and Sausalito Avenue (aka Hidden Valley). To see specific choke points in the hillside neighborhoods, reference pages 109 - 114.

- **Type of action:** Project
- **Example Partners:** Corte Madera Public Works, Transportation Authority Marin (TAM), Marin Transit, CalTrans
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-Ev-3: Identify and support Neighborhood Response Groups (NRGs) to increase community and neighborhood cohesion so communities can do more to help themselves during and after fires. NRGs are essential community support networks that already dedicate a significant amount of time and energy to supporting wildfire preparedness in the Town. The Town could enhance collaboration with the NRGs to make sure they have the tools, knowledge, and resources to support each other during an emergency. This includes providing evacuation training and drills using large-scale, unpredictable, and challenging scenarios and hosting "build an emergency kit" day and other events where community members can come together, learn about resilience, and build an emergency preparedness kit, and more.

- **Type of action:** Program

- **Example Partners:** Central Marin Fire Department, FIRESafe Marin, Corte Madera Planning Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-Ev-4: Enhance traffic congestion controls and parking enforcement along evacuation routes. In order to improve access and egress in the hillside neighborhoods, policies and enforcement need to accompany strategic investments in the hillside transportation infrastructure. For example, law enforcement could expand patrol efforts and the ticketing of cars that are parked illegally on specified streets. Additional no-parking zones could be created and painted on hillside streets to ensure compliance.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, Marin County Sheriff's Office, Central Marin Police Authority, Corte Madera Public Works
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term: (< 5 years)

H-Ev-5: Develop policies to encourage evacuation preparedness and early evacuation (for example, at the warning stage) for residents in the most vulnerable neighborhoods. Using additional tools that support community evacuation preparedness and early evacuation may be necessary to ensure the most vulnerable neighborhoods are prepared in the case of a catastrophic wildfire.

- **Type of action:** Policy
- **Example Partners:** Central Marin Fire Department, FIRESafe Marin, Corte Madera Planning Department, FEMA, Cal EMA, Marin County Sheriff's Office, Central Marin Police Authority
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-Ev-6: Consider policies that further restrict development in the WUI. The first step in reducing wildfire risk is to limit development directly in harm's way. The Town's hillside neighborhoods already have low-density zoning designation that require large lot sizes and limit subdivision of land that effectively reduces densities in these areas. Due to that designation, there is very little opportunity to continue to develop land in the hillside neighborhoods. Reducing the expansion of Accessory Dwelling Units (ADU's), limiting the overall size of structures, and reducing on-street parking in the WUI may help reduce the number of people in highly vulnerable areas and help make evacuations more efficient. It may also be possible to develop policies for responsible expansion of ADUs.

- **Type of action:** Policy
- **Example Partners:** Corte Madera Planning Commission
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-Ev-7: Consider mechanisms to support the construction of "safe rooms" in new builds as described in the 2015 ICC building code to protect citizens during wildfires and extreme weather events. These home retrofits may be particularly important for community members with mobility issues.

- **Type of action:** Policy
- **Example Partners:** Corte Madera Planning Department, Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-Ev-8: Educate community members about the importance of evacuating in a vehicle (as opposed to on foot or on bikes) using paved roads as a means of protection from catastrophic fire.

- **Type of action:** Policy
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

PROTECTION

The actions identified in this focus area are not specific to the Town and should be viewed broadly as options for Town, Central Marin Fire Department, and the Marin Wildfire Prevention Authority. ***It is ultimately up to the Town and its regional partners to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented. The local or regional organization, agency, or department responsible for implementing any action will need to be determined on a case-by-case basis.***

H-P-1: Work with regional partners to monitor and maintain appropriate staffing levels commensurate with the current and projected emergency response environment due to climate change. As the region continues to grow, more strain is put on our local resources to make sure that our communities and first responders have the staff, capacity, and tools to keep our communities safe. In addition, as wildfires continue to grow in size, severity, and duration, planning needs to reflect the increasingly extreme environment firefighters are being tasked with managing.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, Marin County Fire Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-2: Support investment in new equipment and technologies for fire protection. As wildfires continue to grow in size, severity, and duration across the state, Town and regional planning must continue to invest in the technology and equipment that keep our firefighters, first responders, and community safe.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA), Corte Madera Planning Department
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-3: Assess the viability of building wildfire resilience stations in the WUI that have the tools necessary for first responders or trained members of the NRGs to contribute to fire suppression efforts when needed. Communities like Oakland Hills have started providing their neighborhood response groups with the resources, tools, and knowledge to fight fires if first responders are delayed, blocked, or unavailable. This includes placing fire resistant sheds throughout the neighborhoods with the tools (hoses and tools) to access fire hydrants.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA), Corte Madera Planning Department, Neighborhood Response Groups (NRG's)
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-4: Support regional partners to deploy more fire detection cameras in priority areas as necessary. Six fire detection cameras already monitor fire starts in the region. There are also larger camera networks that help identify wildfires when they start. For example, the Alert Wildfire Network, which is a consortium of three universities - The University of Nevada Reno (UNR), University of California San Diego (UCSD), and the University of Oregon (UO) - provides access to their network of fire and tools to improve fire ignitions, scale up fire resources and response, and monitor fire behavior.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, Local ranchers or landowners, FIRESafe Marin, Marin Wildfire Prevention Authority (MWPA), Corte Madera Planning Department, Marin County Open Space District (MCOSD)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-5: Support regional partners to inventory and map vegetation on hillsides with a specific focus on improving hillside stability in the case of extreme rainfall and seasonal creek erosion. The topography of the hills surrounding the Town of Corte Madera could prevent unique challenges during an extreme precipitation event, particularly post-wildfire. Hydrophobic soils and the loss of vegetation that stabilizes hillsides due to wildfire can create large land and mudslides that can impact homes, businesses, and the safety of residents. Identifying and mapping areas that may be particularly vulnerable to landslides and mudslides following a wildfire will support decision-making and planning if necessary.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, State Water Resources Control Board, FIRESafe Marin, California Coastal Commission
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-6: Support regional partners to develop a formal collaboration mechanism between private property owners (and Homeowners Associations) and large landowners to enhance wildfire protection, preparedness, and recovery efforts. Fostering collaboration locally and regionally will continue to enhance the resilience of the Town to prevent, protect, and prepare for wildfires.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, Marin County Open Space District (MCOSD), Marin Municipal Water District (MMWD), Homeowners Associations, Neighborhood Response Groups (NRG's)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-7: Fund, develop, and adopt a pre-disaster recovery plan. Some communities, like Douglas County, Colorado, are investing in pre-disaster recovery plans. In 2015, the county adopted its first plan, designed to "establish the county's comprehensive framework for managing recovery efforts following a major disaster." Not only does this set the framework and foundation for tough decisions before a disaster occurs, but it also strengthens community partnerships, and maximizes the opportunity to enhance local resilience and risk reduction efforts into all aspects of the community's planning.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, Corte Madera Parks and Recreation Department, Corte Madera Public Works Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-8: Consider a "three strike" rule that only allows residents to use recovery funds to rebuild their homes two times before being bought out. In some places, like Santa Rosa, California, decision-makers have considered policies and codes that limit the number of times a resident can rebuild using tax dollars or recovery funds after a wildfire before they are no longer competitive for that funding.

- **Type of action:** Policy
- **Example Partners:** Corte Madera Planning Commission
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-9: Implement a buy-back program that buys land in particularly dangerous areas prone to wildfire to prevent residents from rebuilding there. Decision-makers in Santa Rosa are considering innovative approaches to rebuilding. Certain geographic areas are considered so dangerous and prone to recurring catastrophic wildfire that some decision-makers are weighing the actual cost of purchasing that land with the long-term cost of defending the homes. Not only are leaders calling for programs that compensate property owners to not rebuild, but they are also encouraging economic pressures that disincentivize them from building in these dangerous areas in the first place.

- **Type of action:** Program

- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-10: Rebuild utility infrastructure post-wildfire that is safer, more sustainable, and more resilient. Many communities across California are coordinating with regional utilities to underground all utility lines to reduce wildfire ignitions. Undergrounding utilities can be extremely expensive, especially in areas that are already built. But undergrounding utility or telecommunications infrastructure while rebuilding can limit the risk of those lines being damaged or causing wildfires during extreme weather events and enhance the resilience of the Town. The Town of Paradise created a formalized agreement with PG&E to directly underground all utility lines in order to reduce wildfire risk for the community.

- **Type of action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-11: Require residents to rebuild in accordance with Town WUI codes. Paradise, CA developed fire-resistant design standards that exceeded State, County, and Town WUI requirements. They also formalized a plan to ensure the Town can enforce defensible space codes. Examples of fire resistant design standards include: requiring gutters to be non-combustible (gutters clog with dry vegetation and fuel fires); banning the use of flammable building materials (e.g., retaining walls made from railroad ties); requiring homes to be built with sprinklers, have at least double-paned windows; and have fire-resistant siding; and, requiring homeowners to clear 100' of defensible space around homes including a "0-5' non-combustible zone" rule (including no mulch, flammable plants, non-pressure treated decks and wooden fences). In the case of the "0-5' non-combustible rule," this enables the Town to "stipulate how the local government might enforce the requirement, which the state code does not do. It also allows Paradise to add nuance to the code."

- **Type of action:** Policy
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-12: Ensure every neighborhood that is rebuilt has multiple access and egress routes that meet best practice standards for evacuation. To rebuild, Paradise established a policy that requires two means of access/egress for long dead-end streets and established standards for a safe length/number of homes per street. In addition, they are identifying and building additional road segments that are missing in the transportation network in order to improve road circulation and evacuation options. This also includes limiting long dead-end streets/driveways for individual homes.

- **Type of action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-13: Require fuel break transitions for homes and/or neighborhoods. Not only can landscape-scale fuel breaks between the forest and neighborhoods be extremely important for firefighters as they seek to protect a home, but additional defensible space and safety measures can also improve their safety and willingness to fight a fire in a neighborhood at risk of burning.

- **Type of action:** Policy
- **Example Partners:** Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, Marin County Parks and Open Space District
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-14: Evaluate the need for a Corte Madera specific community wildfire protection plan.

- **Type of action:** Policy
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-15: Identify opportunities to support regional partners to conduct basic fire training for Neighborhood Response Group and CERT members so they can support professional fire fighters prior to, and during, wildfire events.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, Neighborhood Response Groups (NRG's), Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-P-16: Conduct a town-specific vulnerability assessment specifically for wildfire for all sectors (e.g., transportation, natural resources, health, economy) in partnership with the MWPA.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, Marin County Fire District
- **Planning Cost Range:** High ($100k-$1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-17: Dedicate the time, staff, and resources to actively participate in the Marin Wildfire Prevention Authority (MWPA). Not only will this enhance the Town's understanding and approach to wildfire mitigation and education work locally, but it will also help ensure the Town's vision and priorities are included in regional planning efforts.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

Note: This is a working list of adaptation actions. It is ultimately up to the Town to discuss these actions with the community and take into consideration many factors in order to determine which actions get implemented.

H-P-18: Plan (e.g., procedures, protocol, funding, personnel, and training) for rapid post-fire assessment for watershed after a wildfire (e.g., determining town assets at risk within and downstream of the fire perimeter from flooding, debris flows, and excessive surface erosion).

- **Type of action:** Policy
- **Example Partners:** Corte Madera Planning Department, Central Marin Fire Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-P-19: Prepare sample vegetation treatment response plans to manage the re-growth of climate resilient vegetation and tree species and to maintain reduced fuels conditions on private and town lands for post-fire recovery.

- **Type of action:** Policy
- **Example Partners:** Corte Madera Parks and Recreation Department, Corte Madera Planning Department, Central Marin Fire Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

EDUCATION AND COLLABORATION

H-EC-1: Coordinate with FIRESafe Marin to integrate climate change and wildfire projections into all of their current educational materials and programs. Defining the role that climate change plays in exacerbating wildfire risk is key to understanding what is at stake as well as implementing actions that support adaptation and resilience efforts. For example, this information would be essential to include in all local and regional educational materials in order to use the best available science and best practices for supporting individual homeowners in their efforts to reduce their risk to wildfires.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, Neighborhood Response Groups (NRG's), Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-EC-2: Support regional partners (e.g., FIRESafe Marin, MWPA, etc.) in their efforts to effectively educate residents about defensible space, vegetation management, and home hardening efforts. In order to ensure an efficient, effective, and consistent approach to wildfire risk reduction for the Town, strong regulations must be balanced by consistent, clear, and reliable education and outreach with Town residents. This includes consistent messaging using workshops, webinars, forums, door-to-door site visits, educational materials, and more. According to the Marin County Civil Grand Jury Report, the most effective method of educating residents about wildfire preparedness was in neighborhoods on the ground from person to person by education specialists (not firefighters).

- **Type of action:** Program

- **Example Partners:** Central Marin Fire Department , Neighborhood Response Groups (NRG's), Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, Tree Mortality Working Group, Marin Municipal Water District Wildfire Task Force
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-EC-3: Coordinate with FIRESafe Marin to enhance community outreach and education programs about the impacts of wildfires and smoke on physical and mental health. Wildfires not only directly impact our physical health and safety, but they also impact our mental health. In addition, the impacts of smoke can be long-lasting, particularly for frontline community members. Supporting and coordinating with regional education partners like FIRESafe Marin (as well as the MWPA) is an important step in ensuring that Corte Madera residents understand and prepare for the impacts of smoke and wildfires on their physical and mental health.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, FIRESafe Marin, Neighborhood Response Groups (NRG's), Marin Wildfire Prevention Authority (MWPA)
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (<5 years)

H-EC-4: Support regional partners in their efforts to update all planning documents, budgets, and programs to include climate change projections (with a special focus on increased wildfire risk and drought). Wildfire science and modeling is changing drastically due to a new understanding about how climate change is exacerbating the size, severity, duration, and seasonality of wildfires. These changes will impact the way that local and regional fire departments operate, plan, and make decisions.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, Marin County Fire Department, CalFire, Marin Wildfire Prevention Authority (MWPA, FIRESafe Marin, Corte Madera Planning Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-EC-5: Support community outreach and education efforts focused on Town WUI policies, codes, and regulations. Education remains one of the cornerstones of community preparedness. Supporting the local and regional entities to find innovative, equitable, and locally specific ways to reach all residents is key to ensuring ALL Corte Maderans are prepared in the case of a wildfire. This includes identifying and institutionalizing equitable approaches to community engagement that consider linguistic, racial, ethnic, socioeconomic, educational, and political factors that increase the sensitivity of frontline community members to climate change.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, CalFire, Marin County Fire Department, Marin Wildfire Prevention Authority (MWPA, FIRESafe Marin, Corte Madera Planning Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-EC-6: Designate and maintain Demonstration State Forests and related healthy WUI managed land areas in Corte Madera as models to inform and educate residents on forest changes in response to climate change, disturbance, and treatment activities.

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, CalFire, Marin County Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, Corte Madera Parks and Recreation Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-EC-7: Provide resources for homeowners to identify the best options for wildfire insurance in the WUI.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, CalFire, Marin County Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, Corte Madera Parks and Recreation Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-EC-8: Support regional partners to engage with relevant organizations and decision-makers at the regional and state level (e.g., the California Commission on Catastrophic Wildfire Cost and Recovery) to ensure that the Town cultivates the conversation around fixing the insurance marketplace for homeowners living in the WUI.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, California Commission on Catastrophic Wildfire Cost and Recovery, CalFire, Marin County Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, Corte Madera Parks and Recreation Department, Regional Home Insurers
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-EC-9: Support regional partners to coordinate with regional building and development associations (e.g., Marin Builders Association) to incorporate home hardening policies, education, and community engagement into their operations. Consider expanding relationships with regional building supply vendors and contractors to increase education and awareness for customers living in the WUI about home hardening. Identify incentives (e.g., tax breaks) for vendors and contractors as a part of this process.

- **Type of action:** Program
- **Example Partners:** Central Marin Fire Department, CalFire, Marin County Fire Department, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, Corte Madera Parks and Recreation Department, Marin Builders Association, Regional Building Supply Vendors and Contractors
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

H-EC-10: Support regional partners to integrate short educational videos for defensible space, home hardening, and vegetation management into a mobile data collection app (e.g., a personalized reporting app like the CalFire Collector App for residents to show compliance of property).

- **Type of action:** Project
- **Example Partners:** Central Marin Fire Department, CalFire, Marin Wildfire Prevention Authority (MWPA), FIRESafe Marin, Corte Madera Planning Department
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

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COLLABORATION

C-C-1: Monitor groundwater levels and consider associated impacts in current and proposed designs for development. While there have been lots of geotechnical borings for development, there has yet to be a systematic monitoring system for tracking groundwater levels in the Town. SFEI is participating in a California Resilience Grant project to better understand groundwater levels around the Bay. Marin County is one of four counties participating in the study and the Town of Corte Madera should consider partnering with SFEI on this project.

- **Type of action:** Project
- **Example Partners:** Corte Madera Public Works, California Statewide Groundwater Elevation Monitoring (CASGEM) Program, San Francisco Bay Regional Water Quality Board, Bay Area SWAMP
- **Planning Cost Range:** Medium ($25k - $100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

C-C-2: Support efforts of other organizations and academic institutions to conduct studies of the impact combined riverine and coastal flooding, groundwater intrusion, and increased precipitation has on flood risk and vulnerability. Precipitation in the region is likely to remain extremely variable. Where that precipitation falls will largely determine where the flood waters go and who is affected. It will take detailed hydraulic modeling to better understand how the system will work with more extreme precipitation events and how different interventions can reduce or limit those impacts.

- **Type of action:** Project
- **Example Partners:** Corte Madera Public Works, California Statewide Groundwater Elevation Monitoring (CASGEM) Program
- **Planning Cost Range:** Medium ($25k - $100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

C-C-3: Study the combined impact of projected precipitation events, sea level rise, groundwater intrusion, and other flood events for the Town. Engineering approaches to mitigating SLR-driven overland flooding usually do not address groundwater inundation, so assessment of this risk is an essential step in planning for the full impacts of climate change at local and regional scales. Detailed groundwater monitoring efforts coupled with improved

understanding of the relationship between SLR, coastal aquifers, and stormwater systems will help the Town adapt to changing conditions.

- **Type of action:** Project
- **Example Partners:** USGS
- **Planning Cost Range:** High ($100k - $1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

C-C-4: Continue to collaborate with partner agencies and municipalities to align green infrastructure projects and regulations for watersheds across jurisdictions to reduce impervious hard surfaces and require integration of green infrastructure techniques into site design. Working collaboratively to reduce impervious surfaces can effectively reduce the amount of stormwater runoff that flows into the Town flood control system. Working collaboratively with other jurisdictions to align green infrastructure requirements makes localized action more effective at reducing flood risk.

- **Type of action:** Policy
- **Example Partners:** Flood Control Zone 9, Ross Valley Flood Control
- **Planning Cost Range:** Medium ($25k - $100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

C-C-5: Coordinate with local/state/national agencies to create a certificate to provide recognition to homes that have complied with flood-prevention regulations, community rating standards, and building codes.

- **Type of action:** Program
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k - $100k)
- **Timeframe for Implementation:** Near-term (< 5 years)

C-C-6: Support the convening of stakeholders (relevant agencies, organizations, and individuals responsible for stormwater management decisions) across the Ross Valley Watershed to address barriers presented by different regulations, budget limitations, and expected population growth.

- **Type of action:** Program
- **Example Partners:** Ross Valley Flood Control
- **Planning Cost Range:** Low (< $ 25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

PREVENTION

C-P-1: Promote regional efforts to analyze feasibility and effectiveness of additional green infrastructure on commercial and residential properties in mitigating stormwater runoff. Green infrastructure can reduce the strain on stormwater infrastructure by reducing the amount of water needed to be pumped to the Bay during high precipitation events. In order to determine the efficacy of additional green infrastructure, the Town needs to analyze current capacity and potential sites for additional infrastructure. While green infrastructure cannot solve all of Corte Madera's flooding woes on its own, it is an effective flood solution when coupled with improved traditional stormwater infrastructure.

- **Type of action:** Project
- **Example Partners:** Marin Countywide Stormwater Pollution Prevention Program (MCSTOPP), California State Coastal Conservancy
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

C-P-2: Address flooding issues on Casa Buena Drive. Subject to flooding during extreme precipitation events, Casa Buena Drive is a significant surface street for the town, connecting residential areas and small businesses to Tamalpais Drive. The first step to ensure the safety of residents and access to this section of town, is upgrading the storm drain system along the roadway to ensure that it has the capacity to handle the larger precipitation events already occurring almost annually (~$200,000). Over the longer-term, the drive should be added to a list of important roadways to consider elevating to ensure functionality during extreme weather events, especially as sea levels rise (~$500,000).

- **Type of action:** Project
- **Example Partners:** Corte Madera Public Works, Corte Madera Planning Department
- **Planning Cost Range:** High ($100k - $1 million)
- **Timeframe for Implementation:** Medium-term (5-20 years)

C-P-3: Provide policy incentives to property owners by streamlining permitting for green infrastructure and stormwater projects that adhere to a stricter set of requirements. Reducing the time and effort required to adhere to existing requirements incentivizes property owners to not only comply with the green infrastructure requirements, but to voluntarily implement them.

- **Type of action:** Policy
- **Example Partners:** Marin Countywide Stormwater Pollution Prevention Program (MCSTOPP), California State Coastal Conservancy, Bay Area Stormwater Management Agencies Association (BASMAA)
- **Planning Cost Range:** Low (< $25k)
- **Timeframe for Implementation:** Near-term (<5 years)

C-P-4: Develop a "Homeowners and Small Business Guide to Stormwater Management" to educate home and small business owners on regulations and highlight the role that engaged residents can play to assist with community-based stormwater management. Providing homeowners and small business owners a consolidated guide on current stormwater regulations and best practices can aid in compliance. Simply informing residents and business owners of their responsibility and the role they play in reducing stormwater runoff can potentially aid in the success of reducing runoff.

- **Type of action:** Project
- **Example Partners:** Marin Countywide Stormwater Pollution Prevention Program (MCSTOPP)
- **Planning Cost Range:** Low (< $25k)
- **Timeframe for Implementation:** Near-term (< 5 years)

C-P-5: Update the Storm Drainage Master Plan to include an assessment of current infrastructure and its ability to handle projected extreme precipitation and sea level rise that identifies deficiencies and deferred maintenance needs for our stormwater and flood control network. It is time to invest in updating the Storm Drainage Master Plan and to specifically include an analysis of the stormwater and flood control system infrastructure capacity to accommodate increasing sea levels and runoff from heavy precipitation events. Despite major investments in the last 20 years, climate-driven heavy precipitation and stormwater continues to disrupt homes, businesses, and transportation networks. The updated Storm Drainage Master Plan will include an analysis of the Town's detention and retention basins, pumping infrastructure, pips, and the storm drain network; it will also provide current and recommended capacities that consider climate projections. The plan aims to identify a combination of nature-based and, where necessary, hard infrastructure solutions to upgrade the existing flood control system's capacity to handle the compounding, near- and long-term impacts of larger flood events and higher sea levels. Potential strategies include: Analyzing current stormwater system capacity; identifying desired flood protection levels in 25, 50, and 100 years; identifying appropriate green, nature-based, and non-structural approaches to flood mitigation; upsizing pumps to effectively manage increased precipitation, runoff water levels, and water pressure; and, assessing whether dredging projects can achieve desired future flood protection levels.

- **Type of action:** Project
- **Example Partners:** Corte Madera Public Works
- **Planning Cost Range:** High ($100k - $1 million)
- **Timeframe for Implementation:** Near-term (<5 years)

C-P-6: Investigate and track the flood-reduction benefits of Low Impact Development (LID) standards and the potential to improve by adjusting requirements or enforcing compliance among property-owners. Understanding the impact of LID requirements and the rate of compliance among commercial and residential properties can help the Town understand the potential effectiveness of adjusting requirements or increasing enforcement of existing requirements in order to reduce the amount of stormwater runoff.

- **Type of action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

C-P-7: Conduct a thorough assessment (as part of a Drainage Master Plan Update) of the current status, capacity and vulnerability of pumping stations and associated infrastructure (pipes, pump stations, power supply, back-up power supply, and drainage basins) to current and future coastal flooding, taking into account projected changes in precipitation and coastal flood risk. This assessment should address all areas within the town, including shoreline neighborhoods, and inform Near-term actions that can be taken to ameliorate temporary flooding from upland sources.

- **Type of action:** Project
- **Example Partners:** Corte Madera Public Works
- **Planning Cost Range:** High ($100k - $1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

C-P-8: Ensure completeness and availability of identified flood emergency supplies and resources; including, but not limited to items such as water main repair parts, generators, pumps, sandbags, road clearing, medical, and communication.

- **Type of action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** High ($100k - $1 million)
- **Timeframe for Implementation:** Near-term (<5 years)

C-P-9: Adopt a policy that requires all publicly funded capital projects in the Town capture and store a designated amount of rainfall in the first hour of a rain event.

- **Type of action:** Policy
- **Example Partners:** Corte Madera Planning Department, Marin Countywide Stormwater Pollution Prevention Program
- **Planning Cost Range:** High ($100k - $1 million)
- **Timeframe for Implementation:** Near-term (< 5 years)

C-P-10: Develop method for assessing neighborhood stormwater retention rates and applicability of residential stormwater solutions for potential future implementation.

- **Type of action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

C-P-11: Compile and publicize a list of "certified or qualified" shoreline and stormwater infrastructure contractors and engineers to assist with coastal development and renovations.

- **Type of action:** Project
- **Example Partners:** TBD
- **Planning Cost Range:** Medium ($25k-$100k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

C-P-12: Ensure at least one member of Town staff is a Certified Floodplain Manager (CFM).

- **Type of action:** Project
- **Example Partners:** Association of State Floodplain Managers (ASFM)
- **Planning Cost Range:** Low (< $25k)
- **Timeframe for Implementation:** Medium-term (5-20 years)

C-C-13: Develop educational programs, resources, and materials focused on household moisture and mold reduction interventions.

- **Type of action:** Prog
- **Example Partners:** TBD
- **Planning Cost Range:** Low (< $25k)
- **Timeframe for Implementation:** Near-term (<5 years)

APPENDIX C |
ACTION EVALUATION SUMMARY

As part of the adaptation assessment process, the project team collected potentially relevant adaptation actions from discussions with Town staff, community member input, conversations with organizations and agencies around the region, other community adaptation plans in the State of California, and from communities across the country. To determine if these actions were appropriate and suitable for Corte Madera, the project team used the following three-part evaluation process to evaluate each of the actions. This screening process allowed the project to quickly filter out actions that were not a good fit for the community, better understand and then score the potential effectiveness, efficiency, and feasibility of each suitable action, and select a few actions where a more detailed assessment was warranted.

Adaptation Action Evaluation Summary

Tiered Screening and Evaluation Process for Adaptation Actions

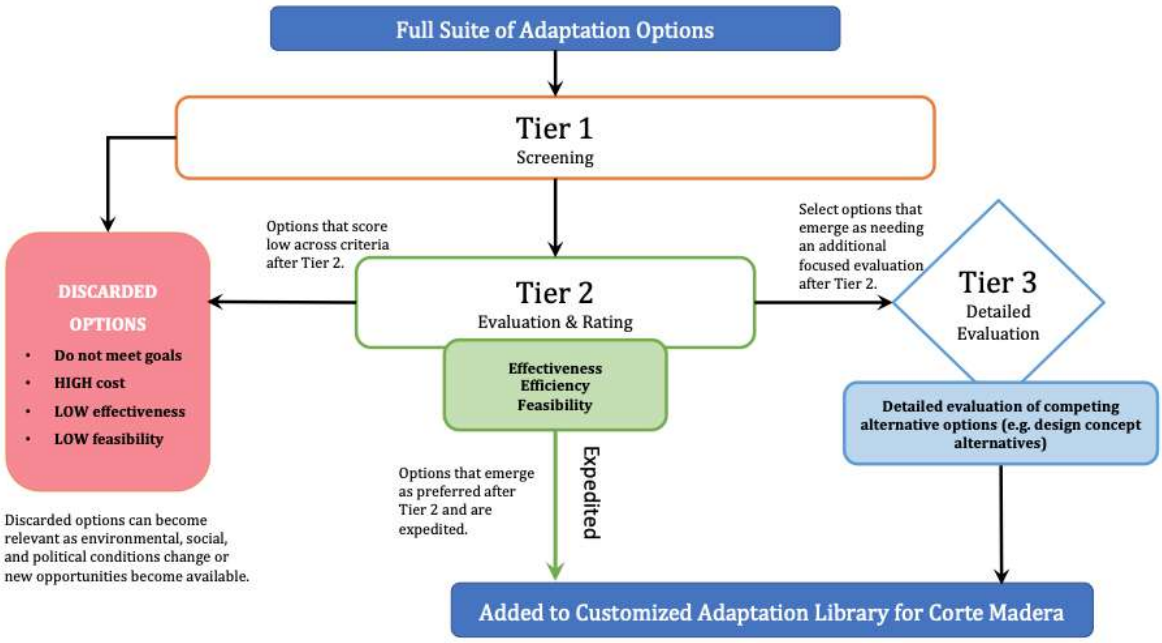

Figure 1. A flowchart of the adaptation action processes that takes the full suite of potential actions from local, regional, national, and international locations, filters, refines, and evaluates actions to create a customized library that is most useful for climate adaptation planning in Corte Madera.

- **Tier 1** - Screening: Briefly evaluate the full suite of actions, and discard actions that:
  - Do not help the Town achieve its resilience goals;
  - Won't be effective;
  - Are extremely costly; or
  - Have very low feasibility.

  Example of eliminated action at Tier 1: *creating a "floating" neighborhood for Mariners Cove and Marina Village (cost too high and current feasibility too low).*

- **Tier 2** - Evaluation & Rating: Review each action for its effectiveness, efficiency, and feasibility (see detailed description of evaluation criteria below). *Evaluation of actions at this step comprised the bulk of the evaluation process for this project.*
  - After this evaluation, some actions scored low across the criteria and were discarded for consideration at that time. *Discarded actions may become relevant as environmental, societal, and political conditions change or new opportunities become available.*
  - Some adaptation actions emerged as preferred, particularly relevant, and a great fit for the Town during the Tier 2 evaluation process. These actions were "expedited" and moved into the final library of customized adaptation actions.

- Some actions needed additional and more detailed evaluation to determine the ability to implement those actions or aid in comparing similar alternative options (e.g., alternative design concepts for specific geographic areas).

- **Tier 3** - Detailed Analysis - Conduct initial cost estimates, review feasibility, and assess effectiveness of selected adaptation actions.
  - This tier of evaluation was used to compare potential hillside transportation alternatives by completing a more detailed ranking/rating of the actions.
  - It is useful for evaluating different policy pathways or refining design concept alternatives for different geographic areas in order to determine the "best" or "better" options for the Town based on available resources.

Evaluation Criteria (Multi-criteria Decision Analysis)

Three overarching criteria have been selected based on the literature as well as adaptation and resilience work occurring in California, and leading examples of resilience work in other parts of the world.[1,2] Each of the three criteria has 3-4 main subcategories that were considered in developing ratings. In the Tier 2 screening, each of the main criteria was initially rated 1-5 *(1 being "limited or no" and 5 being "very high")* to determine relative rankings across actions. Detailed evaluation of each of the subcategories can be used during Tier 3 evaluation to further refine and explore the relative value of the actions. A description of each of the criteria and guiding questions used in the analysis is provided below.

- **Effectiveness:** ***The extent to which the adaptation action achieves the desired outcomes.*** Does the action reduce vulnerability, risk, or short- and long-term impacts of climate change and extreme weather events? What future losses will be avoided? Does the scale of the action meet the scale of the challenge? Is the approach equitable? *Evaluate the adaptation action's ability to:*
  - **Meet the Town's goals** - action helps the Town meet one (or more) of its four resilience goals;
  - **Address key vulnerabilities and prepares the Town for the future** - action reduces current and future risks associated with climate change; and
  - **Be commensurate with the exposure and need -** can the action be implemented in a timely manner and provide necessary reduction in vulnerability and risk that is comparable to the investment in the action over the lifespan of the project.

[1] Bottom-Up Climate Adaptation Strategies Towards a Sustainable Europe (BASE) Evaluation Criteria for Climate Adaptation (BECCA): *Weiland, Sabine und Jenny Tröltzsch. 2015. BASE Evaluation Criteria for Climate Adaptation (BECCA). BASE Policy Brief # 3.*

[2] United States Agency for International Development (USAID) CCRD White Paper: *Raucher et. al. 2013. Evaluating Adaptation Options: Assessing Cost, Effectiveness, Co-benefits, and Other Relevant Considerations. US AID.*

- **Efficiency:** ***The extent to which the adaptation action makes efficient use of resources (funding, expertise, and staff time).*** Does the effort and resources needed to implement the action match the intended result? Is the action equitable, and does it support all residents? *For each adaptation action evaluate the following.*
    - **Direct and Indirect Costs -** consider life cycle costs (including initial upfront and maintenance costs) as well as indirect investments from staffing and other resource inputs. This sub-criteria is used to identify "costs".
    - **External Costs** - consider environmental costs to species and habitats; negative community, social, or health impacts; and adverse economic benefits.
    - **Additional Benefits -** consider environmental benefits; community, social, or health benefits; and economic benefits. Specifically consider the following:
        - Does the action provide benefits irrespective of climate change? Does it have no-regrets characteristics?
        - Does the action limit or reduce greenhouse gas emissions?
        - Is the action equitable? Will some be disproportionately affected? Who bears the "costs" and who will receive the "benefits"?
    - **Flexibility and Robustness-** consider whether the action can be modified over time as conditions change and how robust it is to a variety of scenarios of change.

- **Feasibility** *The extent to which the adaptation action can successfully be implemented.* Is the appropriate technical, political, and community capacity in place to make the action successful? Is it deemed acceptable by all segments of the community or are there undue barriers to implementation? *For each adaptation action, evaluate the following:*
    - **Institutional Feasibility** - How do institutional requirements and/or barriers affect the ease of implementation? Consider the need to cross jurisdictional boundaries or the necessity of multi-jurisdictional collaboration to make the action successful.
    - **Technical Feasibility** - How challenging is the implementation from a technical perspective? Does it require new or novel approaches/applications that haven't been tested? Is the scale of implementation beyond traditional application?
    - **Societal Feasibility** - Are there social or political constraints that will hinder or limit implementation? Is there a current "window of opportunity" that enhances the ability of the strategy to be implemented? Does the social consciousness and awareness of need for the action support implementation, or does a required update to a Town/agency plan provide an opportunity for action?

Examples of Tier 2 Evaluation & Rating

By scoring every individual adaptation action that has made it past the Tier 1 screening process, the Town can better evaluate and assess the effectiveness, efficiency, and feasibility of these individual actions and systematically determine how to best invest the existing resources they have and better plan for the future.

	Adaptation Actions	*Effectiveness*	*Efficiency*	*Feasibility*
1	Identify opportunities to improve cost-sharing with residents for fuel hazard reduction on private lands.	**5**	**3**	**4**
2	Ensure all Town buildings have smoke and particulate filtration systems, especially dedicated emergency evacuation shelters and resilience hubs.	**5**	**5**	**4**

Evaluation Criteria Ratings

1	Limited or No
2	Low
3	Medium
4	High
5	Very High

The example above shows two adaptation actions scored for overall effectiveness, efficiency, and feasibility. Adaptation action #1 is designed to address wildfire risk and receives a total score of 12. Adaptation action #2 is focused on town-wide health and wellness and receives a total score of 14 across its effectiveness, efficiency, and feasibility. Actions scoring very low (total score of 3-8) across all criteria may be discarded from consideration at this point; however, these actions may still be considered as conditions change. The actions can be ordered by total score to help filter out the actions that may be further considered for the Climate Adaptation Assessment for Corte Madera for further discussion and study within the Town and community. This scoring process can also help identify "top" actions (those scoring 12-15) that are further explored in the Climate Adaptation Assessment and provided as key examples for the types of projects that can be explored in the next stages of adaptation planning. All "top" and high scoring actions are included in the Adaptation Action appendix.

Tier 3 Evaluation & Rating

The detailed analysis within the Tier 3 process is unique for individual actions and broader projects throughout the community. In general, these analyses consisted of a deeper dive into preliminary cost estimates and evaluation or identification of the pros and cons of different alternatives to different design concepts and/or locations throughout the hillside neighborhoods. These analyses are designed to support the further discussion with the community on the appropriateness and potential value of these actions. Some Tier 3 analysis has been incorporated into the main body of the Adaptation Assessment for a select set of adaptation actions. As discussed earlier, actions that receive Tier 3 treatment are not necessarily a better fit for the community or more likely to be implemented. Some Tier 2 actions that did not require additional analysis may be the first to be implemented.

All evaluation completed as part of this project is for planning purposes and should or could be reconsidered and reevaluated as individual actions are selected for further exploration and implementation.

APPENDIX D |
GIS METHODS & MAPS

Introduction

In order to better explore the potential climate change related exposures for the community and identify valued assets and their position relative to various hazardous landscape characteristics Adaptation International completed some spatial analysis. This analysis was conducted on an iterative basis throughout the adaptation assessment process. This appendix summarizes the approach and methodologies used in the analysis. In addition, maps derived from this process are presented for reference during future adaptation implementation efforts. Many, but not all, of the maps have been included in the main text of the Climate Adaptation Assessment.

It should be noted that while all of these maps and the associated statistics derived from them are based upon the application of the best available spatial data, they should not be taken as the technical foundation for specific infrastructure or related construction projects. Rather, they should be taken as a high-level set of spatially explicit classifications of the spatial datasets themselves, which may be subject to errors of omission, commission, and/or obsolescence as landscape, building, and legal classifications (such as FEMA flood zones) change over time. Similarly, certain hazards, such as flooding, wildfire, and the long-term effects of sea level rise may have effects that go beyond the boundaries of the various zones identified in the analyses below, and as such, exclusion of a property, parcel, or area from these hazard zones does not preclude them from negative impacts in the future.

Methods

The spatial hazard analysis process began with repeated consultations with Corte Madera staff and exhaustive reviews of the extant literature on climate change risks and current climate-driven hazards within the community. From this, the project team determined that spatial analysis efforts included in the Adaptation Assessment would focus on wildfire and coastal flood risk.

Given the long history and large amount of climate vulnerability information already, it was decided early on in the process that this risk assessment would not involve novel modeling or direct data gathering approaches. Rather, it would rely upon publicly available datasets with a known provenance and validity for the region, and that had been adopted in one form or another by relevant planning agencies and stakeholders as an adequate signifier of associated risks. In the case of inland flooding risk, this proved a rather straightforward data acquisition and utilization

process, as existing Flood Hazard Mitigation Layer datasets[1] (i.e., FEMA Flood Hazard Layers) produced by the Federal Emergency Management Agency were readily available for the area of interest and had immediate relevance to existing understandings of flood risk and property insurance requirements.

Similarly, wildfire risk - a well-known hazard throughout California - had also been the subject of significant study and administrative action, with both statewide (via CALFIRE) and Marin County-level datasets depicting wildland urban interface zones being available through state and county resources.[2] Towards the end of the study period, the Town of Corte Madera also adopted new, slightly expanded wildland urban interface designations[3], which were able to be incorporated into the analysis process through the manual production of shapefiles based on publicly released documents. Maps were also produced based on work by Nelson Nygaard to use remote sensing and imagery to measure Hillside neighborhood road widths as part of their evacuation and adaptation planning efforts.

In both cases, datasets depicting existing structure outlines (derived from the Microsoft Bing 2018 Building Footprints project dataset, Marin County parcel ownership, and USGS road network data were overlaid on top of these hazard layers to derive various statistics related to the exposure of structures, parcels, and roads in the area to each hazard.

Maps developed as part of this process are provided below, both for reference and for secondary use in educational outreach efforts.

[1] Marinmap.org features a variety of datasets - including many used in this analysis and is available for public use. For an interactive map of FEMA flood hazard zones, visit: http://www.marinmap.org/Html5Viewer/?viewer=fema_lomc_h5&run=AutoSuggestAddress

[2] Marin County WUI designation data can be viewed here: https://www.firesafemarin.org/wui; CAL Fire Wildfire Hazard Severity Zone designations and draft elements relating to Local Responsibility Areas can be found here: https://osfm.fire.ca.gov/divisions/wildfire-planning-engineering/wildland-hazards-building-codes/fire-hazard-severity-zones-maps/

[3] Information relating to these new zones can be found at: https://www.townofcortemadera.org/DocumentCenter/View/34/WUI---Wildland-Urban-Interface-Code-PDF

Reference Maps

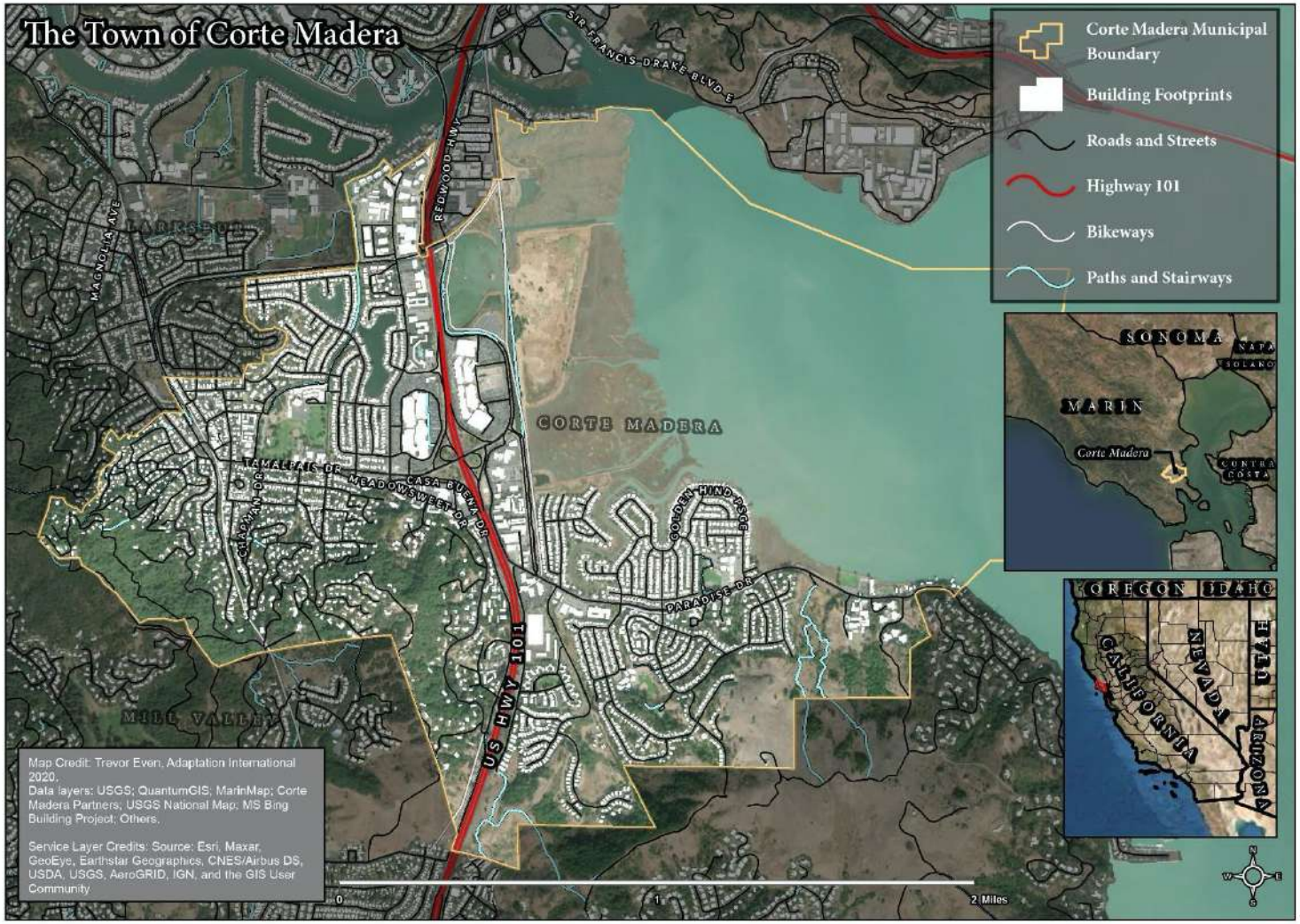

Figure 1 - Base Map for Town of Corte Madera Adaptation Assessment Mapping.

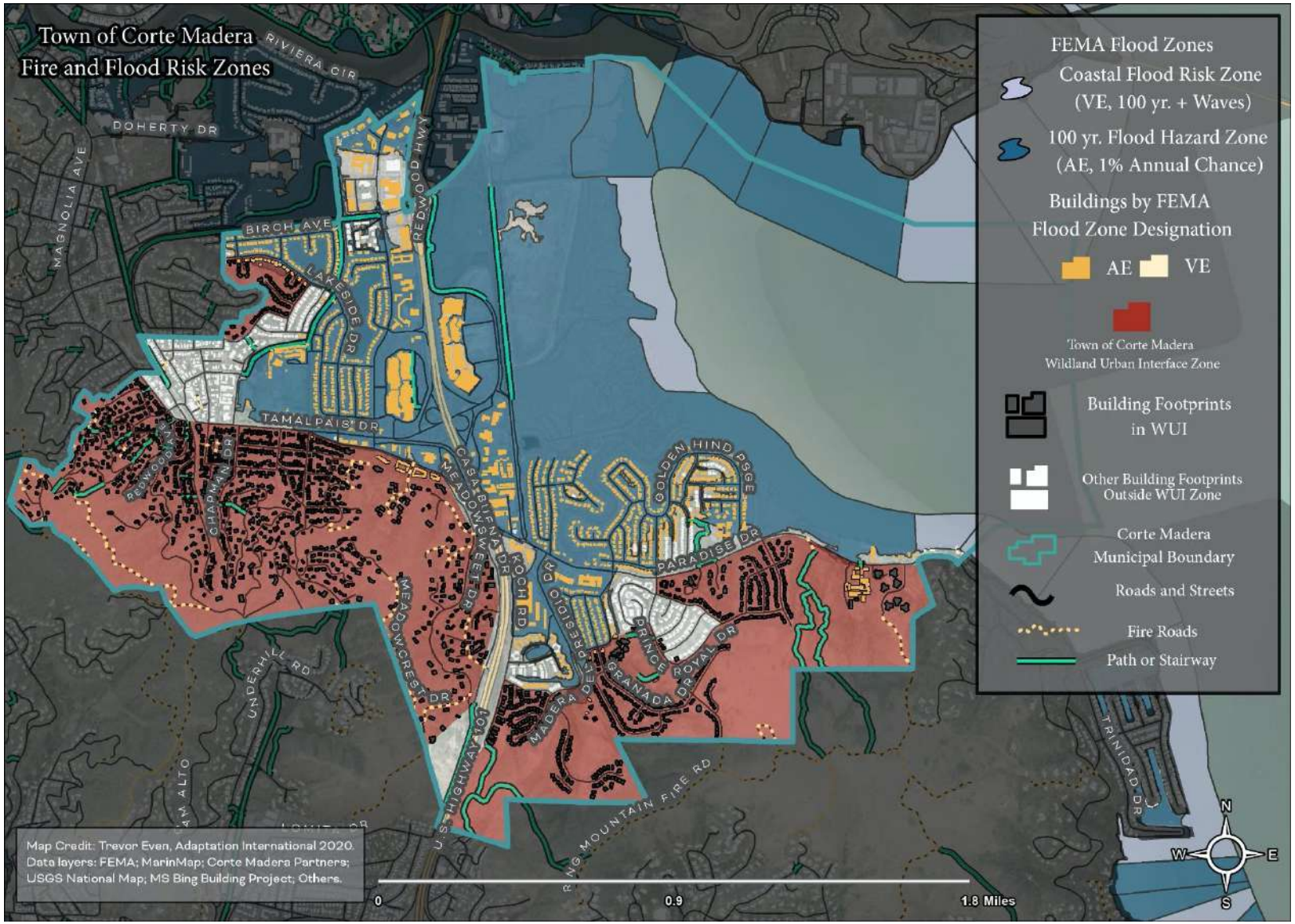

Figure 2 - Map depicting combined Wildland Urban Interface and FEMA Flood Zones hazard areas. Note that these two hazard areas cover nearly the entirety of the Town's jurisdictional area, with several structures falling under both classifications.

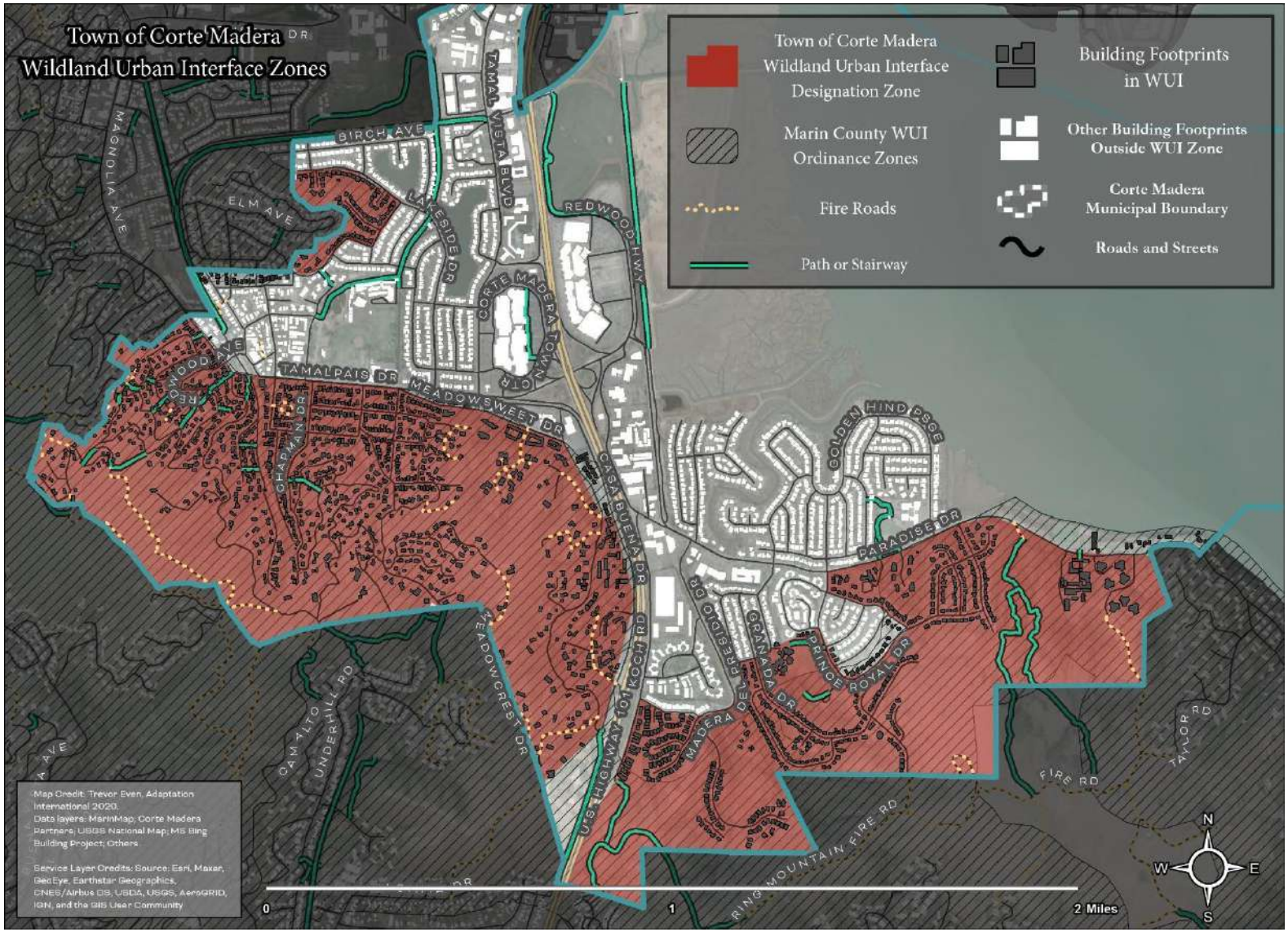

Figure 3 - Map depicting both the Marin County WUI Ordinance Zone and the newly adopted Town of Corte Madera WUI Zone. In both areas, parcels, homes, and other structures must meet certain fire prevention criteria due to the increased risk of wildfire ignition and spread resulting from extant vegetation.

Figure 4 - Map depicting the Town of Corte Madera Wildland Urban Interface Zone in and around the neighborhoods in the southeast portion of town south of Paradise Drive.

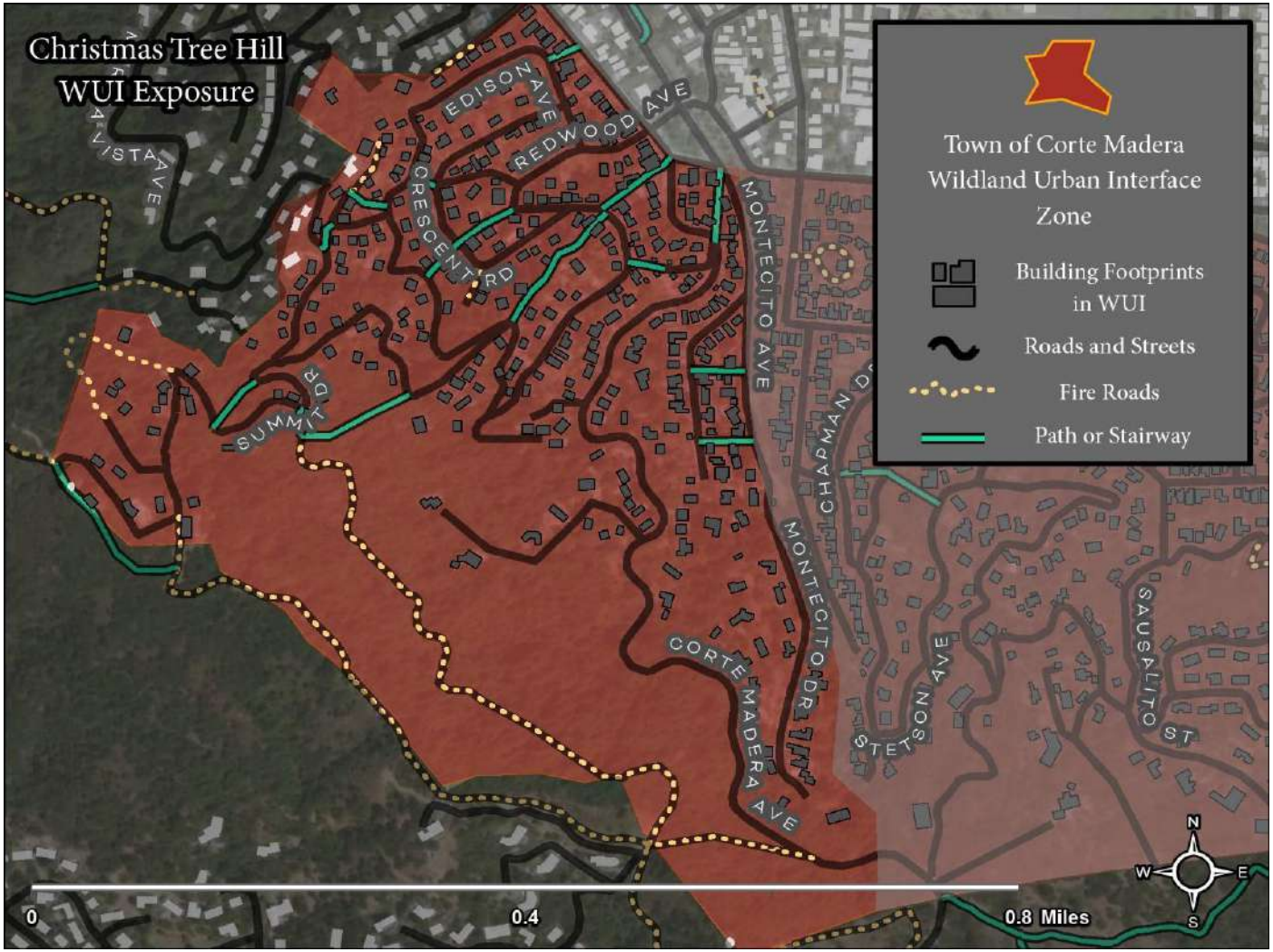

Figure 5 - Map depicting the Town of Corte Madera Wildland Urban Interface Zone in the Christmas Tree Hill neighborhood, located in the southwestern corner of the town.

Figure 6 - Map depicting the Town of Corte Madera Wildland Urban Interface Zone in the Chapman neighborhood, located south of Tamalpais Drive and southwest of the Highway 101 interchange.

Figure 7 - Map depicting road widths in the Christmas Tree Hill and Chapman neighborhoods, as ascertained by Nelson Nygaard field technicians. In these neighborhoods, steep slopes, narrow roads, dead end streets, and dense vegetation combine to create significant challenges to wildfire preparedness and potential evacuation scenarios.

Figure 8 - Map depicting road widths in the Granada and Madera del Presidio neighborhoods, as ascertained by Nelson Nygaard field technicians. Although not as constricted as roads in other Hillside neighborhoods, careful coordination during a potential wildfire scenario in this area will be required, especially so as to avoid traffic jams as neighborhood streams empty onto Paradise Drive.

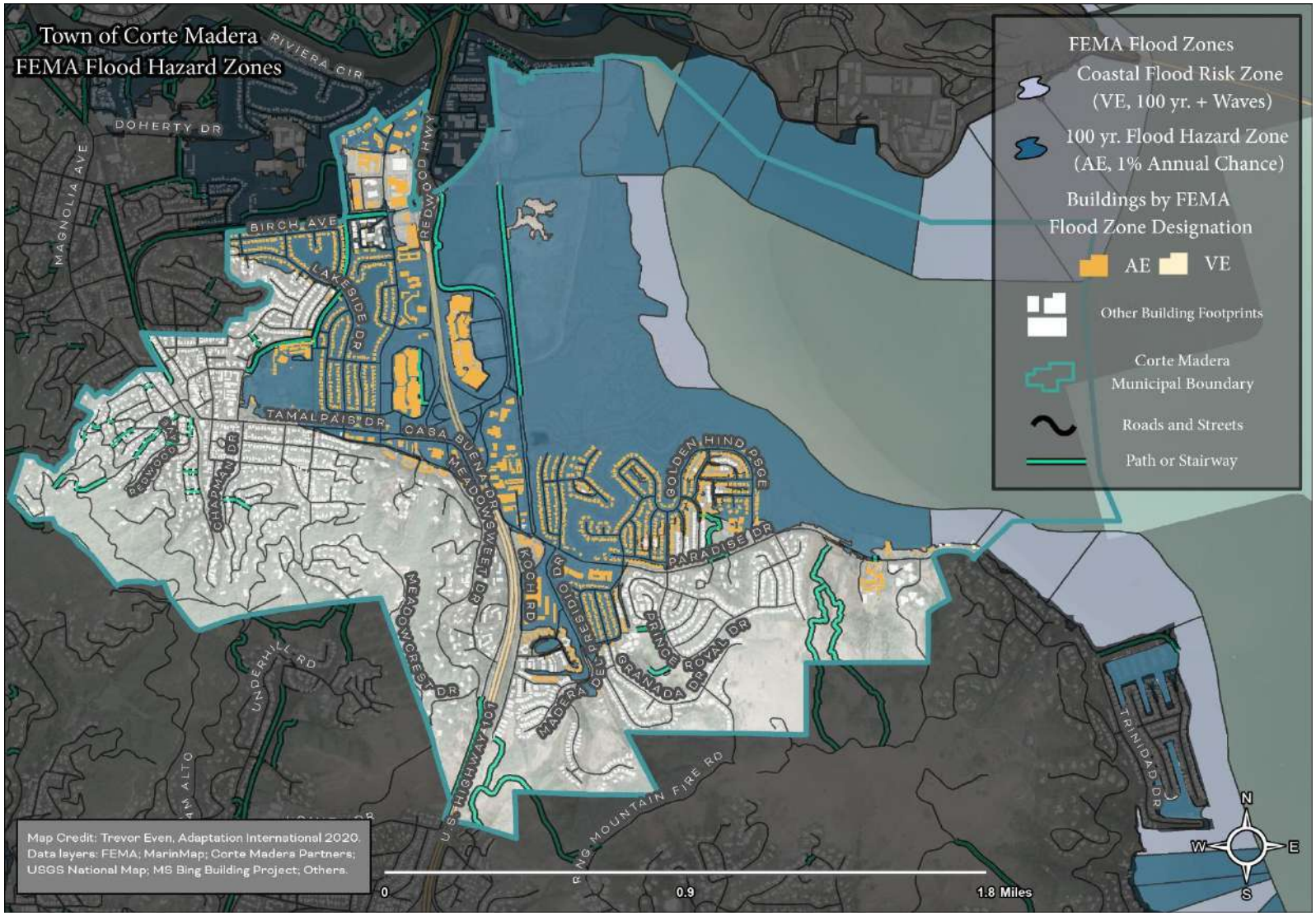

Figure 9 – Map depicting the current FEMA Flood Hazard Classification Zones for 100 yr. (or 1% annual chance of occurrence) flood events, which in this case includes zone types AE and VE.

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