APEASE Heat Interventions Table

Table 2: Interventions Proposed by CHAMPions

Intervention	Practicability / Appropriateness	Effectiveness	Implementation	Affordability / Cost	Spill-Over Effects	Equity
Individual- level						
(None)						
Community – level						
Tree planting: Create areas to plan trees where there is a lot of concrete Visualize the benefits of having trees for groups Incentivize tree planting (policy level); e.g. re-imbursement plans for planting trees		London example reduced temperatures and lower heat attributable deaths(1) London example: trees don't impact air temps as much as surface temps, and may not work in all cities (1) Tacoma example showed ~30 degree F differences in temperature between areas with tree cover/ no tree cover (2)	How to collaborate on cooling strategies across sectors and work within cultural needs (3)		More green space can improve mental health outcomes and has positive influence on physical activity (1) Potential to increase pollen related healthcare costs (1)	Maintaining / increasing tree canopy can be accomplished through equitable, inclusive, and community-engaged approaches (2) Questions around decision-making regarding where people are most vulnerable to heat and how to allocate resources (3)
Reducing mental health stigma Raise awareness about mental health issues (through group sessions in community centers, educating providers on cultural issues around mental health, information al campaigns)	Some participants come from tight-knit communities, but their culture still has stigmas surrounding mental illness. (10	Public disclosure of mental health disorders on social media are can reduce stigma – results were strongest in individuals from middle income countries with low levels of education(7) Arts based programs also	Challenging to find the right balance on length of program and time of day (8) Destigmatization programs used gender inclusive, culturally appropriate materials relevant to student experiences (9)	The online module- based program was described as "low-cost", and required no clinician input (10)	Reduction in anxiety over time, specific to attending the program activities (8) Participants in the online program showed more intentions to seek help after the program than nonparticipants (10)	Social media creates opportunity for contact with minority groups on this issue (7) People in the arts program demonstrated reduced anxiety, showing programs like this can successfully

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Increase the mental health workforce (policy)		demonstrated reductions in stigma across diverse demographic/psychological backgrounds (8) An education based destigmatization program was effective in reducing stigma towards peers in adolescents in different settings – Germany, Vietnam, Cambodia (9)	Schools may struggle with sufficient training for staff, space, competing priorities, and funding. (9) Too much time in between online modules/ lessons can result in participant drop off (10)			bring diverse groups together (8)
Free swimming lessons		Participation in formal free swimming lesson program was associated with an 88% reduction in the risk of drowning in the 1- to 4-year-old children (11)			When parents perceive their children are better at swimming, they may take less caution around water (12)	
Community gardens for chronic disease More community gardens means more green space		Community gardens improve wellbeing and important behavioral risk factors for non-communicable and chronic diseases and increase low to moderate exercise (13) Community gardens can also increase veg and fruit consumption – decreasing unhealthy food intake, and gardeners can spend less on food. (14)	It is a seasonally limited approach in m any locals (15)		Increased social contact (15)	In Missouri case study, those with less than high school education have the highest rates of chronic disease. Suggests that community gardens may be viable method to reduce the chronic disease burden among this population. (14)

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Sharing information on heat risk and reduction strategies Creating interactive billboards Sustained information center (YMCA or library) Outreach to community organizations so they can educate their constituents about heat and health.		Multi-pronged heat action plans highly effective and include early warning systems, building local capacity to identify, prevent, treat and manage HRI, and disseminate information (17)	Recommendations for social media, increasing communication of explicit safety guidelines aligned with the tiered heat-warning system; prioritizing heat advice early on in Facebook posts; and highlighting self-assessment strategies for heat safety (16) Focus on multisectoral engagement (17) Needs to be structured to specific community needs; targeted programs for vulnerable populations require additional resources (volunteers and funding) (17)			stronger efforts to reach out to vulnerable communities and offer concrete advice could encourage stronger public safety in extreme situation (16)
Education on misinformation [through 'circles', community meetings, educational campaigns]	Librarians in a library-based misinformation program think these programs are important and that it is a role of librarians to prevent the spread of misinformation (20)	A majority of program participants trained in fake news and misinformation detection were able to identify misinformation; 70% of students trained said they would not share inaccurate information (18) Game based, vs graphic	One-time trainings may not be adequate, ongoing programming is recommended (18) Librarians may lack skills/ training on technology (20)) Game-based inoculation focuses on texts and images – important to include		Misinformation training may result in participants taking pause before sharing potentially fake information (18)	

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		based, inoculation was more effective in teaching how to identify misinformation, though both methods lowered credibility/ likelihood to share uncredible info (19)	videos in future (19)			
Free healthy lifestyle classes in community centers/public spaces	new park programs can attract users, however new programs alone may not be enough to increase overall park use in low-income neighborhoods at times when the programs are not taking place (24)	Community based free programs promoting physical activity in California (21), Paris (22), and Brazil (23), all found increases in physical activity – especially for women. Participating in the exercise classes increased likelihood of awareness of other park activities (24)	Regularity in programming (weekly) contributed to success (23) Instructor scheduling can present a challenge for consistent scheduling (24) Park staff turnover/ capacity also can be a barrier (24)	the cost of the program was limited to equipment purchases mentoring of students, which required no additional funding. Sustainability depends on a park hiring staff or continuing university partnership (21) Programs around LA were limited to $4000 per park (24)	Classes serve as a visual reminder or encouragement for other people to become physically active, even if they do not participate in the class (21)	Multiple social factors interfere with leisure time physical activity among low-income populations, suggesting modest interventions may be insufficient to overcome these issues. (24)
Host Opportunity Circles → bring individuals together to discuss different success stories						
Health System level						

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Primary care ahead of heat events Ensure individuals see their primary care physician prior to a heat event.	people in one study were interested in receiving advice from doctors on health protection during heat; especially females and people interested in effects on medicine; age7 5+ were very interested (25)	A community health worker heat intervention was associated with decreased unscheduled hospital visits, improved heat literacy and practices but did not impact all-cause mortality. (27)	Lack of knowledge, conversational skills and guidance, and time for clinicians may pose barriers to implementation (26)			People with lower educational attainment were more interested in hearing from doctors (25)
Community navigator programs Increase number of community navigators	The community navigator role was facilitated by patients' expressed need for and acceptance of their services, recruitment of navigators from the patient community, and their training and motivation for the role (30)	Community navigators have shown to be effective for fostering inclusivity and community integration (28), improve access to care (29), provide a suite of add on services (30), while providing a collaborative experience (31). One study found the needs of homeless patients going through palliative care to have their needs met (29).	Relationship building is critical (28) Sufficient time and energy from navigators is required (29) Time is a limited resource for participating families; it's important too to normalize the need for support (31)	Considered a "low-cost approach" but no #s given (31)	The benefits of connecting with someone from a shared language or culture was comforting for participants (31)	Service navigation may represent a more socially just intervention to ensure child safety, permanency, and well-being. (31)
Policy Level						
Energy Assistance Programs	Difference between people who use energy while understanding it impacts income, and	LIHEAP (Low Income Home Energy Assistance Program) is considered an effective tool in mitigating energy	Sliding scale eligibility recommended (4) Personal indoor	The program in Phoenix said budget could adapt to seasonal needs	Fatigue of workforce from constantly turning away applicants (6)	How we assess who needs energy assistance is an equity issue. (4)

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	those who forgo energy use because of income. (4)	insecurity. There are gaps - the need is high and coverage can be low. (5)	temperature preferences differ and may impact implementation (4) Personal relationship with applicants can help with referrals (6)	(plan for more in summer, taper down in winter) (6) Phoenix program didn't specify cost but said more $$ needed to cover all families who qualify for assistance (6)		Low income households tend to be in older buildings (4) Price shifts disproportionately impact Black population (4) In Phoenix ex ample, minority groups require disproportionate assistance (6)
Educating workers on rights in extreme heat		After a culturally tailored worker education and supervisor heat awareness intervention, average knowledge scores increased compared to the comparison group (32). In Abu Dhabi, a program educating workers on heat resulted in a notable reduction in heat related illness over a 2-year period (33). Another construction worker focused program on heat stress, including training acclimatization, hydration, work-rest cycles, cool down stations, emergency preparedness, and environmental	There is often a lack of practical awareness among employers and safety officers on risk factors and protective measures for heat (33) Facilitators to worker's safety include buddy system, environmental monitoring, safety precautions and heat stress communication tools. (34)	Evidence of a reduction in heat-related illness with a low per-capita investment per worker and worksite. Cost of interventions was low (< US$ 0.50 per person covered or US$ 69.85 per workplace or labor residence facility), and employers incurred no direct costs. (33)		Younger workers perceived older worker's extended work period without breaks as a safety issue and highlight need to educate older works on importance of breaks. (34)

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		monitoring was perceived as effective (34)				
Free Internet		The group in one study receiving free Internet access appeared to use the internet for health info and said to benefit from it. (35) In another free internet study, increased empowerment among citizen leaders was attributed to increased access to health information and utilization of that information to address health concerns, including those related to pregnancy, medications, and management of chronic disease (36)			Internet is used for a variety of applications outside of health information (35) Neighbors of participants in the free internet intervention benefitted from their peers' new knowledge (35)	Among those w/o Internet access prior to the intervention, vulnerable populations were equally as likely to search the Internet as those considered less vulnerable & reported similar benefits (35)
Classroom education on heat		A heat and health education program in China found improvements in students and their parents understanding and behavior for adapting to heat waves. (37) In a scoping review of climate change and health education in	Some areas in the curriculum require extra attention/ time (37)		Potential for intergenerational learning (e.g, parents from children) (38)	

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		schools, 5 out of 9 studies found that the interventions impacted knowledge awareness or perceptions (38)				
Funding medical education to increase primary care in low-income communities	Physician vacancy rates in Indian Health Services (IHS) result in poorer care and low morale among workforce, and three existing IHS programs (scholarship program, loan repayment, and a psychology program) are proposed as solutions to address these gaps. (2)	Families participating in National Health Service Corps (NHSC) were more likely to practice in rural areas, health professional shortage areas, or medically underserved populations than those in the Public Service Loan Forgiveness (PSLF) program. (39) Graduates from PRIME-LA program reported a higher intention to practice in underserved areas, to serve underserved populations, and to practice family medicine than in comparator groups. These results support effectiveness of mission-based medical education programs designed to graduate physicians who intend to practice or provide clinical care for underserved communities. (40)	For the IHS Scholarship program, challenges include an individual's responsibility for relocation costs once assigned; problems with placement and position opportunities; and a lack of tax exemption for tuition and school fees (42	In fiscal year 2021, the IHS scholarship program funded 134 new and 121 extension scholarships with approximately $13.7 million (42)	Program participants were more likely to participate in activities (eg, mentoring, public health, community-based learning, and health disparities) aligned with the improvement of underserved communities, during medical school (40) More/ stronger partnerships with educational institutes (42)	Medical students participating in the NHSC were more likely than those in the PSLF program to come from underrepresented groups (30) California is experiencing a shortage of primary care physicians, most acutely felt by underserved and minority populations. To tackle this, the state needs to implement new programs like PRIME to train a workforce that aligns with the state's population (40)

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Rental Assistance Programs		New Haven program found recipients of rental assistance to have lower odds of reporting housing instability, low quality housing, lack of housing autonomy compared to those not receiving assistance. (43) those receiving rental assistance report significantly less psychological distress than those on waiting lists (44) In another study, tenants with rental assistance were less likely to experience food insecurity and consumed 0.23 more cups of daily fruits and vegetables compared to those without assistance (45) Another study focused on the chronically homeless population found access to rent assistance helps to promote recovery outcomes (46)	Individuals receiving vouchers only have 60 days to find a qualifying unit that accepts voucher payments, and passes HUD certification. Even in areas with ample affordable rentals, individuals may face challenges identifying landlords that accept vouchers. (44) application process and eligibility requirements can prevent a barrier for many; landlord discrimination and housing affordability (46) relationship between rental assistance program participants and staff is important (46)		The waiting period to obtain assistance can be harmful for low income adults' mental health (44) The unmet need for rental assistance and long waitlists as a result have negative health implications, including decreased food security (45) Participants in the program described a wide range of new future goals (46) The attention from these efforts may create more opportunities for housing and raise awareness about matters of homelessness and mental illness in the community (46)	Food insecurity and affordable housing challenges are unequally borne by communities of color owing to an ongoing history of discriminatory employment, incarceration, and housing policies and practices. (45)
Land Trusts		Land in urban areas is often more expensive to purchase and more	In the volunteer model, maintaining volunteer interest, unreliable	In the volunteer model study: a majority of	Land trusts can lead to increasing property	the following to be associated with greater likelihood of reporting

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		degraded than comparable parcels due to issues like poor soil quality or generations of habitation and intensive use. (47) A study of volunteer-based land trust model found that volunteers collect a wide range of data and engage in a variety of data collecting activities. A high % of volunteers also return year after year which helps with service continuation (48) In another study, the land trusts evaluated reported success in terms of the amount of land protected and the money raised (49)	data, and cost are all cited as common barriers to implementation (48)	programs operate on less than $1000 annually and 32.5% operate for less than $100 annually (48) By choosing to protect land in urban areas, land trusts may quantitatively protect "less" at a dollar-for-dollar level in terms of conservation impact (47)	values in nearby areas (47)	justice, equity, and access impact: protecting land in urban areas, drawing on a broad base of volunteers and visitors, and prioritizing local community work over broader landscape-scale conservation efforts (47) local partnerships with community organizations was described as a critical aspect of l equity work (47)
More accessible public transportation						
Incentivize rental property owners to weatherize with heat in mind						
City officials host meetings in the community (build trust)						

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Legislative sessions have virtual option (more participation)						
Permit access for "green" buildings/construction						
Expand access of time for cooling center/for visitors at rental spaces						

King County Extreme Heat Mitigation Strategy Interventions

Intervention	Practicability / Appropriateness	Effectiveness	Implementation (Recommendations in the Plan)	Affordability / Cost	Spill-Over Effects	Equity
Individual- level						
(None)						
Community – level						
Community-led Cooling Spaces	Considered directly responsive to priorities identified by community members during engagement efforts. Community-trusted facilities are uniquely positioned		This action calls on action partners to support the development of more community-trusted cooling locations via the following activities: 1. Work with frontline community partners to identify potential locations and site hosts 2. Equip community		Resilience Hubs specifically help communities to be more resilient and to prepare for hazards beyond heat (ex: wildfire smoke, earthquakers, etc)	

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	to serve as cooling locations that are culturally compatible and attuned to the needs of their high-risk community members.		facilities with the necessary resources and upgrades to serve as a cooling location. 3. Train community-based organization staff to organize and operate cooling locations 4. Support the creation of Resilience Hubs.			
Cool Kits for Unhoused People	Unhoused people often bear the worst of extreme heat due to a lack of access to hydration, shade, and indoor facilities with cooling. This action seeks to reduce heat-related illness and the adverse impacts of extreme heat through the direct distribution of personal cooling items delivered as close as possible to where the residents are located. Considered directly responsive to priorities identified by	During the 2021 Heat Dome and 2022 heat events, the King County Regional Homelessness Authority (KCRHA) worked with service providers to distribute cooling resources directly to unhoused residents in King County. Setting up cooling tents and directly providing cooling resources such as cold water, cooling towels, UV protective clothing, sunscreen, and other personal cooling items to vulnerable individuals in the form of "Cool Kits" helped bring heat relief to unhoused residents wherever they were sheltering.			Strengthening coordination between KCRHA, local govt, and other partners.	This work will promote heat safety and reduce the potential for heatrelated illness in communities that are the most prone to adverse health impacts

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	community members during engagement efforts.					
Multilingual Communication	While the availability of heat and health information, including in-language resources, has increased in recent years additional work is needed to help ensure that information is reaching households and communities with limited English proficiency, many of whom live in the hottest areas of the county.	Ex: The *Stay Safe in the Heat* mini comic book designed by PHSKC and University of Washington. It provides guidance for preventing heat illness during hot weather, and it is available in 11 different languages apart from English	1. Co-create more comprehensive and culturally relevant heat preparedness and mitigation content 2. Expand public, private, and community networks and formats for distributing heat safety and preparedness messaging prior to and during heat waves.			Analysis of King County's heat island map shows that the top 20 percent hottest areas in King County have the highest proportion of limited English-speaking residents over the age of 18 relative to other mapped heat areas
Heat Resilience Trainings	Community-based organizations and service providers who work directly with heat-sensitive populations, and/or caregivers are uniquely positioned to help provide information and training within their communities on identifying and		1. Develop a Community Climate Resilient Housing Curriculum 2. Create additional heat safety awareness and preparedness trainings 3. Provide a training point of contact for community organizations			

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	mitigating heat-related risks Considered directly responsive to priorities identified by community members during engagement efforts.					
Health System level						
(None)						
Policy Level						
In- home heat safety	Considered directly responsive to priorities identified by community members during engagement efforts.	In 2022, Oregon passed legislation (Senate Bill 1536) requiring the Oregon Health Authority to create a program for distributing portable air filters and air conditioning (AC) units to residents who qualify for medical assistance through the Oregon Health Authority, the Department of Human Services, or Medicare. This program was set to distribute approximately 3,000 AC units and 4,700	Increase access to portable air conditioners and other lower cost options for cooling Support passive cooling approaches such as interior or external shades and ultraviolet reflective window films to help reduce interior heating Expand in-home heat safety support for low-income seniors, people with disabilities, and homebound individuals			Implementation of this action should prioritize low-income individuals in identified heat islands.

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		air filtration devices in 2023.				
Heat Pump Installations	Considered directly responsive to priorities identified by community members during engagement efforts.	Multiple model programs and initiatives in the Puget Sound have successfully installed heat pumps in low- to moderate-income homes. Examples include Energy Smart Eastside, Seattle's Clean Heat, and King County's Energize! programs	1) Expand individual installation programs to cover additional households or wider geographic areas . Engage multifamily landlords to increase enrollment of their properties in heat pump programs while ensuring rent protections for tenants. b. Pursue distributor rebate programs, point-of-sale rebates for homeowners for equipment meeting specific requirements, and reduced installation costs. c. Develop a larger King County-wide heat pump program that allows cities to pool funding with King County to support installations. This would need additional staff support or sufficient funding to contract with a consultant or nonprofit provider	In 2024, King County was awarded $1.5 million to install heat pumps in Adult Family Homes (AFHs) in King County. King County anticipates that the grant will fund heat pump installations in 50 to 60 AFHs, helping up to 360 persons.		The example of the AFH heat pump program will help address community needs by supporting primarily low-income seniors and lower-wage workers or AFH operators with cooling services and improved indoor air-quality, while also reducing fossil fuel consumption and greenhouse gas emissions from improvements to targeted AFH facilities
Enhanced Cooling Centers	Considered directly		a. Collaborate to identify and address			Implementation of this action will be

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	responsive to priorities identified by community members during engagement efforts.		gaps in cooling centers services and transportation access. b. Promote and advertise transit options to and from extreme weather respite locations. c. Provide additional incentives such as snacks, bottled water, Wi-Fi access, and the ability to charge devices at cooling centers. d. Increase communications related to cooling center options during heat events, including information on disability accessibility. e. Budget additional funding for staff and operation costs to accommodate longer access to cooling centers.			prioritized in lower income neighborhoods that are identified heat islands based on temperature mapping
Maximize Tree Survival		Newly planted trees generally require a two to three-year establishment period for the tree to generate a healthy root system and adjust to the planting	a) Establish & update guidelines to meet industry standards/ best practices. b. Build capacity to assign a staff point of			

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		location. Poor site conditions, environmental stress, improper planting techniques, and inadequate watering and care during this critical period contribute to low survival rates	contact. c. Test and share innovative planting and watering techniques, . d. Collaborate with regulatory agencies to streamline permitting and build partnerships with utility companies to coordinate tree planting activities and minimize underground conflicts.			
Track Equitable Canopy Cover		One of the most valuable tools available to local jurisdictions and community stakeholders for understanding, managing, and enhancing the ecological, social, and economic benefits of urban trees is an Urban Tree Canopy (UTC) assessment. UTC assessments systematically evaluate the extent and distribution of tree cover within an urban area. These assessments help identify disparities in tree canopy coverage and areas suitable for planting, especially in relation to identified heat areas. Repeated assessments can	a. Consistent, standardized & comparable data developed using replicable methods; b. Collaboration to acquire County-wide Light Detection and Ranging (Lidar) mapping and aerial imagery, updated at regular intervals; c. Guidance on using data d. Updated UTC assessment every five years; e. Translation of data			Some jurisdictions lack the resources to comprehensively set and track canopy goals essential for equitable distribution across neighborhoods and management zones. This emphasis on equity is critical given the disproportionate impact of high heat events on marginalized communities

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		help jurisdictions track tree canopy over time and inform ongoing project implementation.	into plans with specific goals and strategies that address high heat and low canopy neighborhoods; f. Effective ways to communicate UTC assessment results and trends to agency leadership and the public;			
Open Space Access	Considered directly responsive to priorities identified by community members during engagement efforts.		1. Increase and protect open space via acquisition. 2. Utilize depaving to reduce impervious surface and create space for urban greening. 3. Leverage planned investments in stormwater parks and green stormwater infrastructure to increase green space and access to shaded outdoor spaces in heat islands.			One of the key markers of heat islands is a lack of tree canopy and open space relative to cooler locations. Hotter areas of the county also have a higher proportion of residents living below 200 percent of poverty level. This action supports reduction of the heat island effect by increasing, protecting, and maintaining accessible open space, particularly in lower income communities and identified heat islands.
Cool Schools	Considered directly responsive to priorities		1. Providing training and information resources related to heat.		The initiative also seeks to incorporate co-benefits with other weather and pollution-related	Implementation of the above actions could have the most benefit for older facilities located in identified

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	identified by community members during engagement efforts.		2. Promoting infrastructure upgrades and maintenance. 3. Increasing green spaces and shading on school campuses. 4. Incorporating heat resilience in policies and facility design standards. 5. Supporting Cool Schools implementation.		concerns (such as wildfire smoke) and energy reduction goals of schools.	heat islands to address the most at-risk communities
Building & Development Codes	Developing codes that improve thermal comfort or increase heating and cooling efficiencies help to ensure access to more energy efficient buildings over time. Building codes can also help reduce the heat island effect by reducing overall thermal loading on buildings	Example of NYC's Cool Corridors (2021) - streets with features that help lower ambient temperatures and provide relief from extreme heat to street users. These features include shade canopies, trees, and reflective surface treatments which lower the air temperature and fans, drinking fountains, and water misters which lower users' body temperature. Used in combination along a corridor, these features can have a great impact.	1. Develop a King County heat mitigation building code package 2. Promote adoption of model codes in the State Building Code 3. Support King County jurisdictions in adopting codes locally as needed.		Anticipated building codes will have co-benefits with building decarbonization, reducing greenhouse gas emissions, and smoke and indoor air quality improvement	Integrating heat mitigation into building codes ensures more King County residents have access to green building benefits, not just those with economic means
Heat Smart Parks & Playgrounds	Parks and playgrounds are frequently preferred outdoor locations for cooling off when it is hot,	A recent project at Riverview Park in Snoqualmie aimed to replace aging playground equipment while maintaining and enhancing	1. Develop and implement best practice guidelines for designing and/or retrofitting parks and playgrounds for heat			

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	particularly for youth, families with young children, and other residents who lack air conditioning and who are looking for a low or no cost alternative to hot indoor temperatures. Community engagement participants frequently cited parks as the most likely place they would go when it is hot outside. Participants also identified heat-related improvements to parks as a priority	canopy cover and shade around the playground. Five mature trees were preserved by protecting their Critical Root Zones (CRZ) including a Norway maple directly adjacent to the playground. Two smaller trees were removed. Seven new trees were planted, including coastal redwood, swamp white oak, yellowwood, and blue Atlas cedar	2. Incorporate heat safety programming and amenities in parks during summer months 3. Increase access to recreational areas that contain pools, water features, or beaches			

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