

# Land Use and Development Objectives to Mitigate Flooding and Heat Impacts

Cambridge, MA Climate Resilience Zoning Task Force

	<b>Land Use/Development Objectives</b>	<b>Heat-Related Benefits</b>	<b>Flooding-Related Benefits</b>	<b>Issues/Considerations</b>
	What are the types of outcomes that we would like property owners to achieve through redevelopment of sites? Which are the most important to achieve?	How do these outcomes help to mitigate heat island effects, and to what extent will they benefit the city?	How do these outcomes help to mitigate flooding impacts, and to what extent will they benefit the city?	What practical issues are raised by these desired outcomes? What are the potential tradeoffs with other City development objectives?
<b>1. Elevate and Floodproof</b>	<b>Protect flood-sensitive uses such as residential units and critical building systems by elevating above future design flood elevations or dry floodproofing where below future design flood elevations</b>		Ensure health and safety during current and future flood events on a particular site	Affects other development outcomes such as building heights, use of basements
<b>2. Design to Recover</b>	<b>Design buildings to withstand or recover from projected flooding (e.g. wet floodproofing, temporary barriers, water-resistant or replaceable materials)</b>		Reduce impacts due to future flooding (e.g., health and economic impacts), foster faster recovery	Performance-based options allow for solutions with different cost implications, but need more holistic review
<b>3. Green Infrastructure</b>	<b>Use green infrastructure (e.g., swales, wetlands, green roofs) in addition to gray infrastructure (e.g. storage tanks) to manage stormwater on-site</b>	Green infrastructure can have co-benefits for heat mitigation (see below)	Manage flooding and minimize impact on the public stormwater system; improve water quality	Green infrastructure may occupy more space on a lot, balance with other uses that occupy site area
<b>4. Preserve Vegetation</b>	<b>Preserve existing vegetation (e.g. trees, ground cover, planted roofs)</b>	Provide shade and planted surfaces to reduce heat absorption	Help manage stormwater on-site, reduce peak runoff, improve water quality	Difficult to ensure maintenance through zoning
<b>5. Create Vegetation</b>	<b>Create new vegetated areas (e.g. trees, ground cover, planted roofs) and design so that plantings can thrive over time</b>	Provide shade and planted surfaces to reduce heat absorption; improve air quality	Help manage stormwater on-site, reduce peak runoff, improve water quality	Balance with other uses that take up site area, including required uses such as parking
<b>6. Limit Paved Areas</b>	<b>Limit amount of paved area, increase permeable area</b>	Reduce heat absorption	Help manage stormwater on-site, reduce peak runoff, improve water quality	Balance with required functions that need paving (e.g., parking, accessible walkways)
<b>7. Provide Shading</b>	<b>Provide shade with trees or structural shading where trees are infeasible, especially over paved areas</b>	Decrease air temperature, including in public realm (streets & sidewalks); trees can also improve air quality		Structures can impact floor area and setback limitations
<b>8. Use Reflective Surfaces</b>	<b>Use solar-reflective surface materials for roofs, buildings, and paved surfaces to the extent possible</b>	Decrease air temperature, including public realm (streets & sidewalks)		Balance with other functions such as solar PV; materials difficult to regulate through zoning
<b>9. Promote Passive Resilience</b>	<b>Incorporate “passive resilience” features including high performance building envelope, shading, natural ventilation, and limit air leakage</b>	Sustain occupant comfort and health during heat events with minimal energy use	Ensure that occupants are able to safely stay inside during a flood event that involves loss of power	May need a more holistic review process
<b>10. Shelter in Emergencies</b>	<b>Provide spaces for sheltering and services during extreme events</b>	Provide refuge during extreme weather events to occupants of the building; could be part of an area-wide strategy	Ensure that occupants of the building are able to safely stay in the building during a flood event; could be part of an area-wide strategy	More practical for larger developments
<b>11. Create Emergency Plans</b>	<b>Create emergency plans with protocols to implement during an extreme weather event, where practical</b>	Ensure health and safety during extreme heat events for occupants of the building; could be part of an area-wide strategy	Ensures health and safety during flood events for occupants of the building; could be part of an area-wide strategy	Programmatic strategies are possible where there is a holistic review process and project-specific conditions can be imposed

<b>12. Implement Area-Wide Strategies</b>	<b>Achieve the above results across larger areas (e.g., protective berms, elevated infrastructure, larger-scale green infrastructure, pooled open space, neighborhood preparedness plans)</b>	Provide cooling benefits at a larger scale than an individual building or site	Provide flood protection at a larger scale than an individual building site	May be practical for development at very large scales or when costs can be shared
<b>13. Produce Co-Benefits</b>	<b>Promote objectives with other environmental benefits, such as reducing energy demand, greenhouse gas emissions, and auto trip generation; and increasing renewable energy production</b>	Mitigating the causes of climate change indirectly reduce heat gains and promote air quality	Mitigating the causes of climate change indirectly reduce instances of flooding and promote water quality	Need to balance incentives for climate change mitigation and resilience (e.g., green/white roofs vs. rooftop solar energy systems)