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波士顿：海之巨变展览
SEA CHANGE: BOSTON EXHIBITION

Sasaki设计事务所 / Sasaki Associates, Inc.

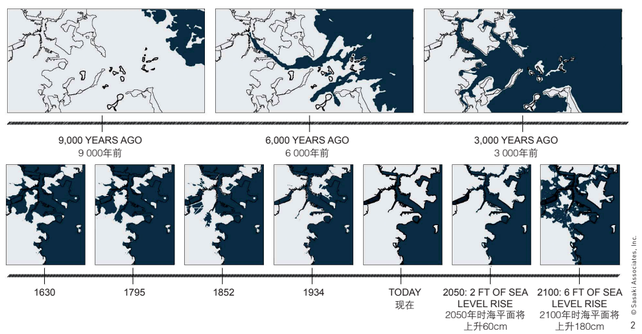
1. “波士顿：海之巨变”展览形象设计
2. 波士顿湾自冰河时代起的海岸线演变

1. Image design of the *Sea Change: Boston* Exhibition
2. Boston Harbor's evolution since the ice ages

对海平面上升的预测因地而异，主要取决于当地的地质条件。美国东北地区极易受到海平面上升的影响，观察结果显示，该地区的海平面上升程度是全球平均水平的3~4倍。除了上述全球性预测外，至2100年，墨西哥暖流也可能使该地区的海平面上升约15~23cm。

在波士顿，海平面上升已然发生。在过去的一个世纪中，波士顿的海平面已经上升了约30cm；据预测，到本世纪中叶，海平面将升高50cm，而到2100年时，将升高约152cm。届时新的潮汐线将令大波士顿地区的景观发生巨变，并增加大都市区遭受大型风暴侵害的概率。

Sasaki拥有在美国及世界各地处理滨水空间的丰富经验，设计师们认为有必要对气候变化、海平面上升和弹性规划等问题进行更广泛、深远的思考。在超级飓风桑迪与波士顿擦肩而过后，Sasaki意识到波士顿的弹性规划应未雨绸缪，而不是等到自然灾害发生后才有所改变。波士顿尽管拥有科德角和海港群岛这样的天然屏障，但历史上也经历了多次大型飓风和东北风暴的侵袭。然而，到目前为止，波士顿决策讨论在很大程度上缺少设计师的参与——在了解并提升整个城市独特场所感的同时，在为波士顿制定一个



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摘要

“海之巨变”是一项针对海平面上升发起的研究，其旨在为大波士顿区域的海岸线提出一种长期的弹性策略。该项目团在Sasaki设计事务所的跨学科实践的基础上，与工程专家、学者、拥护人士及政策制定者展开合作，以在建筑、城市和区域尺度上进行准备规划。Sasaki策划了一场名为“波士顿：海之巨变”的展览，以向人们展示这一研究，尤其向公众强调了波士顿地区的薄弱所在，并展示了以提升地区弹性的设计策略。与展览相关的活动和数字媒体进一步促进了设计师、城市官员、房地产界代表与学者在位大波士顿地区制定一个弹性规划这一议题上进行对话。

关键词

数据挖掘；数据可视化；海平面上升；教育；区域弹性

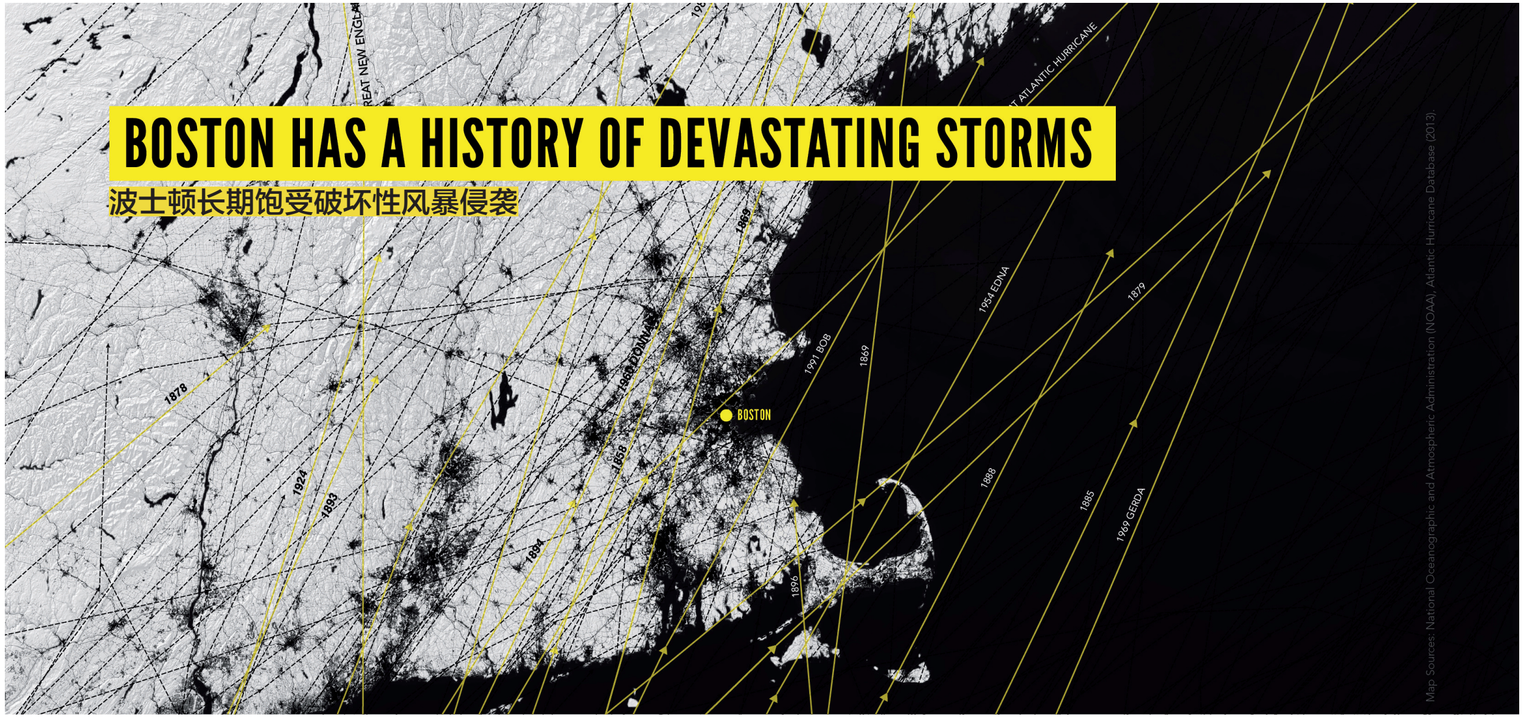
ABSTRACT

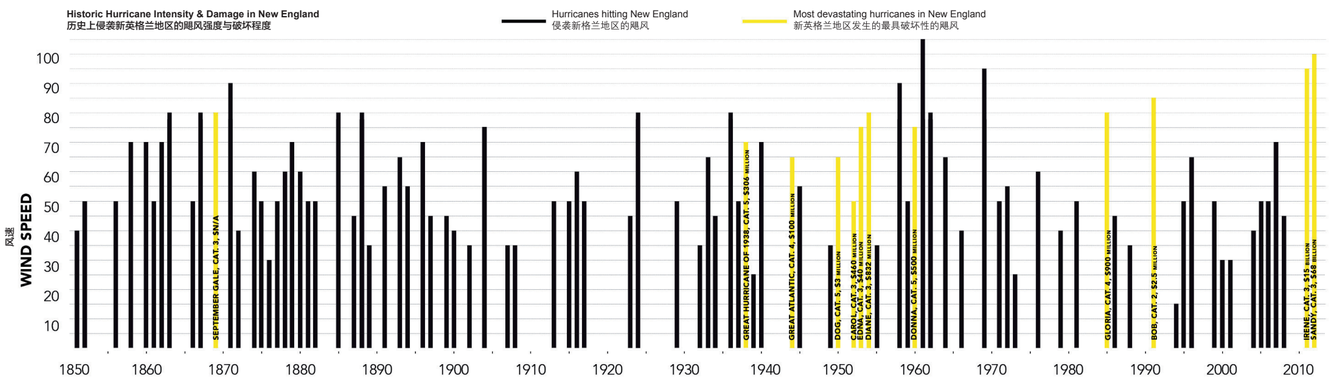
Sea Change is a research initiative on sea level rise that advocates for a long-term coastal resiliency strategy for the Greater Boston area. The Sea Change team tapped into Sasaki's interdisciplinary practice and also collaborated with experts in engineering, academia, advocacy, and policymaking to engage in preparedness planning at the building, city, and regional scale. Sasaki curated an exhibition, *Sea Change: Boston*, to showcase this research, highlighting Boston's vulnerabilities and demonstrating design strategies for resilience. Events and digital media associated with the exhibition catalyzed a conversation among designers, city officials, real estate leaders, and academics about a specific call to action: to develop a regional resiliency plan for the Greater Boston area.

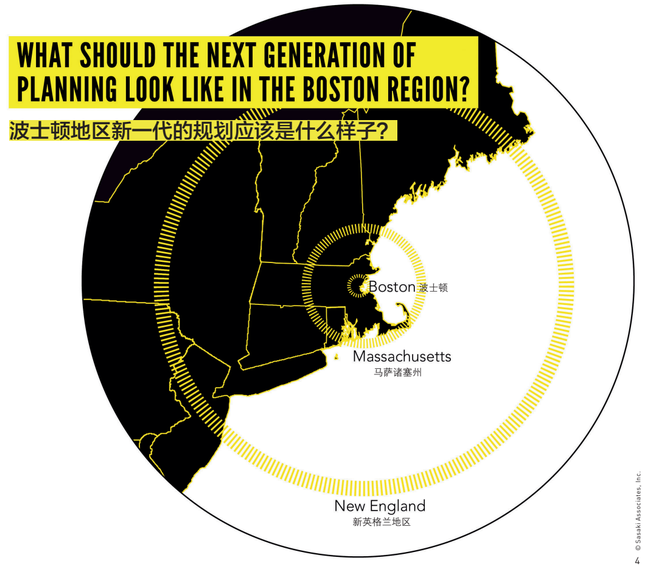
KEY WORDS

Data Mining; Data Visualization; Sea Level Rise; Education; Regional Resiliency

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EDITED BY Tina TIAN
TRANSLATED BY Robin SUN　Tina TIAN







Map Sources: National Oceanographic and Atmospheric Administration (NOAA), Atlantic Hurricane Database (2013).

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3. 波士顿长久以来一直饱受风暴侵袭。地图数据来源：美国国家海洋与大气管理局(NOAA)、大西洋飓风数据库（2013年）。
4. 海平面上升将会对波士顿及更广泛的地区带来连锁效应。

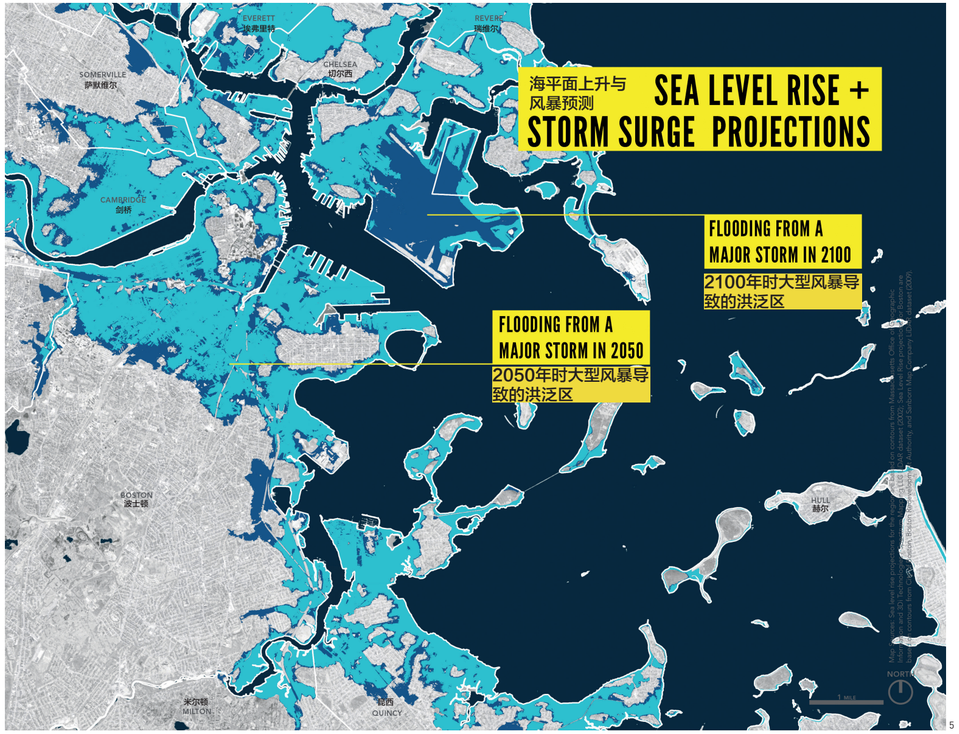
3. Boston has a history of devastating storms. Map sources: National Oceanographic and Atmospheric Administration (NOAA), Atlantic Hurricane Database (2013).
4. Sea level rise will have a ripple effect within and beyond Boston.

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展览场地：
美国马萨诸塞州波士顿市会展中心
策展方：
Sasaki设计事务所
合作组织：
波士顿建筑学院、波士顿市政府、波士顿港口协会、波士顿市区会展厅
指导委员会：
Steve Brittan、Robert Culver、Gina Ford、Jason Hellendrung、James Miner
项目核心团队：
Nina Chase、Chris Merritt、Ruth Siegel、Carey Walker
研究与筹备时间：
2013年2月~2014年6月
展览时间：
2014年4~6月

EXHIBITION VENUE:
District Hall, Boston, Massachusetts, USA
CURATOR:
Sasaki Associates, Inc.
PARTNERS:
Boston Architectural College, The City of Boston, The Boston Harbor Association, District Hall
STEERING COMMITTEE:
Steve Brittan, Robert Culver, Gina Ford, Jason Hellendrung, James Miner
CORE PROJECT TEAM:
Nina Chase, Chris Merritt, Ruth Siegel, Carey Walker
RESEARCH AND PREPARATION PERIOD:
February 2013 – June 2014
EXHIBITION DURATION:
April – June 2014



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5. 海平面上升与风暴预测。地图数据来源：地域性海平面上升预测基于美国地理信息与3D信息技术马萨诸塞州办公室提供的等高线地图，以及美国Spectrum Mapping公司提供的LiDAR数据库（2002年）；波士顿地区海平面上升预测基于波士顿市政府、波士顿重新开发管理局提供的等高线等图，以及美国Sanborn Map公司提供的LiDAR数据库（2009年）。

5. Sea level rise and storm surge projections. Map sources: Sea level rise projections for the region are based on contours from Massachusetts Office of Geographic Information and 3Di Technologies / Spectrum Mapping LLC LiDAR dataset (2002); Sea level rise projections for Boston are based on contours from City of Boston, Boston Redevelopment Authority, and Sanborn Map Company LiDAR dataset (2009).

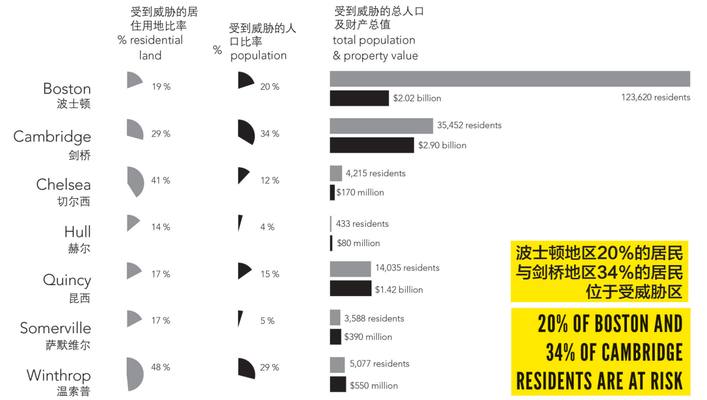
符合当地条件、可实施性强且行之有效的可增加区域弹性的解决方案方面，设计师的角色至关重要。

以为大波士顿地区制定一个长期的弹性策略为目标，设计师发起了一项关于海平面上升的研究，名为“海之巨变”。该项目团队在Sasaki设计事务所跨学科实践的基础上展开准备规划。该项目需要进行大量的数据收集、整理、管理和分析等工作。为了评估波士顿在海平面上升方面的脆弱性，团队对高精度的高程数据、海岸线特点和水资源管理基础设施信息进行了整合。在认知风险等级并绘制成图后，团队合成了几十个专题数据库，以了解波士顿地区关键的基础设施系统——包括医疗设施、治安管理、消防响应、能源网和交通基础设施——可能遭受的破坏影响。

“海之巨变”项目的研究工作持续了一年半的时间。在此期间，团队与科学、宣传与政策制定方面的专家展开了合作。此外，学术伙伴关系的建立作为理念生成的推动力为项目提供了积极的智力支持。2013年6月，在Sasaki年度实习生研讨会期间，学生们就海平面上升的影响进行了研究，并为波士顿南部社区设计了具体的解决方案。2013年秋，波士顿建筑学院景观设计系的自然系统设计工作室基于这些研究成果，为波士顿

6. 可能遭受侵袭的居住人口分析图。

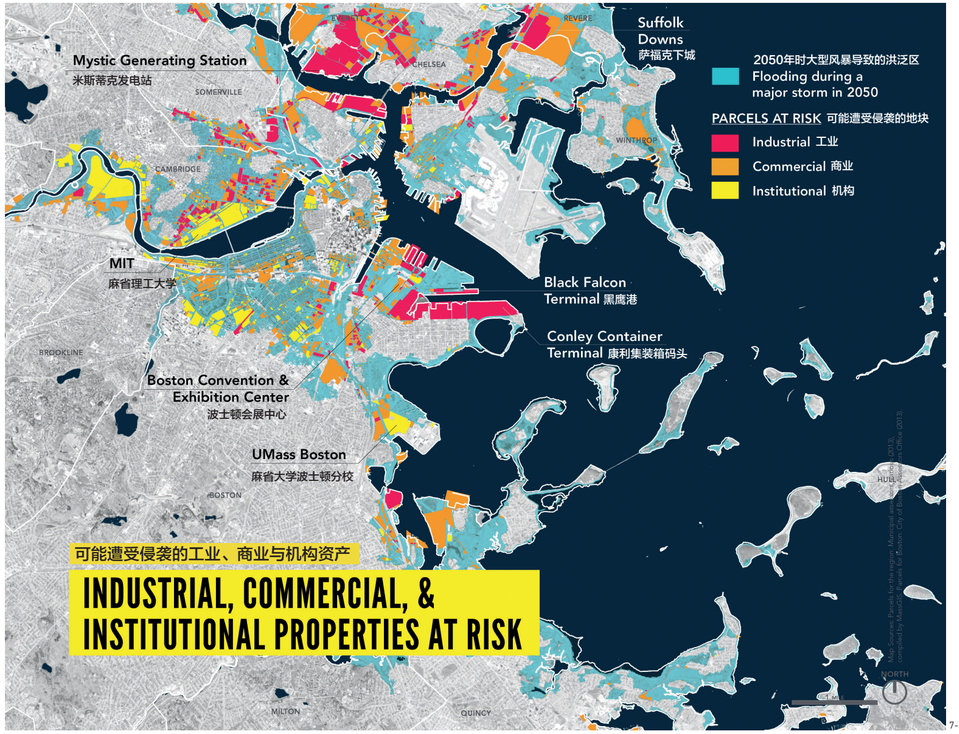
6. Residential populations at risk



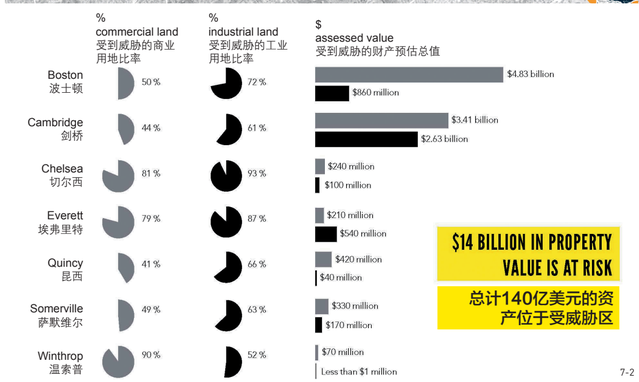
6-1



6-2



7-1



7-2

7. 可能遭受侵袭的工业、商业与机构资产。地图数据来源：地域性地块资料由多个市政资产评估机构提供（2013年），由马萨诸塞州地理信息系统管理局编绘；波士顿地块资料由波士顿资产评估办公室提供（2013年）。

7. Industrial, commercial, and institutional properties at risk. Map Sources: Parcels for the region: Municipal assessors, various (2013), compiled by MassGIS. Parcels for Boston: City of Boston Assessors Office (2013).

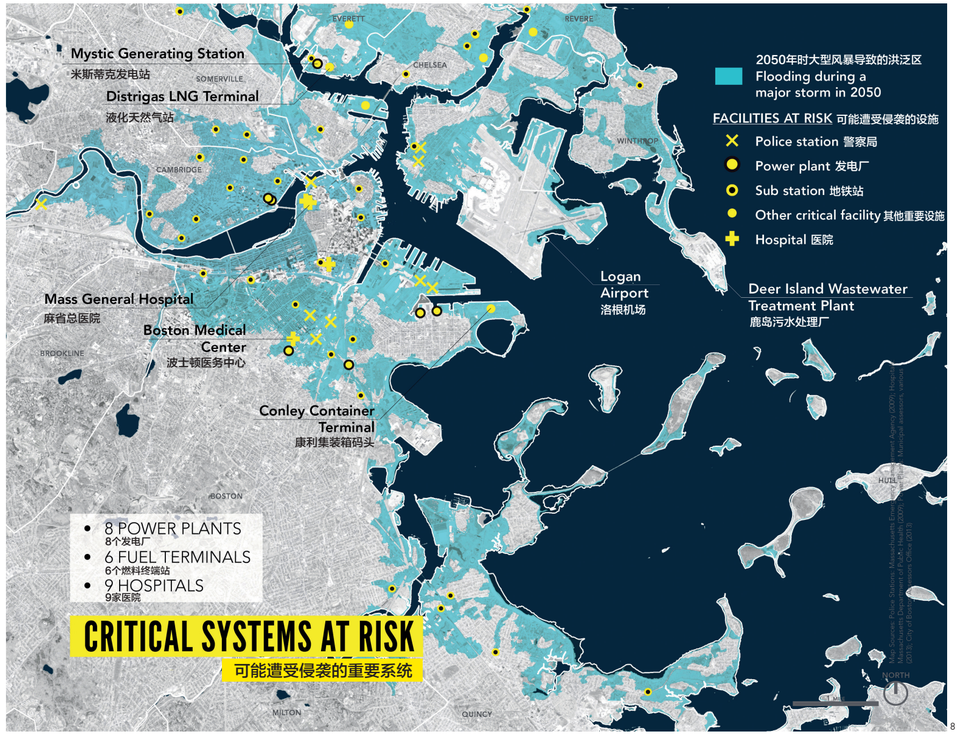
东部社区制定了弹性策略。当地海岸工程师、设计师与波士顿港口专家也为研讨会和自然系统设计课程的工作贡献了他们的见解和专业知识。

“海之巨变”强调我们对关键城市系统的考量必须跳脱出市政边界。从交通路网、能源网，到商业区和历史街区，波士顿的城市系统错综复杂地交织在一起，很容易受到水位上升的威胁。该项目研究包括对波士顿地区的海平面上升范围，及其对波士顿土地利用、人口、交通系统及其他可能遭受侵袭的系统影响范围进行了识别，并绘制成图。“海之巨变”团队在全市范围内对居民进行了走访、记录，并对公众关于海平面上升的意识进行了解。这些采访以一系列的照片、视频和文章的形式予以呈现。

除了记录海平面上升的威胁，“海之巨变”项目还在建筑、城市和地域尺度上提出了前瞻性的设计和规划战略。从浮动公寓楼到可吸收、引导洪水的公园，世界各地的设计师和工程师纷纷想象和制定应对海平面上升的弹性解决方案。研究表明，弹性的设计策略可以令波士顿的建筑和基础设施能够在风暴侵袭后迅速恢复，并适应上涨的潮水。该研究提出了分类策略、案例研究，并以切实可行的解决方案加以说明，旨在保护波士顿地区边缘地带不受侵袭的同时，提升滨水地带的活力和连接性，并推动经济发展。2014年春，一场名为“波士顿：海之巨变”的展览对该项目的研究成果予以了展示。此

8. 可能遭受侵袭的重要系统。地图数据来源：警察局资料由马萨诸塞州应急管理局提供（2009年）；医院资料由马萨诸塞州公共卫生局提供（2009年）；发电厂资料由多个市政资产评估机构（2013年），及波士顿资产评估办公室提供（2013年）。

8. Critical systems at risk. Map sources: Police Stations: Massachusetts Emergency Management Agency (2009); Hospitals: Massachusetts Department of Public Health (2009); Power Plants: Municipal assessors, various (2013), City of Boston Assessors Office (2013).



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WHAT ARE THE OPTIONS?

有哪些方案可供我们选择?



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展览于波士顿会展中心举行。

“波士顿：海之巨变”展览旨在以一种清晰、易懂、平衡的方式向公众传播海平面上升和弹性等复杂问题，以提高公众意识、鼓励在城市和地域尺度采取行动。这项复杂的研究分为7个简明的主题：

（1）“海平面上升的原因”：这一主题对海平面上升原因予以说明，并对上升程度进行了预测。

（2）“已发生的风暴”：这一主题对潮汐、飓风和东北风暴在海平面上升的情况下的影响进行了探究。

（3）“会有哪些风险？”：这一主题对易受侵袭的系统、能源网和交通网络进行了分析，并对位于风险范围内的居民区进行了调查。

（4）“棘手的问题”：这一主题提出了该地区长远规划中的问题和替代方案。

（5）“社区参与”：这一主题突出了展览的协作和学术过程。这个主题对波士顿沿海地区居民的肖像，2013年实习生研讨会和2013年波士顿建筑学院自然系统设计工作室的预见性设计进行了展示。

（6）“设计战略”：这一主题展示了真切的景观和建筑，以及可以适应于波士顿的建筑设计的战略和案例研究。

（7）“大思维”：这一主题呼吁我们需要一个区域性的规划方案。

本次展览将“海之巨变”项目的研究成果通过图像和交互媒体向波士顿的广大民众进行传播，并与包括波士顿市政府、波士顿港口协会和波士顿建筑学院在内的有关组织建立了合作伙伴关系，在波士顿全市范围及设计界激起了广泛对话。与该展览相关的活动和数字媒体进一步促进了设计师、城市官员、房地产界代表与学者在大波士顿地区弹性规划制定这一议题上进行对话。

除了该实体展览外，“波士顿：海之巨变”还以数字作品的形式存在。交互式地图[1]的开发可供参观者和网络用户在对海平面上升和风暴潮预警进行探索的同时，能够查看有关城市薄弱系统的分析。该展览还设置了二维码，参观者可由此登陆到“波士顿绿叶”竞选活动的网页。可供在线观看的“社区参与”视频包含对波士顿当地居民和经营者的采访，反映他们的担忧和对海平面上升的认识。在“反思弹性”系列博客中，来自各行各业的从业者们对于弹性规划各抒己见。多个基于社交媒体的活动——#SummerofSLR、#SemesterofSLR、and #SeaChange——也成为了研究海之巨变的数字化平台。

展览同期还举办了一场名为“波士顿：海之巨变”的研讨会。根据展览的几个主题，该为期一天的会议由三个分会组成，促进了设计师、城市官员、房地产代表和学者之间的交流。在“波士顿：海之巨变”获得成功的基础上，设计师们继续推进沿海地区弹性规划的公众参与。除了对相关组织产生影响外，“海之巨变”研究项目也影响了Sasaki在可持续性和弹性规划方面的实践。该项目亦对众多总体规划和建成项目提供了支持和补充。**LAF**

① 关于该地图的更多信息请浏览http://seachange.sasaki.com/map。

9. 应对风暴的不同策略
10. 设计策略

9. Different strategies addressing the storm issue
10. Catalog of design strategies

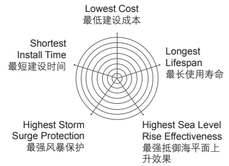
Projections for sea level rise vary regionally due to local geologic conditions. The Northeast is especially vulnerable to sea level rise with observed rates 3 to 4 times higher than the global average. In addition to the global projections, the warming of the Gulf Stream could add 6 to 9 inches of sea level rise by 2100.

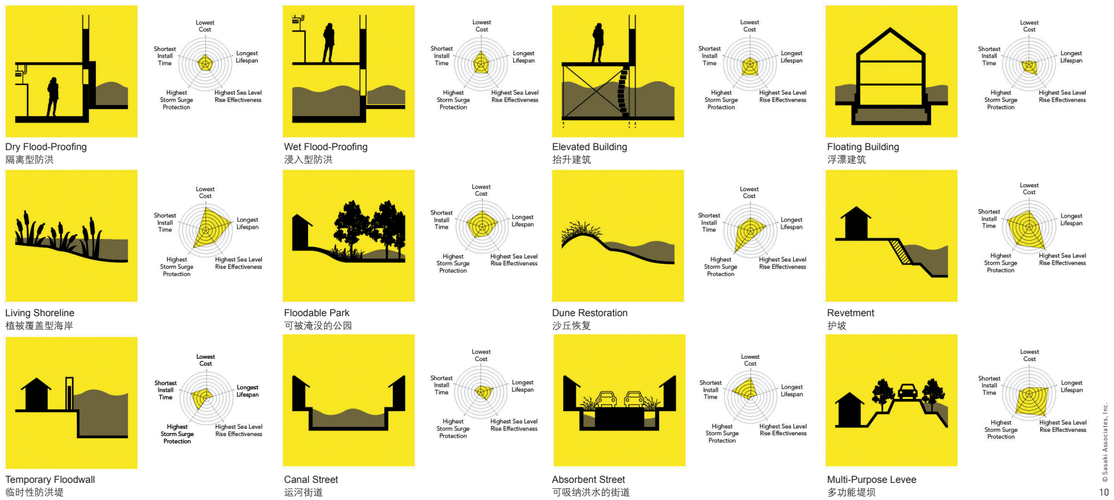
In Boston, sea level rise is already occurring. Over the past century, the relative sea level rise in Boston has been 12 inches, and it is projected that sea levels will rise two feet by mid-century and six feet by 2100. The new tide line will transform the landscape of Greater Boston and increase the probability of a major storm devastating the metropolitan region.

Having worked along many waterfronts across the United States and internationally, several Sasaki practitioners saw the need for greater understanding around climate change, sea level rise, and resilience. And after Superstorm Sandy narrowly missed Boston, Sasaki recognized an opportunity to proactively plan for resilience in Boston, rather than waiting for a natural disaster to necessitate change. Although Boston is sheltered geographically by Cape Cod and

CATALOG OF DESIGN STRATEGIES

设计策略





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11. 我们需要在多种尺度上来应对海平面上升问题。
12. 这些策略为波士顿地区提供了一系列切实可行的方案，在保护波士顿边缘地区不受侵袭的同时，也能够提升滨水地带的活力和连接性，并推动经济发展。

11. We need to design for rising seas at multiple scales.
12. The strategies illustrate an array of tangible solutions for how the Boston region can protect its edge while introducing greater vibrancy, connectivity, and economic opportunities along the water.

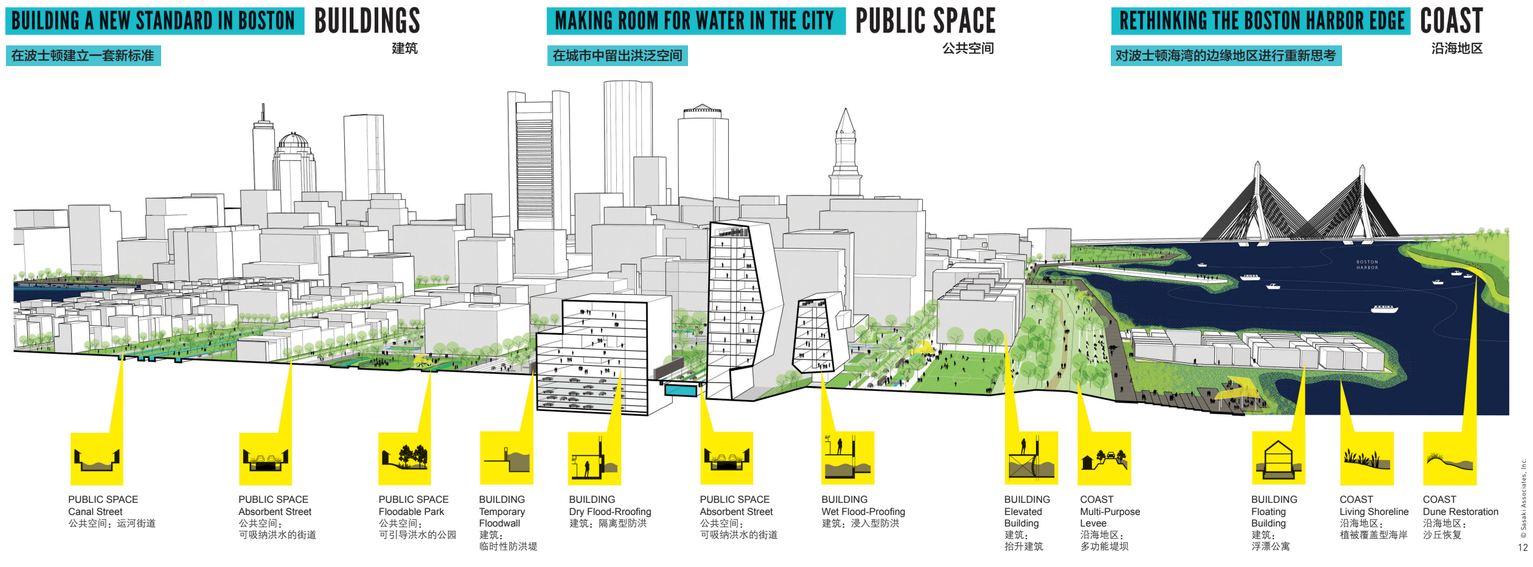
the Harbor Islands, historically the city has experienced several major hurricanes and Nor'easters. However, until recently the conversation in Boston had largely lacked the input of designers — a critical voice in determining contextual, implementable, effective solutions to make Boston more resilient while acknowledging and enhancing the city's unique sense of place.

Advocating for a long-term resiliency strategy for the Greater Boston area, designers launched a research initiative on sea level rise called Sea Change. The Sea Change team tapped into Sasaki's interdisciplinary practice to engage in preparedness planning. This project required intense data collection, cleaning, management, and analysis. To assess Boston's sea level rise vulnerability, the team integrated high resolution elevation data files with information about coastline characteristics and water management infrastructure. Once threat levels were understood and mapped, the team synthesized dozens of thematic data sets to understand potential impacts on the major physical systems that support the Boston region, including medical facilities, police, fire response, energy grid, and transportation infrastructure.

Research for Sea Change was conducted over a year and a half. During that time, the team collaborated with experts in science, advocacy, and policymaking. In addition, academic partnerships emerged as a productive model for idea generation. In June 2013, during Sasaki's annual intern charrette, students researched sea level rise implications and design solutions specific to the South Boston neighborhood. During fall 2013, the Natural Systems Design Studio within the Boston Architectural College's Landscape Architecture Department built upon the interns' research and offered resiliency strategies for the East Boston neighborhood. Throughout the charrette and studio, local guest critics — including coastal engineers, designers, and Boston Harbor experts — provided insight and expertise.

Sea Change emphasizes that critical urban systems must be considered beyond municipal boundaries. From transportation routes and energy grids to commercial districts and historic neighborhoods, Boston's urban systems are intricately entwined and vulnerable to rising water. Research includes the mapping and diagramming of sea level rise in Boston and its effect on land use, demographics, and transportation systems, among other vulnerable systems. The Sea Change team conducted interviews across the city to document the public voice and learn about the public's awareness of sea level rise. These interviews are documented in a series of photos, videos, and written essays.

In addition to documenting the threat of



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13–15. “波士顿：海之巨变”展览于波士顿会展中心举行。

13–15. The *Sea Change: Boston* Exhibition was held at District Hall in Boston.

sea level rise, Sea Change features proactive design and planning strategies at the building, city, and regional scales. From floating apartment buildings to floodable parks, designers and engineers around the world are imagining and constructing resilient solutions to rising sea levels. Research explores how resilient design strategies can allow Boston's buildings and infrastructure to bounce back from storms and adjust to rising tides. The strategies and case studies are cataloged and illustrated in an array of tangible solutions for how the Boston region can protect its edge while introducing greater vibrancy, connectivity, and economic opportunities along the water. In spring 2014, the Sea Change research was presented as an exhibition, *Sea Change*: *Boston*, at District Hall in Boston.

Sea Change: Boston is designed to communicate the complexities of sea level rise and resilience in a clear, accessible, and balanced way, with the goal of raising awareness among the general public and



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encouraging a call for action at the city and regional scales. The complex research is organized into seven simple themes:

(1) "Sea Level Rise Explained" illuminates the causes and projections for sea level rise.

(2) "The Perfect Storm" explores the impacts of tides, hurricanes, and nor'easters when combined with elevated sea levels.

(3) "What's at Risk?" analyzes vulnerable systems, energy grids, and transportation networks, and surveys threatened neighborhoods.

(4) "Tough Questions" poses long-term planning questions and alternatives for the region.

(5) "Engaging the Community" highlights the collaborative and academic process that informed the exhibition, including portraits of coastal Boston residents and speculative designs from the 2013 intern charrette and the 2013 Boston Architectural College Natural Systems Design Studio.

(6) "Design Strategies" offers tangible landscape, architecture, and architectural design strategies and case studies that could be applied to Boston.

(7) "Thinking Big" calls attention to the need for a regional plan.

The exhibition shared the Sea Change research with the broader Boston community through graphics and interactive media, and built partnerships between allied organizations including the City of Boston, The Boston Harbor Association, and the Boston Architectural College, encouraging an inclusive dialogue spanning Boston's neighborhoods and design scales. Events and digital media associated with the exhibition catalyzed a conversation among designers, city officials, real estate leaders, and academics about a specific call to action: to develop a regional resiliency plan for the Greater Boston area.

In addition to the physical exhibition, *Sea Change: Boston* lives as a digital body of work. An interactive map[ⓘ] was developed and invites exhibition visitors and web users to explore sea level rise and storm surge scenarios while simultaneously overlaying vulnerable urban systems analysis. QR codes, interspersed within the exhibition, link visitors to the City of Boston's Greenovate campaign. The online "Engaging the Community" video features interviews with local Boston residents and business owners, illuminating their concerns and awareness of sea level rise. The "Reflections on Resilience" blog series features a broad range of practitioners sharing ideas and insights on how planning and design can help to create a more resilient future. Multiple social media campaigns — #SummerofSLR, #SemesterofSLR, and #SeaChange — also became digital platforms for the Sea Change research.

Events associated with the exhibition include the Sea Change: Boston Symposium. The daylong conference was organized into three panels, based on themes from the *Sea Change: Boston* exhibition, and catalyzed a conversation among designers, city officials, real estate leaders, and academics. Following the success of *Sea Change: Boston*, designers have continued to engage the public on the topic of coastal resiliency planning and design. Beyond the influence on allied organizations, the Sea Change research has also impacted the way Sasaki approaches both sustainability and resiliency in practice. Sea Change research has supported and supplemented multiple master-planning and built-work projects. **LAF**

16. 社区参与

16. Engaging the community

ⓘ Please visit http://seachange.sasaki.com/map for more information.

17. Sasaki暑期实习生研讨会
18. 波士顿建筑学院秋季自然系统设计课程
19. 同期举办的“波士顿：海之巨变”的研讨会

17. Sasaki summer intern charette
18. Boston Architectural College fall Natural Systems Desgin Studio
19. The *Sea Change: Boston* symposium


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