

# Port Authority of New York & New Jersey Climate Impacts and Costs

Climate change poses many costly risks to the Port Authority of New York and New Jersey (PANYNJ), including increasing sea level rise, heavy rainstorms, coastal erosion and flooding, and hotter temperatures.<sup>1</sup> Even if fossil fuel emissions and atmospheric concentrations of greenhouse gasses eventually stabilize through aggressive climate action, the severity of these events will continue to rise as we adjust to the new reality of the climate crisis.

## Sea Level Rise

Globally, sea levels are rising due to climate change,<sup>2</sup> as glaciers melt and ocean waters expand.<sup>3</sup> Sea level rise poses severe risks to infrastructure along the coasts of New York and New Jersey — where relative sea level is rising faster than the global average.<sup>4</sup> The high rate of sea level rise in the northeast U.S. is attributed to land subsidence from natural adjustments in the earth's mantle, extraction of groundwater from the subsurface, the melting of glaciers, and increased ocean temperatures.<sup>5</sup> At the Battery tide gauge in Manhattan, NY, relative sea level rose approximately 3.1 mm/year in the 20th century; and between 2000 to 2022, has increased to 4.4 mm/year.<sup>6</sup> Along the New Jersey coast, sea level is projected to likely (66% chance) rise 0.5 to 1.1 feet by 2030

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- 1 EPA, "What Climate Change Means for New York," 2016, <https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-ny.pdf>; EPA, "What Climate Change Means for New Jersey," 2016, <https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-nj.pdf>.
  - 2 Ekwurzel et al., "The Rise in Global Atmospheric CO<sub>2</sub>, Surface Temperature, and Sea Level from Emissions Traced to Major Carbon Producers." <https://doi.org/10.1007/s10584-017-1978-0>.
  - 3 Miller et al., "A Geological Perspective on Sea-Level Rise and Its Impacts along the U.S. Mid-Atlantic Coast." <https://onlinelibrary.wiley.com/doi/abs/10.1002/2013EF000135>.
  - 4 Kopp, R., Nordstrom, K., & Quispe, J., "The Future of Sea Level in New Jersey: 3 feet, 4 feet, 7 feet higher?" Rutgers University, n.d..
  - 5 Ibid.
  - 6 Buzzanga, B., et. al., "Localized uplift, widespread subsidence, and implications for sea level rise in the New York City metropolitan area," Science Advances, September 27, 2023, <https://doi.org/10.1126/sciadv.adi8259>.

and up to 2.1 feet by 2050, as compared to the level in 2000.<sup>7</sup> Likely projected sea level rise beyond 2050 is increasingly dependent on greenhouse gas emission scenarios — rise from 2000 to 2100 could vary between 1.7 to 4.0 feet under a low-emissions scenario, to 2.3 to 6.3 feet under a high-emissions scenario.<sup>8</sup>

Sea level rise also causes more frequent tidal flooding, also known as “sunny day” or “nuisance” flooding, which occurs from tides and is not related to storm surges or weather events.<sup>9</sup> Between 1950 to 2014, there were about 53 flood days that exceeded nuisance flooding in The Battery that would not have occurred without anthropogenic global sea level rise.<sup>10</sup> According to NOAA, The Battery had 10 high tide flood days in 2019, double that of the typical five high tide flood days experienced in 2000 based on a linear trend fit of the tide gauge data.<sup>11</sup> In 2023, The Battery experienced 24 flood days.<sup>12</sup> Of the seven NOAA tide gauges along the New York and New Jersey coasts, five experience almost twice as many flood days in 2019 as compared to the typical flood days in 2000.<sup>13</sup> By 2050, NOAA predicts that, depending on location, coastal cities will experience between 25 and 75 flood days per year.<sup>14</sup> Figure 1 below shows that in The Battery tidal flooding is increasing and is projected to significantly increase by the end of the century. The combination of high tides and storm surges poses even more risk for communities and infrastructure along the coast.

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**7** Kopp, R.E., C. Andrews, A. Broccoli, A. Garner, D. Kreeger, R. Leichenko, N. Lin, C. Little, J.A. Miller, J.K. Miller, K.G. Miller, R. Moss, P. Orton, A. Parris, D. Robinson, W. Sweet, J. Walker, C.P. Weaver, K. White, M. Campo, M. Kaplan, J. Herb, and L. Auermuller. New Jersey’s Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel. Rutgers, The State University of New Jersey. Prepared for the New Jersey Department of Environmental Protection. Trenton, New Jersey.

**8** Ibid.

**9** Wamsher, I., Shope, J., Broccoli, A., Gerbush, M., Herb, J., Kaplan, M., Kohut, J., Saba, G., Garzio, L., Nazzaro, L. & Robinson, D. 2024. State of the Climate: New Jersey 2023. Rutgers, The State University of New Jersey, New Brunswick, NJ, page 13.

**10** Strauss, B. H., Kopp, R. E., Sweet, W. V. and Bittermann, K. Unnatural Coastal Floods: Sea Level Rise and the Human Fingerprint on U.S. Floods Since 1950. Climate Central Research Report, pp. 1-16.

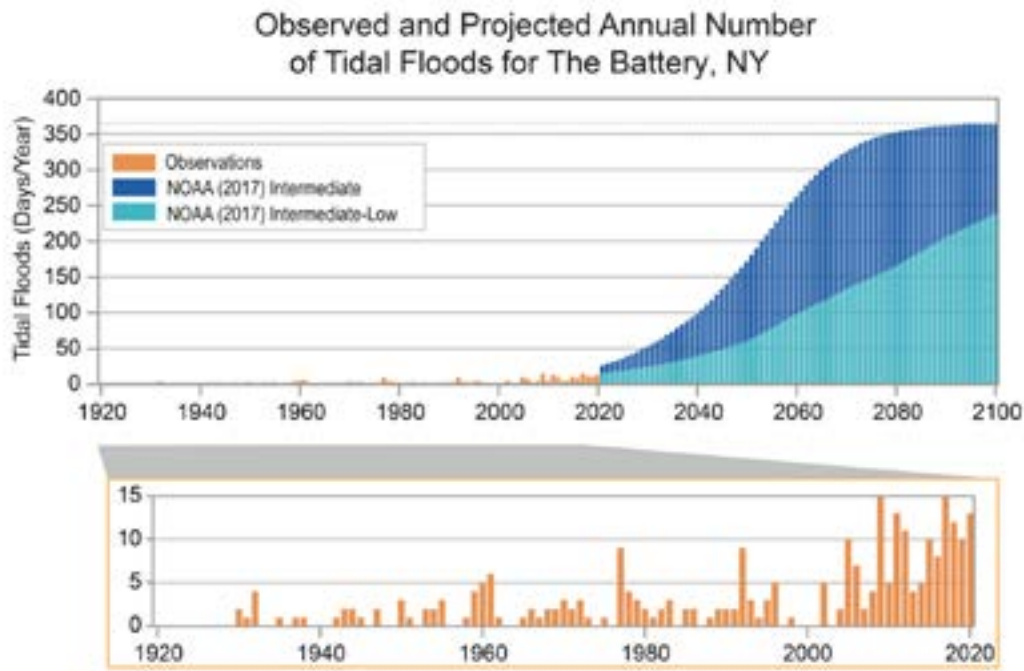
**11** William Sweet et al., “2019 State of U.S. High Tide Flooding with a 2020 Outlook,” NOAA Technical Report, July 2020, [https://tidesandcurrents.noaa.gov/publications/Techrpt\\_092\\_2019\\_State\\_of\\_US\\_High\\_Tide\\_Flooding\\_with\\_a\\_2020\\_Outlook\\_30June2020.pdf](https://tidesandcurrents.noaa.gov/publications/Techrpt_092_2019_State_of_US_High_Tide_Flooding_with_a_2020_Outlook_30June2020.pdf).

**12** NOAA, “Annual High Tide Flooding Outlook,” NOAA Tides & Currents, 2024, <https://tidesandcurrents.noaa.gov/high-tide-flooding/annual-outlook.html?station=8531680>.

**13** Ibid.

**14** NOAA, “High Tide Flooding,” NOAA Office for Coastal Management, accessed September 4, 2024, <https://coast.noaa.gov/states/fast-facts/recurrent-tidal-flooding.html>.

**Fig. 1.** “Number of tidal flood days per year at The Battery, NY, for the observed record (1920–2020; orange bars) and projections for two NOAA (2017) sea level rise scenarios (2021–2100): Intermediate (dark blue bars) and Intermediate-Low (light blue bars). The NOAA (2017) scenarios are based on local projections of the GMSL scenarios [1.0 m and 0.5 m respectively]. Sea level rise has caused a gradual increase in tidal floods associated with nuisance-level impacts. The greatest number of tidal flood days (all days exceeding the nuisance-level threshold) occurred in 2009 and 2017 at The Battery. Projected increases are large even under the Intermediate-Low scenario. Under the Intermediate scenario, tidal flooding is projected to occur nearly every day of the year by the end of the century. Additional information on tidal flooding observations and scenarios is available at <https://statesummaries.ncics.org/technicaldetails>. Sources: CISESS and NOAA NOS.”<sup>15</sup>



The PANYNJ’s coastal infrastructure will be seriously impacted by sea level rise. In region 11 of New York City’s transportation network — which only includes Bronx, Kings, New York, Queens, and Richmond counties<sup>16</sup> — there is a 68% risk of at least one flood over 6 feet taking place by 2050 — which would put 25 rail stations, 35 passenger stations, two intermodal freight terminals, as well as many

<sup>15</sup> Graph and description: Frankson, R., K.E. Kunkel, S.M. Champion, B.C. Stewart, W. Sweet, A.T. DeGaetano, and J. Spaccio, 2022: New York State Climate Summary 2022. NOAA Technical Report NESDIS 150-NY. NOAA/NESDIS, Silver Spring, MD, 5 pp, <https://statesummaries.ncics.org/chapter/ny/>.

<sup>16</sup> New York State Department of Transportation, “Region 11 at a Glance,” n.d., <https://www.dot.ny.gov/regional-offices/region11/general-info>.

other infrastructure assets at risk for severe and disruptive flooding.<sup>17</sup> Runway 13/31 at LaGuardia Airport, which was built over a former landfill, has been identified as a subsidence hotspot as it sinks approximately 3.7 mm/year.<sup>18</sup> Already tidal flooding is interrupting transportation operations in the New York City area. In April of this year, the Croton-Harmon Train Station had to close section I of parking for a day due to flood risks.<sup>19</sup>

Sea level rise is already impacting the operations of the PANYNJ. Rising sea levels heightens storm surges and sea level-associated erosion makes coasts more vulnerable to storms.<sup>20</sup> On October 30, 2012, anthropogenic sea level rise caused Superstorm Sandy to flood approximately 70 square kilometers that it would not have flooded in 1880,<sup>21</sup> resulting in an additional \$4.2 billion in damages in New York and \$3.7 billion in damages in New Jersey.<sup>22</sup>

## Potential Costs Related to Sea Level Rise

### Structure and Infrastructure Projects and Costs

- Protecting infrastructure owned by the port from sea level rise and associated corrosion by:
  - installing beach nourishment structures, jetties, and seawalls;
  - restoring natural wetland areas;
  - flood-proofing port-owned buildings.
- Elevate port area or remove, relocate, acquire, or demolish structures to minimize future flood losses — this approach may make more sense for the port building itself, but maybe not the right approach for an airport.
- Disruption and delays in transportation services due to flooding.

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**17** "Region 11, New York, USA," Surging Seas Risk Finder, Climate Central, [https://riskfinder.climatecentral.org/dept-of-transportation/region-11.ny.us?comparisonType=dept-of-transportation&forecastName=With+extreme+flood&forecastType=NCAA2017\\_int\\_p50&impact=Roads&impactGroup=Infrastructure&level=6&unit=ft&zillowIsPct=true&zillowPlaceType=dept-of-transportation&zillowVarType=Count](https://riskfinder.climatecentral.org/dept-of-transportation/region-11.ny.us?comparisonType=dept-of-transportation&forecastName=With+extreme+flood&forecastType=NCAA2017_int_p50&impact=Roads&impactGroup=Infrastructure&level=6&unit=ft&zillowIsPct=true&zillowPlaceType=dept-of-transportation&zillowVarType=Count).

**18** Buzzanga, B., et. al., "Localized uplift, widespread subsidence, and implications for sea level rise in the New York City metropolitan area," *Science Advances*, September 27, 2023, <https://doi.org/10.1126/sciadv.adi8259>.

**19** Village of Croton-on-Hudson, "Croton-Harmon Train Station Commuters Be Advised: Anticipated Tidal Flooding 4/3 & 4/4," April 2, 2024, <https://www.crotononhudson-ny.gov/home/news/croton-harmon-train-station-commuters-be-advised-anticipated-tidal-flooding-43-44>.

**20** Lathrop, R., "NJ Flood Mapper: How Does Sea Level Rise and Storm Surge Interact?" Rutgers University, 2017, [https://crssa.rutgers.edu/projects/njloodmapper/about\\_2b.html](https://crssa.rutgers.edu/projects/njloodmapper/about_2b.html).

**21** Miller, K., et. al., "A geological perspective on sea-level rise and its impacts along the U.S. mid-Atlantic coast," *Earth's Future*, December 5, 2013, <https://doi.org/10.1002/2013EF000135>.

**22** Strauss, B.H., Orton, P.M., Bittermann, K. et al. Economic damages from Hurricane Sandy attributable to sea level rise caused by anthropogenic climate change. *Nat Commun* 12, 2720 (2021). <https://doi.org/10.1038/s41467-021-22838-1>.

- Runway damage from flooding induced by sea level rise.
- Elevate infrastructure and buildings owned and operated by the PANYNJ.
- Remove, relocate, acquire, or demolish structures to minimize future flood losses related to sea level rise.

### **Local Planning and Regulation**

- Identify, map, and track coastal erosion and flood hazards.
- Develop and enforce a coastal zone management plan.
- Develop site and building standards.

### **Education and Awareness Programs**

- Increase awareness by disclosing location of high-risk areas to current and future property owners; offer mitigation technique information.
- Locate new utilities and critical facilities outside of susceptible areas.
- Identify, map, or track erosion hazard areas.
- Other education and awareness programs.

## **Increased Precipitation and Severe Storms**

Climate change has led to a warmer atmosphere that can hold more water. Increased moisture in the air leads to more intense rain events, which often cause massive flooding of infrastructure<sup>23</sup> and contributes to steel corrosion.<sup>24</sup> In August 2024, the governor of New York declared a state of emergency after a severe storm flooded communities in New York causing severe damage to roads and infrastructure.<sup>25</sup>

Over the past century, average annual precipitation and intensity of extreme storms have increased in the areas the PANYNJ operates in.<sup>26</sup> Extreme

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<sup>23</sup> Tabari, Hossein, "Climate change impact on flood and extreme precipitation increases with water availability," Scientific Reports, August 13, 2020, <https://doi.org/10.1038/s41598-020-70816-2>.

<sup>24</sup> Zhang, Yating; Ayyub, Bilal; & Fung, Juan, "Projections of corrosion and deterioration of infrastructure in United States coasts under a changing climate," Resilient Cities and Structures, March 2022, <https://doi.org/10.1016/j.rcns.2022.04.004>.

<sup>25</sup> "Governor Hochul Declares Statewide State of Emergency as Remnants of Debby Cause Severe Flooding | Governor Kathy Hochul," August 9, 2024, <https://www.governor.ny.gov/news/governor-hochul-declares-statewide-state-emergency-remnants-debby-cause-severe-flooding>.

<sup>26</sup> U.S. EPA, "What Climate Change Means for New York," (August 2016), <https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-ny.pdf>.

precipitation, defined as the amount of rain falling on the top 1% of days with precipitation, in the northeastern United States has already increased over 60% from 1958-2021.<sup>27</sup> The number of days with over 5 inches of rain in total has doubled in the last 64 years from about 5 to about 15 days per year.<sup>28</sup> This will only continue to get worse — extreme precipitation events are predicted to increase another 50% by the end of this century.<sup>29</sup>

In September 2021, Post Tropical Cyclone Ida rapidly intensified over an eddy of warmer waters in the Gulf of Mexico.<sup>30</sup> The thunderstorms that made up Tropical Cyclone Ida then made their way to the northeast, colliding with another extratropical front and creating a storm system that wreaked havoc on the northeast.<sup>31</sup> The excessive rainfall that resulted over New Jersey caused flash floods with streamflows that were 10 to 20 times the National Weather Service's thresholds for issuing flash flood warnings.<sup>32</sup> The Port of New York and New Jersey had to close the Maher terminal and empty the depot due to the storms.<sup>33</sup>

According to NOAA, extreme weather events that cost over a billion dollars, or "billion-dollar events," have been increasing. Billion-dollar flooding events cost an average of \$4.6 billion per event and billion-dollar severe storms cost an average of \$2.4 billion per event.<sup>34</sup> A recent analysis by Swiss Re, a reinsurance company, found that severe storms in the U.S. incurred \$60 billion in insured losses during 2023 — a record high.<sup>35</sup> Severe storms are increasingly causing insurance

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- 27** "Extreme Precipitation in a Warming Climate," Climate Central, 2024, <https://www.climatecentral.org/graphic/extreme-precipitation-in-a-warming-climate?graphicSet=Extreme+Precipitation+Change+1958+to+2021&location=US&lang=en>.
- 28** Mara Hoplamazan, "National Climate Assessment Shows Extreme Precipitation Has Increased Most in the Northeast," *New Hampshire Public Radio*, (November 20, 2023), sec. NH News, <https://www.nhpr.org/nh-news/2023-11-20/national-climate-assessment-shows-extreme-precipitation-has-increased-most-in-the-northeast>.
- 29** Christopher J. Picard et al., "Twenty-First Century Increases in Total and Extreme Precipitation across the Northeastern USA," *Climatic Change* 176, no. 6 (May 30, 2023): 72, <https://doi.org/10.1007/s10584-023-03545-w>.
- 30** Henry Fountain, "Ida Strengthened Quickly Into a Monster. Here's How," *The New York Times*, August 29, 2021, sec. Climate, <https://www.nytimes.com/2021/08/29/climate/hurricane-ida-category.html>.
- 31** Bill Chappell, "Why Ida Hit The Northeast So Hard, 1,000 Miles Away From Its Landfall," *NPR*, September 3, 2021, sec. National, <https://www.npr.org/2021/09/03/1034058911/hurricane-ida-climate-change-northeast-flooding-rainfall>.
- 32** Shope, J., Broccoli, A., Frei, B., Gerbush, M., Herb, J., Kaplan, M., Langer, E., Marxen, L., & Robinson, D. (2022). *State of the Climate: New Jersey 2021*. Rutgers, The State University of New Jersey, New Brunswick, NJ.
- 33** Ibid.
- 34** National Atmospheric and Oceanic Administration (NOAA), "NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters," 2023. <https://doi.org/10.25921/stkw-7w73>.
- 35** "Insured Losses from Severe Thunderstorms Reach New All-Time High of USD 60 Billion in 2023, Swiss Re Institute Estimates," *Swiss Re*, December 7, 2023, <https://www.swissre.com/press-release/Insured-losses-from-severe-thunderstorms-reach-new-all-time-high-of-USD-60-billion-in-2023-Swiss-Re-Institute-estimates/4a15acf7-64b4-4766-8662-1c35d268ab12>.

companies to lose money.<sup>36</sup> Superstorm Sandy alone caused the PANYNJ to incur \$2.2 billion in damages, including lost operational time.<sup>37</sup> To mitigate the damage of extreme precipitation events, the PANYNJ has ongoing plans to continue implementing flood mitigation projects like installing flex gates at the Holland Tunnel.<sup>38</sup>

## Potential Costs Related to Increased Precipitation and Severe Storms

### Structure and Infrastructure Projects

#### Impact: Increased Precipitation

- Stabilizing bridges to handle faster flows and protecting against scour by hardening abutments and piers.
- Combatting road degradation in tunnels and airport runways by resurfacing roads with more permeable pavement and concrete.
- Elevating, removing, relocating, acquiring, or demolishing structures to minimize future flood losses.
- Elevating port-owned roads and bridges above the base flood elevation (BFE) to maintain dry access.
- Floodproofing inside of port buildings, for example by installing check valves, sump pumps, or backflow prevention devices.
- Protecting port infrastructure from floods using any other technique:
  - raising components above BFE;
  - installing pumping systems or back-up generators for pumping;
  - building dikes or stabilizing banks.
- Constructing floodwalls, small berms, revetments, bioengineered bank stabilization, or other small structural mitigants to protect critical port-owned infrastructure.

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**36** Christopher Flavelle and Mira Rojanasakul, "As Insurers Around the U.S. Bleed Cash From Climate Shocks, Homeowners Lose," *The New York Times*, (May 14, 2024), sec. Climate, <https://www.nytimes.com/interactive/2024/05/13/climate/insurance-homes-climate-change-weather.html>.

**37** "Case Study: How a government agency is safeguarding against super storms," CDP, (July 12, 2020), <https://www.cdp.net/en/articles/climate/case-study-how-a-government-agency-is-safeguarding-against-super-storms>.

**38** Stella Pagkas, "At the Port Authority, Prep for Hurricane Season Is a Year-Round Effort," accessed August 22, 2024, <https://corpinfo.panynj.gov/content/port-authority/en/blogs/sustainability/at-the-port-authority--prep-for-hurricane-season-is-a-year-round.html>.

- Protecting critical infrastructure by requiring all facilities be built one foot above the 500-year flood elevation (to meet requirements of FEMA Executive Order 11988).<sup>39</sup>
- Protecting and enhancing natural floodplain mitigation features (such as wetlands, dunes, and vegetative buffers) to help prevent flooding.

### **Impact: Severe Storms**

- Losses to vessels and crew members.
- Delays and disruptions to transportation.
- Increased insurance premiums.
- Road closures.
- Implementing severe storm adaptation strategies for the future like burying utility lines underground for train and bus operations.

### **Port Authority Planning and Regulation**

- Updating flood risk maps and flood zones.
- Developing a floodplain management plan.
- Adopting a stormwater management or drainage plan.
- Adopting, applying, and enforcing building codes to ensure buildings can withstand flooding.

## **Hotter Temperatures**

The northeast United States has already experienced a heatwave this summer with temperatures up to 20°F hotter than normal and heat indexes up to 106°F in Trenton, NJ.<sup>40</sup> The early season heatwave prompted officials to declare emergencies across the northeast and open cooling centers for vulnerable residents.<sup>41</sup>

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<sup>39</sup> Federal Emergency Management Agency, "Executive Order 11988: Floodplain Management," [www.fema.gov/executive-order-11988-floodplain-management](http://www.fema.gov/executive-order-11988-floodplain-management).

<sup>40</sup> Johnny Diaz, "Northeast Braces for First Severe Heat of the Year," *The New York Times*, June 17, 2024, sec. Weather, <https://www.nytimes.com/2024/06/17/weather/heat-wave-plains-northeast.html>; Juliana Kim, "Temperature Records Are Shattered as Extreme Heat Grips the West and East Coasts," *NPR*, July 7, 2024, sec. Weather, <https://www.npr.org/2024/07/06/nx-s1-5031553/extreme-heat-west-east-coast>.

<sup>41</sup> Jenna Russell, "Emergencies Declared Across the Northeast as Heat Index Hits Triple Digits," *The New York Times*, June 18, 2024, sec. Weather, <https://www.nytimes.com/live/2024/06/18/weather/heat-wave-news>.



According to Climate Central, the average annual temperature in New Jersey has increased about 3.5°F since 1970, which is one of the fastest warming places in the United States.<sup>42</sup> Similarly, New York City is about 3°F warmer than it was in 1900. New York City will only continue to get warmer and is projected to be up to 7.1°F warmer by 2050 and up to 13.5°F warmer by 2100 than the average temperature from 1981-2010.<sup>43</sup> In New York City, both heat waves and days with temperatures over 90°F are expected to triple.<sup>44</sup> Similarly, days over 90°F have increased by 36% in New Jersey since 1949.

Heatwaves and extreme heat cause many problems for the PANYNJ. Heat causes roads and sidewalks to buckle, leads to shutdowns and slow downs of trains and other public transit, warps railroad tracks, and causes electric lines to sag.<sup>45</sup> NJ Transit and Amtrak trains have both experienced massive delays due to heat multiple times this summer from power outages, sagging wires, and overheated tracks.<sup>46</sup>

**Table 1:** The average seasonal increase in temperature (°F) in New Jersey from 1970-2022, taken from Shope et al. (2023); Table 1.<sup>47</sup> The average seasonal increase in temperature (°F) in New York from 1901-2022, estimated from Lamie et al., (2024).<sup>48</sup>

Temperature Statistic	1970-2022 (New Jersey)	1901-2022 (New York)
Winter (December - February)	5.2 ± 0.9	4.1
Spring (March - May)	3.3 ± 0.6	2.2
Summer (June - August)	3.6 ± 0.4	1.8
Fall (September - November)	3.3 ± 0.5	2.2

- 42 Hillary Howard, "New Jersey Is One of America's Fastest-Warming States, Data Shows," *The New York Times*, July 3, 2024, sec. New York, <https://www.nytimes.com/2024/07/03/nyregion/new-jersey-warming-climate-change.html>.
- 43 Samantha Maldonado, "New Climate Projections: NYC Will Keep Getting Hotter and Wetter," *THE CITY - NYC News*, January 22, 2024, <http://www.thecity.nyc/2024/01/22/new-climate-projections-heat-rain-sea-level/>.
- 44 U.S. Department of Agriculture, "New York City | Climate Change Response Framework," 2024, <https://forestadaptation.org/assess/ecosystem-vulnerability/urban/new-york-city>.
- 45 Mark Gongloff, "Heat Waves Are Deadlier Than Hurricanes. Make Them 'Disasters,'" *Bloomberg.Com*, June 18, 2024, <https://www.bloomberg.com/opinion/articles/2024-06-18/northeast-heat-wave-2024-this-is-a-disaster-treat-it-that-way>.
- 46 Rebecca Greenberg and Nia Clark, "NJ Transit, Amtrak Service Suspended Again at Penn Station," *Spectrum News*, June 21, 2024, <https://ny1.com/nyc/all-boroughs/news/2024/06/21/power-outages-cause-widespread-amtrak-nj-transit-delays>.
- 47 James Shope et al., "State of the Climate: New Jersey 2022," April 26, 2023, <https://policycommons.net/artifacts/3742666/state-of-the-climate-2022-042423/4548594/>.
- 48 Christopher Lamie et al., "New York State Climate Impacts Assessment: Chapter 2: New York State's Changing Climate," 2024, <https://nysclimateimpacts.org/wp-content/uploads/2024/01/Assessment-ch2-NYS-changing-climate-01-09-24.pdf>.

## Potential Costs Related to Hotter Temperatures

### Structure and Infrastructure Projects

- Reduce stress on metal port structures, such as container handling cranes and warehouses.
- Increasing energy costs in port-owned buildings.
- Implementing energy efficiency retrofits for port-owned buildings.
- Increasing road, rail, and runway maintenance to combat damage due to more frequent extreme heat events and generally hotter temperatures.
- Mitigate sagging of overhead wires due to heat stress.
- Painting rail tracks with reflective paint to reduce track temperatures and prevent slow downs and disruptions.
- Economic losses from delays and disruptions due to extreme heat.
- Increase high-albedo surfaces on buildings, roads, and other locations where feasible.
- Reduce the urban heat island effect at airports, terminals, etc by planting trees.

### Employee Health

- Treating an increase in asthma attacks requiring hospitalization (resulting from increased heat and ground level ozone, and the increase in airborne allergens).
- Treating heat-related illness of port workers due to unsafe working conditions.
- Loss of productivity due to required implementation of breaks during extreme heat events.