

# CLIMATE HAZARD ASSESSMENT



City of Highland Park  
July 2019

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## EXECUTIVE SUMMARY

The City of Highland Park, Illinois, has a longstanding and firm commitment to environmental protection and sustainable stewardship of the air, water, land, and natural resources. Nearly a decade after publication of the city’s Sustainability Plan, a collaboration of staff, elected officials, and resident volunteers developed this Climate Hazard Assessment in 2018. The objective of this assessment is to acknowledge the physical changes global climate change has already caused in Highland Park, and those yet to come as the planet continues to warm.

This assessment complements and supports the City’s sustainability efforts by highlighting the most problematic alterations to our physical environment, and the variances in weather event frequency and intensity from what we experience today. To summarize, storms and heat will cause the most disruption, from warmer winters that fail to cull insect populations to lengthy periods of extreme heat in the summer which will strain emergency services, and more intense rain events which are already causing flooding, property damage, and loss of the city’s highly valued tree canopy.

This assessment explores the hazards and their impact and was designed to comply with the Global Compact of Mayors for Climate & Energy, which the City Council officially joined in June of 2019. The next phase, beginning in 2020, will identify mitigation and adaptation efforts to address these hazards, and to prepare for, reduce, or alleviate their impacts on the city, its residents, and businesses.







HIGHLAND PARK CLIMATE HAZARDS			
Climate Hazard	Impact by 2025	Impact by 2050	Summary of Impacts
Extreme Heat Summer			Health risk for children and seniors, strain on emergency services, drought conditions, tree deterioration, fire risk
Warmer Winter			Increased freeze/thaw cycle degrades streets and utility infrastructure, roadway ice danger, reduced die-off of insects and pests
Rain Events			Increase in frequency and intensity, flooded streets, imperiled land use, ravine and slope degradation, insect breeding

Figure 1: Summary of Climate Hazards and Impacts

## INTRODUCTION

Highland Park published its first sustainability plan in 2010, and over nearly a decade of persistent action, many of its goals have been accomplished. In 2017, the City Council adopted the Greenest Region Compact II which established environmental impact reduction goals such as reducing greenhouse gas (GHG) emissions, advancing renewable energy, and supporting safe and effective active transportation. Also in 2017, Mayor Nancy Rotering pledged support for the Paris Climate Accord. In 2019, Mayor Rotering and the City Council committed the City to the Global Covenant of Mayors for Climate & Energy (the Compact of Mayors)<sup>1</sup>, which requires public reporting of the citywide GHG emissions inventory and engaging in an assessment of potential threats due to global climate change.

Changes in the weather affect human life adversely, for example, when an abnormally hot day makes outdoor activity difficult for seniors and children, or when a major snowstorm closes school. Changes in the global climate increase the frequency and intensity of these events, such as increasing the number of extreme heat days, and reducing winter snowfall leading to summer drought conditions. A climate hazard assessment is the first step in understanding and managing those risks, reducing the risk where possible and, where not, learning how to live with the new reality without compromising quality of life.

Highland Park's approach to reducing its impact on climate change, and building resilience to these changes, is being conducted in phases:

- 2017: Completed the citywide greenhouse gas emissions (GHG) inventory baseline
- 2018: Drafted the Climate Hazard Assessment and emissions reduction targets
- 2019: Joined the Global Covenant of Mayors and reported to the Climate Disclosure Project and set an emissions reduction target of 5% by 2023
- 2020-22: Develop climate action and adaptation plans, including emissions reduction strategies

The physical boundary of this assessment is the City of Highland Park. This effort is being led by the City Manager's Office in collaboration with other departments, primarily Public Works and Community Development, and members of the Sustainability Advisory Group, a resident-led committee, and the Green Alliance, a group convened by the City representing other units of government including the school and park districts, the library, Moraine Township, and private institutions such as the Chamber of Commerce and NorthShore Hospital.

This climate hazard assessment is a beneficial resource as it highlights the areas of greatest risk and thus demand the greatest focus. Paired with the emissions inventory, these documents lay the groundwork for the action plan to be developed.

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<sup>1</sup> Meadows, Jonah. "Local Climate Action: Highland Park Remains Committed to Paris Agreement." [www.patch.com](http://www.patch.com), 06/05/2017

## CLIMATE IMPACTS

Highland Park, a city of 29,000 residents, is located in an area of the East North Central Midwest where air temperature fluctuates throughout the year. Days of extreme heat and extreme cold are normal in the region, as are occasional cold spells, heat waves, major snowstorms and heavy rains. The impact of climate change will be deviations in the frequency and intensity of such events and their associated impacts.

Individual days of extreme heat are projected to occur with greater frequency, as will days-long heat waves. In addition to extreme heat, persistently higher temperatures may affect the stability of ravine slopes as air temperatures dry vegetation and soils. Droughts also aggravate conditions for wildfires<sup>2</sup>.

Changing weather patterns may affect the timing, amount and type of precipitation. Natural hazards that might be affected include more intense seasonal rain or snow events, increasing the frequency and intensity of floods. Water scarcity may also increase as rainfall becomes more intermittent, or reduced winter snowfall decreases the volume of melt waters<sup>3</sup>.

Flooding is a major concern in Highland Park. It disrupts mobility by closing roads, degrades water quality and biodiversity by carrying debris, salt, and chemicals into Lake Michigan, the Skokie River, and the North Branch of the Chicago River, destabilizes the ravine structure and ecosystem, and causes property damage to homes and businesses. As much as Highland Park works to improve stormwater management within city limits, it is downstream of large developments that increase the volume of stormwater heading its way independent of climate change. This is a significant issue for properties adjacent to the rivers, and for all users of Lake Michigan water.

Research by Great Lakes Integrated Sciences and Assessments (GLISA, a division of the National Atmospheric and Oceanic Administration) suggests the amount of precipitation falling in the heaviest one percent of storms increased by 37 percent over the Midwest during events from 1958 to 2012<sup>4</sup>. Highland Park is already experiencing the impact of more frequent and intense storm events, particularly rain.

Combined, changes in temperature and precipitation will impact Highland Park in multiple ways. This report outlines the potential impacts and how the City is, or will be, working to adapt to its new reality without losing its high quality of life.

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<sup>2</sup> C40 Cities, "City Climate Hazard Taxonomy."

<sup>3</sup> Ibid

<sup>4</sup> Reardon, Kelly. "How is Climate Change Affecting the Great Lakes?" Cleveland.com, 08/14/2017

## Human Health

The impact of climate change on human health is not as easy to see as a flooded street. Increases in the number of individuals suffering from respiratory distress or from vector-borne diseases are usually only visible to front-line medical professionals and record-keeping agencies. An additional impact, sometimes called the 'accordion effect', compounds the issue: a child with respiratory distress misses more days of school and thus loses out on education, while their parent misses more days of work thus losing out on additional income and financial stability. By discussing these potential outcomes in advance, the City is better prepared for the change, regardless of how slowly or rapidly it arrives.

### Risk Statement

The current risk level in 2019 is moderate though unpredictable. Intermittent days of extreme heat do occur but at a frequency low enough that existing municipal resources and capacity are able to manage. The City has no record of major health events specifically tied to climate impacts such as heat stress emergency calls or vector-borne disease outbreaks. Exposure levels for future human health impacts of climate change in Highland Park is expected to increase, but outbreaks are expected to be irregular. Consistently increasing risk is not expected to be seen until 2030.

### Expected Future Impacts

Highland Park expects the following impacts of climate change on human health may be possible:

- A higher number of extreme heat days will strain emergency services as they respond to more health-related calls. This will be compounded as the city's population ages.
- Winters that are warmer on average than historical norms lead to increased pest and rodent outbreaks in the spring and summer. The frequency of such outbreaks is expected to increase as average annual temperatures rise. Diseases spread by insects such as ticks and mosquitoes could increase as a result as well.
- Flooded areas that remain stagnant may harbor insect growth and could result in vector-borne disease outbreaks.
- Persistent moisture inside buildings due to flooding and seepage can lead to mold growth which decreases indoor air quality and compromises respiratory health.

### Adaptive Capacity

The School of Public Health at the University of Illinois at Chicago sponsors a program that monitors the public health impacts of climate change<sup>5</sup>. In a 2017 study<sup>6</sup> using nearly 30 years of Illinois-specific hospitalization data, researchers determined that Lake County has a rate of hospitalization for heat illness of 2.66. This is the baseline figure, and future studies will show whether or not changes in this figure can be correlated to climate change. It is important to note that the baseline rate of heat illness is the same rate as Cook County, where the 1995 heat wave resulted in the deaths of over 700 individuals. Health statistics are maintained by the Lake County Health Department, therefore the City will collaborate with the County to analyze future data.

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<sup>5</sup> Building Resilience Against Climate Effects (BRACE) <https://www.cdc.gov/climateandhealth/BRACE.htm>

<sup>6</sup> Jagai et al. Environmental Health (2017) 16:38; DOI 10.1186/s12940-017-0245-1

## Natural Areas

Highland Park's natural areas are integral to the community's culture and identity. Its vast tree canopy, unique ravines, and miles of Lake Michigan shoreline inspire civic pride and are protected in many ways by the municipal code.

In Highland Park there are over 75 residences along the shoreline, and two recent incidents highlight the risks of shoreline erosion. In April 2018, a home on the shores of Lake Michigan just 35 miles north of Highland Park began to crumble into the lake due to erosion<sup>7</sup>. The Army Corps does not assist homeowners in this situation and private insurance does not cover the cost of damages; the homeowners are even responsible for the cost to remove the debris from the lake. In July 2018, a 60-foot section of a bluff in Lake Forest, just six miles north of the city, collapsed into the lake following a heavy rain event<sup>8</sup>. The rebuilding effort is expected to cost the village at least \$1.5 million dollars.

Beach structure permit applications have increased since 2016, an indication that shoreline vulnerability is already increasing. The City expects the impact of climate change on the shoreline and ravines to be noticeable within the next five to 10 years, including the possibilities listed below.

- Sudden changes in wind and atmospheric pressure cause an intense wave phenomenon in the lake called a seiche (seish) which can accelerate erosion. At least one study predicts a nearly 20% decrease in wind in the northern hemisphere by the end of the century<sup>9</sup>, which could reduce this risk, but increased storm activity is likely to be paired with intense wind events.
- The ravines are vulnerable not only to the higher volume of stormwater, but also by the velocity at which the stormwater flows during intense events. Despite heavier rains, the lower than historical average winter snowpack is causing drought-like failure of many vegetated areas, compromising ravine stability. The City predicts that ravine-adjacent homeowners will need to construct protection infrastructure over the coming decades.
- Dry vegetation also increases the risk of wildfire, not only in the ravines but elsewhere in the heavily-vegetated city.
- The city's tree inventory is vulnerable to invasive pests and disease. A loss of tree cover would intensify other environmental impacts (e.g., air quality, habitat), and could change perceptions of the city's overall condition, leading to negative economic impacts.
- Highland Park's two rivers, the Skokie and North Branch, will be impacted by more frequent and intense storm events. Greater areas of adjacent land will flood, increasing the strain on the City's budget to acquire that land for mitigation projects.
- The extreme freeze/thaw cycle is leading to increased applications of salt during the winter to combat more frequent ice buildup on roadways. The snow melt runoff degrades the adjacent natural areas and will eventually reach the lake and rivers, adding to water contamination and negative impacts on biodiversity.

### Risk Statement

The current risk to natural areas in 2019 varies by location: the ravines and Lake Michigan shoreline are at a higher risk than inland areas. The future risk to natural areas by climate

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<sup>7</sup> Zampanti, Jeffrey. "Somers Home on the Brink of Falling into Lake Michigan." [Kenosha News](#), 04/20/2018

<sup>8</sup> Dorfman, Daniel. "Heavy Rain Causes Collapse of 60-foot Portion of Bluff in Lake Forest." [Chicago Tribune](#), 07/03/2018

<sup>9</sup> Niler, Eric. "Climate Change Could Take the Air out of Wind Farms" [Wired Magazine](#), 12/11/2017

change in Highland Park is expected to be high, but the peak impact is not expected to be seen in the ravines and along the shoreline for 10 years, and in inland areas for 20 years. Flooding of land adjacent to the rivers caused by stormwater is already occurring and is expected to continue annually due to record setting rainfall volumes, with some fluctuation.

#### Adaptive Capacity

Municipal ordinances are in place to protect the ravines and the City is already working to streamline its segment of the shoreline permit review process, separate from State and Federal reviews, to aid homeowners in protecting their property. The City also coordinates with the Lake County Stormwater Management Commission to purchase land in flood-prone areas. The Commission is expected to release new flood maps by 2020, and the City will use these to identify vulnerable locations and set land acquisition budgets accordingly.

To measure and compare annual impacts, the City will maintain a centralized record of beach and ravine protection permit applications, and the number and location of acres of land acquisitions.

### **Water Quality**

Lake Michigan is the source of water for Highland Park. The City has one water plant and supplies water to its residents and the municipalities of Deerfield, Lincolnshire and Bannockburn, the Glenbrook Sanitary District and Fort Sheridan. The City has the capacity to provide water on an emergency basis to Northbrook, Highwood, Lake Forest and Glencoe. Conversely, the City is able to receive water from Lake Forest and Northbrook in the event of an emergency. Lake Michigan is also a primary recreational asset for Highland Park, with one marina, one swimming beach, and two passive (non-swimming) beaches.

If the lake is compromised by climate change, the city's water supply could be vulnerable and access to its recreational assets would be limited. Extreme cold temperatures in recent years have caused ice buildup in the water intake system. The following impacts of climate change on water quality are possible:

- Water supply service interruptions due to increased cold.
- Contamination of Lake Michigan water quality due to either (a) increased stormwater runoff, (b) decreased lake water level, or (c) a combination of both<sup>10</sup>. Part of Highland Park's storm sewer system drains directly to the lake. Additional contaminated runoff originating beyond the city limits also reduces biodiversity in the lake ecosystem could cause algal blooms to increase.
  - The extreme freeze/thaw cycle is leading to increased applications of salt during the winter to combat more frequent ice buildup on roadways. The snow melt runoff, contaminated with this higher level of salt, will eventually reach the lake where it may have negative impacts on the lake's ecosystem.

As noted in the Natural Areas section, the additional applications of salt for roadway safety will lead to degradation of water quality in the Middle Fork and the North Branch of the Chicago River. While these waterways are not used for recreation or potable water sources, their quality and biodiversity are of significant importance to Highland Park.

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<sup>10</sup> Ibid



### Risk Statement

The current risk to potable water quality in 2019 is low, and this is expected to continue well into the future. When the quality of Lake Michigan water is compromised, adaptation measures will be addressed on a regional level.

### Adaptive Capacity

The City cannot control or influence most sources of contamination in Lake Michigan, but it does have some control and influence over stormwater runoff within City limits. The City will work to increase permeable surface area, encourage on-site stormwater management on private property, and raise awareness about stormwater risks among residents and businesses. Metrics will include the area of permeable surfaces under City control and changes to the permeable surface area of private property as recorded by permit applications.

## **Mobility**

The streets of Highland Park are popular with cyclists and multiple mass transit options are available. However, in general the city's population is car-dependent, therefore any restrictions on roadway access have a significant impact on the local economy and quality of life. Road closures disrupt mobility and increase traffic on other streets.

In April 2018, a section of Route 41 at Lake Cook Road was closed for few hours due to weather-induced buckling. Additionally, the City is experiencing more frequent roadway flooding than in the past 30 years. Highland Park expects climate change to impact mobility in the following ways:

- Road closures will increase due to water main breaks and roadway buckling caused by the intensified freeze-thaw cycle.
- Road closures will increase due to standing water after major storm events.

### Risk Statement

The current risk to mobility in 2019 is already measurable, and the future impact, primarily from increased stormwater volume, is expected to be high. Long term capital planning costs are expected to escalate, and changes to the municipal code may be required to influence the permeable areas per lot size, and/or increasing stormwater utility fees.

### Adaptive Capacity

The City has partnered with neighboring communities and the US Army Corps of Engineers to consider a study on the impact mitigation work could have on reducing the area's flood risk. The Army Corps conducted a preliminary study and, if the study met certain criteria, a feasibility study to pursue flood control options would have commenced, however, evaluation of two potential reservoir sites indicated that they would not produce enough flood risk reduction to warrant further consideration by the Army Corps.

The Lake County Stormwater Management Commission is expected to release new flood maps by 2020 and the City will use these to identify vulnerable locations and prioritize mitigation and construction projects accordingly. To measure and compare budget impacts over time, the City will track annual expenditures on stormwater system construction, weather-influenced road closures, and the cost of clean-up and repairs that are beyond annual budget allocations. An initial report of trends will be presented in 2021, with a full assessment and report in 2024.

## Finance and Economy

Highland Park is financially stable at the municipal, residential, and commercial level. For the foreseeable future this is not expected to change, but dramatic climate changes, and global economic forces, could have an impact on the city's financial health within the next 20 to 40 years.

During the height of tree loss caused by Dutch Elm disease and the Emerald Ash Borer, the City spent more than \$400,000 on tree replacement. After the flood of July 2017, the City spent more than \$20,000 on waste hauling expenses over that year's budget allocation and re-allocated additional funds to buy-out flood prone properties. In April 2018, a section of Route 41 was closed due to breakage in the roadway caused by the freeze-thaw cycle, an unrecorded cost to emergency services, commuter mobility, and economic activity. At the point where these additional costs cause the City to shift budget priorities or raise revenue, Highland Park's financial stability may be vulnerable.

Global climate change is expected to impact Highland Park's local economy and the municipal budget in at least the following ways:

- A significant loss of tree cover could negatively impact property values, and an increased demand for tree replacements could strain the City's budget.
- More days of extreme cold often result in overtime for city staff and greater use of trucks and equipment.
- Temperature extremes also place a higher demand for social service support of resource-limited households.
- A higher number of intense storm events will require more City staff time and equipment usage for clean-up and repair activities.
- Land acquisition, which reduces property damage due to flooding, is expensive in Highland Park. The City's cost varies by need, year, and property value; it is unpredictable and challenging to budget.
- An increase in the number of calls to emergency services for respiratory distress (from air pollution, extreme heat) will put a strain on emergency services operations.
- Productivity of municipal staff may be negatively impacted by increasing need for medical attention for themselves and family members which may deplete insurance reserves.
- The City's budget for road salt is based on high-use years of the past, but the extreme freeze-thaw cycle now becoming normal requires the same volume of salt even without snow. The freeze-thaw cycle also causes water main breaks and highway buckling requiring costly repairs.
- Freezing of the water intake system compromises production and may accelerate the replacement schedule.
- Public Works anticipates higher costs for future stormwater system construction.
- If poor air quality reduces individuals' daily excursions, Highland Park's vibrant business districts may be negatively impacted.

### Risk Statement

The current risk to the local economy due to climate change is low, and this is expected to continue. However, the risk to the City's annual budget could be high if the predicted impacts to public infrastructure occur. Financial impact on the municipal budget may be evident within 10 years.

### Adaptive Capacity

Additional spending on City services due to climate change is not likely to be visible year-over-year but may be on a five-year trend line. An initial report of trends will be presented in 2021, with a full assessment and report in 2024. The focus of this assessment will be on Public Works, emergency services, insurance reserves, and expenditures on land acquisition.

## **Population**

Similar to economic impacts, the City anticipates that if global migration patterns vary due to climate change it will not be felt in Highland Park for at least one or two generations. Despite the increasing frequency and intensity of weather-related disasters, cities in Texas, Florida, and California continue to grow while the Chicago metro area loses population. Humans are resilient and resourceful, and until the physical environment becomes unlivable, or until the environmental challenges and the cost of living combined become unmanageable, people will not move.

It has taken nearly 40 years to build out Highland Park's RO building zone, and there is more room for development in the Central Business District. Highland Park anticipates that when climate change forces global population shifts, the following impacts may be possible:

- The City will experience a greater demand for multi-unit housing, particularly in areas close to mass transit.
- Increased population will increase the demand for municipal services, but it also will bring increased revenue.

### Risk Statement

There is no noticeable change in Highland Park's population at the time of this report. Economic forces have been the driving factor in Illinois' population changes for the past decade. The risk of population change caused by climate change in Highland Park is expected to be low and not noticeable for at least 40 years. Higher taxes, primarily at the state level, are more likely to influence population shifts, although any increase in local taxes or fees to accommodate climate change impacts also could be an influencing factor.

### Adaptive Capacity

The municipal zoning code already allows for increased density and more multi-unit buildings, therefore the City's readiness to accommodate more residents in the future is not a significant concern.

## CONCLUSION

Global climate change poses a number of risks to the city and people of Highland Park. Of greatest significance are the risk of localized flooding due to increased frequency and intensity of rain events, and the human health impacts due to extreme temperatures. Pressure on municipal finance is also a concern, with the potential for more services required to manage environmental impacts. With advanced planning and data management, City departments can collaborate with other units of government (Lake County, fellow municipalities), major institutions (hospitals, parks, and schools), and resident representatives to mitigate the negative impacts brought about by climate change.

In the future, global climate change may also present opportunities for Highland Park, as the potential shifts in population drive more people from coastal areas to the Midwest. Thoughtful planning, the Highland Park standard, will prepare the City for this eventual change.

This assessment has been developed as part of the City's commitment to the Global Covenant of Mayors for Climate & Energy (the Compact of Mayors). The City has calculated its greenhouse gas emissions inventory as required, set its reduction target at 5% by 2023, and submitted its inaugural report to the Climate Disclosure Project. The next required steps – detailing the plan for achieving the emissions reduction target and creating a climate action plan, will be completed by the end of 2020.