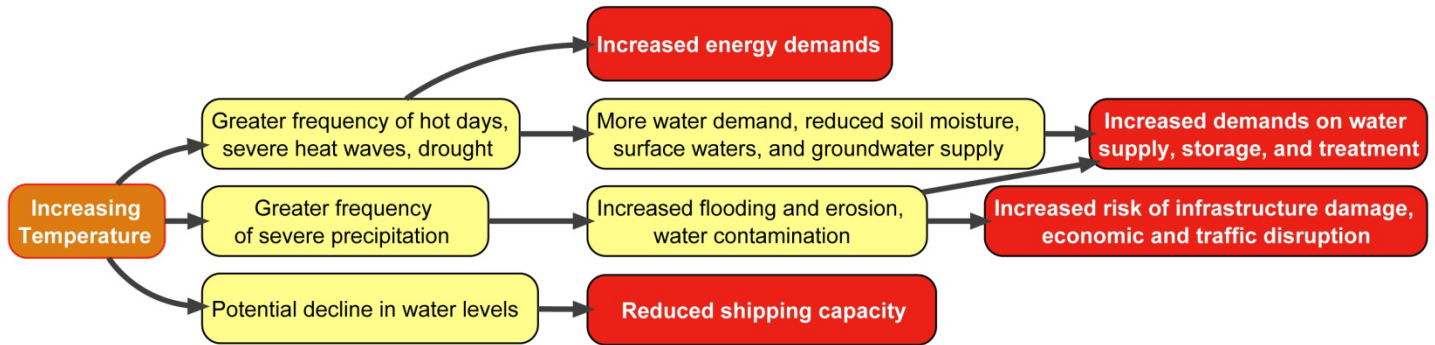


## Impacts of Climate Change on Infrastructure

Heat waves and severe storms will likely continue to increase in number and strength, carrying many implications for utilities and transportation infrastructure. Growing energy demands, stormwater management, and changes in water availability are critical issues.



### Stormwater Management

**Risks:** A higher frequency of droughts and severe precipitation events will increase the risk of flooding and erosion. When coupled with more severe storms, the use of impervious surfaces amplifies flooding risks by diverting stormwater into concentrated flows. Flooding and erosion damage transportation infrastructure, interfere with traffic, and cause economic disruption. More frequent flooding also poses numerous public health concerns that require investment in infrastructure to avoid.

**Strategies:** Improved storm water management could help control these issues by diverting flows away from vulnerable areas and into treatment facilities. Urban forests and “green” spaces can both reduce concentrated flow and erosion. Ann Arbor has implemented large, subsurface holding tanks in some areas, and in others the city has provided incentives for private entities to install smaller, inexpensive stormwater holding systems and to use pervious surfaces.

### Water Supply

**Risks:** The Great Lakes region will likely become drier overall due to increasing temperatures and evaporation rates. Changes in precipitation patterns and more frequent droughts will likely reduce soil moisture, surface waters, and groundwater supply. The region could see a 30-percent decrease in soil moisture in the next century. These effects would be felt most strongly in the summer months when groundwater recharge will decrease most severely and drought is more likely.

**Strategies:** Water storage planning and efficient water use policies could help reduce complications during periods of limited water supply. To protect wetlands in some areas, water supplies might have to be more heavily shared for human use and natural purposes. Adapting water infrastructure to changes in groundwater distribution may be necessary.



## Heat Waves and Utilities Use

**Risks:** Increasing temperatures will increase the number of days with highs above 90 °F (32.2 °C) and lead to greater frequency and severity of heat waves. Heat-island effects of urban areas amplify these issues. The past two decades have already seen the rate of heat-related death and illness increase Toronto, Chicago, and Detroit. Increased energy demand can stress electrical supplies and lead to more brownouts. Declining lake levels and decreasing water supplies during prolonged periods of intense heat could render hydroelectric power generation less effective and exacerbate energy shortages. It is unclear if rising lake levels would increase the productivity of hydroelectric power plants.

**Strategies:** There are a number of things that can be done to reduce the impacts of severe heat events. When severe heat waves are forecast, implementing energy conservation plans that both reduce public power consumption and alert private consumers of energy shortfalls can be effective. Energy efficient building codes, such as requiring “green” roofing and appropriate insulation, have helped reduce energy demands in many urban areas. Urban forests can reduce the need for air conditioning by providing shady canopies and mitigating heat-island effects.

## Shipping

**Risks:** Although less ice cover on the Great Lakes would extend the navigation season, most research estimates that climate change will have an overall negative impact on shipping, due to lower water levels in lakes and rivers. To adjust for lower water levels, ships may have to reduce the amount of cargo they carry on each trip. Ships may lose up to 30 percent in vessel capacity due to climate change, and potentially increase vessel operation costs between 5 and 22 percent.

**Strategies:** Dredging may be necessary to keep shipping routes and harbors open, but this would be expensive and potentially suspend polluted sediments, which can in turn lead to negative environmental and health impacts.

## Roadways and Transportation Infrastructure

**Risks:** Although little research has focused on the effects of climate change on transportation infrastructure in the Great Lakes region, typical impacts to paved surfaces include expansion of pavement and bridge joints and the softening of asphalt and other materials due to flooding. Greater flood risks may lead to increased opportunity costs due to interference with traffic and business operations. The increased risk of direct damage due to storms from severe weather such as hail and high winds will also increase preparation and repair costs.

**Strategies:** Implementing improved storm water management, porous pavement, and heat-resistant surfaces would help reduce impacts on roadways.



Pavement buckled due to extreme heat in Calhoun County, MI during the June, 2011 heat wave.