

December 14, 2022

To: Mayor and Members of City Council

From: Sheryl M.M. Long, City Manager

**202202205**

Subject: Environmental Impacts of Surface Parking Lots

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### **Reference Document #202201801**

The City Council, at its session on September 21, 2022, referred to the following item for review and report:

MOTION, submitted by Councilmembers Jeffreys and Owens, WE MOVE that, the Administration report back to Council within sixty (60) days on the environmental impacts of surface parking lots, which may include but is not limited to; their relation to urban heat islands, stormwater management, materials/construction, and vehicle emissions. Administration may consider soliciting feedback from the Office of Environment and Sustainability, Greater Cincinnati Water Works, the Department of Transportation and Engineering, and any other agency with relevant expertise

#### **Summary**

Surface parking lots can create a variety of environmental impacts including effects to (1) stormwater management, (2) increased urban heat island effect, (3) increased air pollution, and (4) enabling automobile-oriented lifestyle choices. The paved materials used for surface parking lots are generally comprised of black asphalt which is a high-contrast impermeable surface shown to decompose into complex mixtures of organic compounds when exposed to extreme heat and solar radiation.<sup>1</sup> These paved areas are a contrast to permeable surfaces such as gravel lots, greenspaces, or forested areas.

#### **I. Stormwater Runoff**

The impermeable materials of surface parking lots prevent permeation of water into the soil and groundwater supply during rain events. This can cause an overwhelming amount of water to collect on streets, streams, and ultimately enter the combined sewer leading to damaging floods and combined sewer overflows.<sup>2</sup> The high volume and velocity of water on these impermeable surfaces can also contribute to overland flooding, soil erosion, and landslides on hillsides. The movement of surface water also increases the delivery of pollutants from these surfaces into the environment - and ultimately the Ohio river watershed - through storm sewers and combined sewer overflows.<sup>3</sup> These effects on stormwater management are exacerbated by large rain events, increasing in frequency in recent years.<sup>4</sup>

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<sup>1</sup> <https://news.yale.edu/2020/09/02/asphalt-adds-air-pollution-especially-hot-sunny-days>

<sup>2</sup> <https://www.epa.gov/caddis-vol2/urbanization-stormwater-runoff>

<sup>3</sup> <https://www.epa.gov/caddis-vol2/urbanization-stormwater-runoff>

<sup>4</sup> [https://www.cincinnati-oh.gov/sites/oes/assets/File/2018%20Green%20Cincinnati%20Plan\(1\).pdf](https://www.cincinnati-oh.gov/sites/oes/assets/File/2018%20Green%20Cincinnati%20Plan(1).pdf)

## **II. Urban Heat Island Effect**

The high-contrast asphalt surfaces of surface parking lots can increase the urban heat island by absorbing heat and radiating, creating hotter surfaces and air temperatures.<sup>5</sup> The urban heat island effect was quantified across city neighborhoods in the 2021 Climate Equity Indicators Report which shows the highest effects are in areas with low tree canopy coverage and high percentage of impermeable surfaces - including paved surface parking lots. Neighborhoods with high percentages of paved surfaces were 12 degrees F hotter than in neighborhoods with lower percentages of paved surfaces.<sup>6</sup> The urban heat island effect contributes to increased heat-related injuries and deaths, increased energy costs, and increased air pollution levels.<sup>7</sup> Heat waves are increasing in frequency and duration across the United States.<sup>8</sup> This trend suggests that the urban heat island effect will increase in areas with large percentages of impermeable surfaces in future years.

## **III. Air Quality Issues**

The exposure of asphalt to extreme heat and solar radiation has shown a decomposition of the material into complex mixtures of organic materials including secondary organic aerosols. These materials contribute to PM2.5 air pollutants and are hazardous to human health and contribute to unhealthy air quality.<sup>9</sup> Hot temperatures and sunlight in areas with high percentages of asphalt, such as paved surface lots, can contribute to poor air quality. The potential secondary organic aerosols formed from the decomposition of asphalt is comparable to the level from vehicle emissions and is an important non-combustion source of emissions.<sup>10</sup>

## **IV. Enabling Automobile-Oriented Lifestyle Choices**

In Cincinnati, emissions from transportation now account for more than 30% of greenhouse gas pollution, driven by use of single-passenger vehicles. The use of urban land for surface parking contributes to car-oriented culture, lifestyle, and urban design. Parking availability has been shown to influence transportation decisions. Increases in parking options have led to increases in car-ownership, increases in driving frequency, and decreases in public transit use.<sup>11</sup>

cc: Oliver Kroner, Director of the Office of Environment and Sustainability

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<sup>5</sup> [https://www.cincinnati-oh.gov/sites/oes/assets/File/Summary\\_Report\\_Heat\\_Watch\\_Cincinnati.pdf](https://www.cincinnati-oh.gov/sites/oes/assets/File/Summary_Report_Heat_Watch_Cincinnati.pdf)

<sup>6</sup> [https://www.cincinnati-oh.gov/sites/oes/assets/File/Climate%20Equity%20Indicators%20Report\\_2021.pdf](https://www.cincinnati-oh.gov/sites/oes/assets/File/Climate%20Equity%20Indicators%20Report_2021.pdf)

<sup>7</sup> <https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect>

<sup>8</sup> <https://www.epa.gov/climate-indicators/climate-change-indicators-heat-waves>

<sup>9</sup> <https://news.yale.edu/2020/09/02/asphalt-adds-air-pollution-especially-hot-sunny-days>

<sup>10</sup> <https://news.yale.edu/2020/09/02/asphalt-adds-air-pollution-especially-hot-sunny-days>

<sup>11</sup> [https://people.ucsc.edu/~jwest1/articles/MillardBall\\_West\\_Rezaei\\_Desai\\_SFBMR\\_UrbanStudies.pdf](https://people.ucsc.edu/~jwest1/articles/MillardBall_West_Rezaei_Desai_SFBMR_UrbanStudies.pdf)