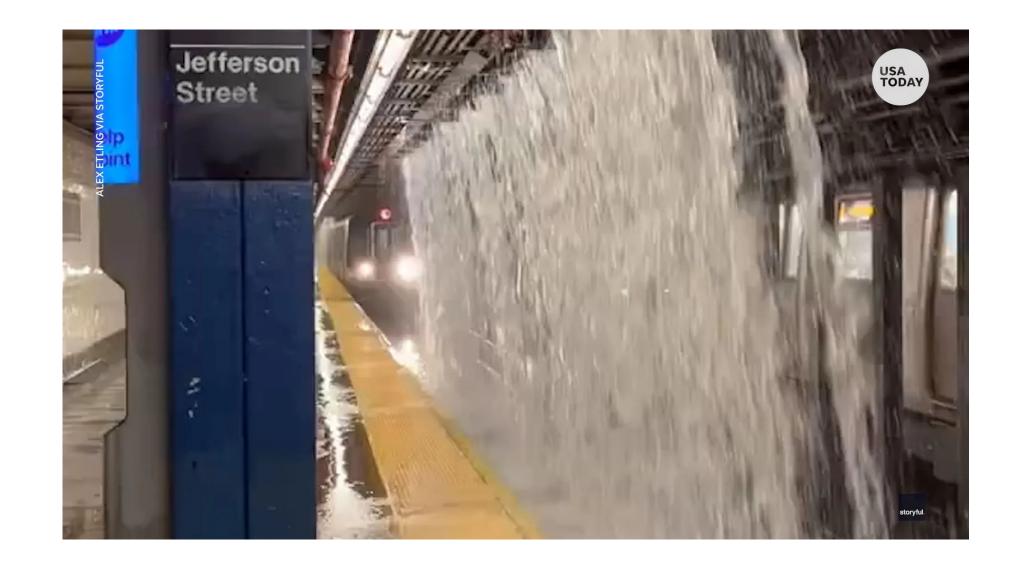
# MTA Turnstile Analysis: Extreme Weather

**CREATED FOR:** NYC Extreme Weather Task Force

ANALYSIS BY: Olivia Offutt, Metis EDA



### INTRODUCTION

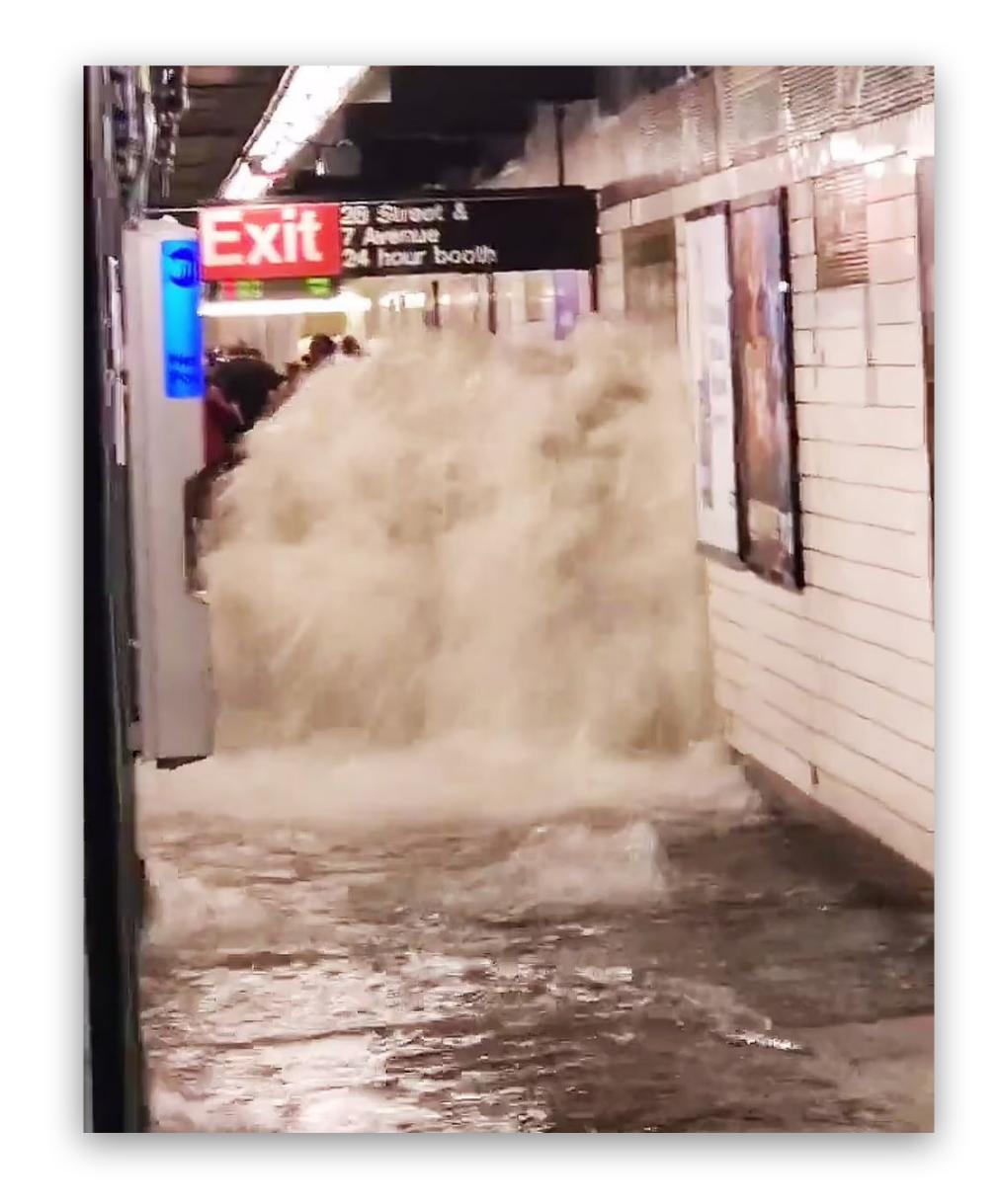
#### **OVERVIEW**

- Climate change is increasing extreme weather patterns in NYC
- NYC Extreme Weather Task Force launched following the deadly impacts of Tropical Storm Ida in 2021 to improve citywide planning and response to extreme weather
- The Task Force needs transit data on storm system events to target MTA capital improvements and emergency planning strategies

#### **PROJECT GOAL:**

For 2021 hurricane season:

- Explore hurricane season ridership trends
- ID stations with highest impacts to service during and following storm events



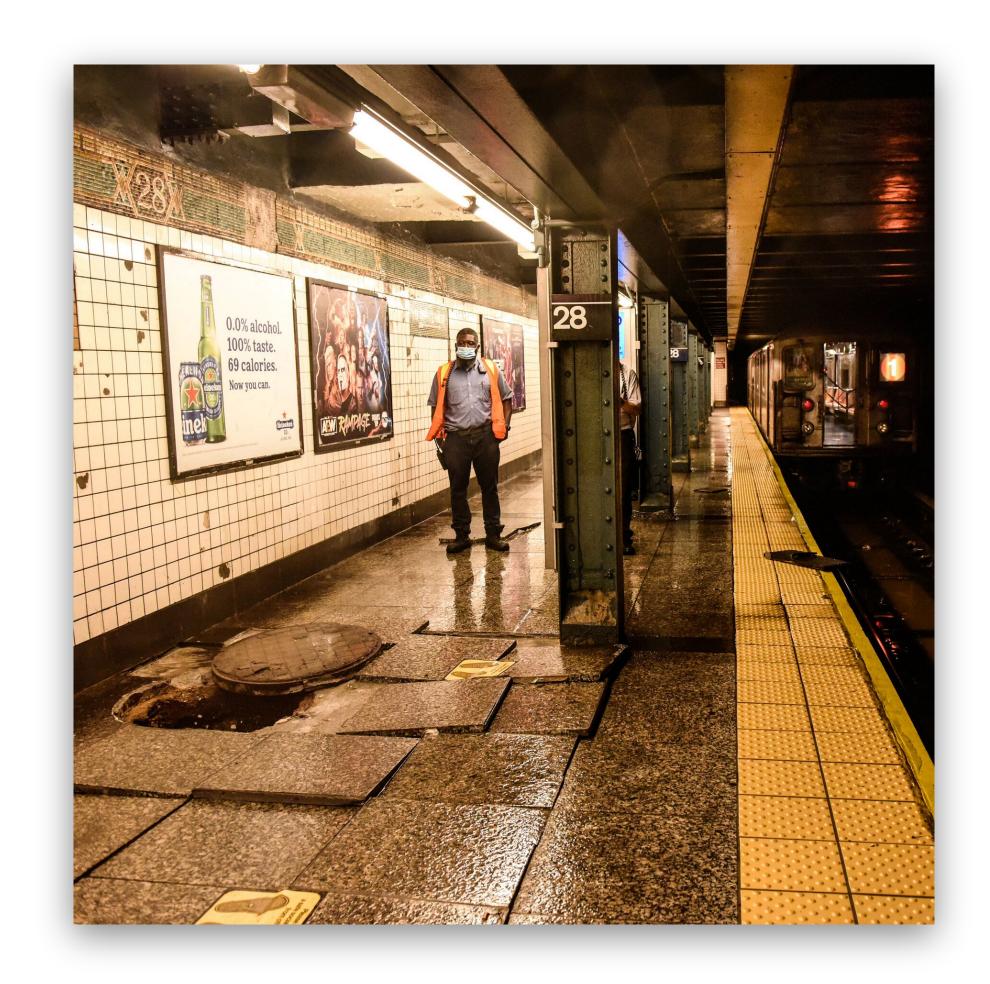
# METHODOLOGY

#### **DATA**

- MTA cumulative turnstile entry data by station for peak storm season in New York (August 1 - October 31, 2021)
- National Weather Service storm warning data detailing dates and counties for official flash flood warnings

#### **TOOLS**

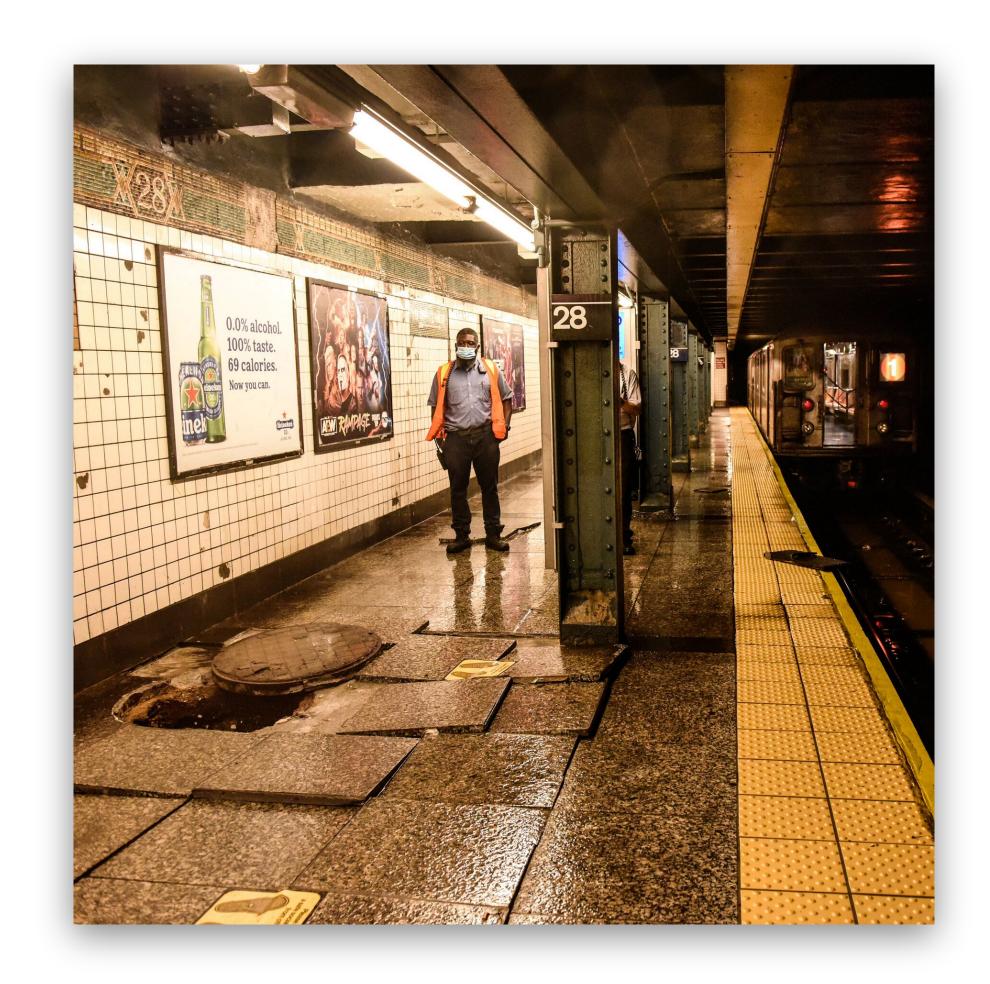
- SQLite and SQLAlchemy (data import)
- Pandas (data exploration / analysis)
- Matplotlib and Seaborn (data visualization)



## METHODOLOGY

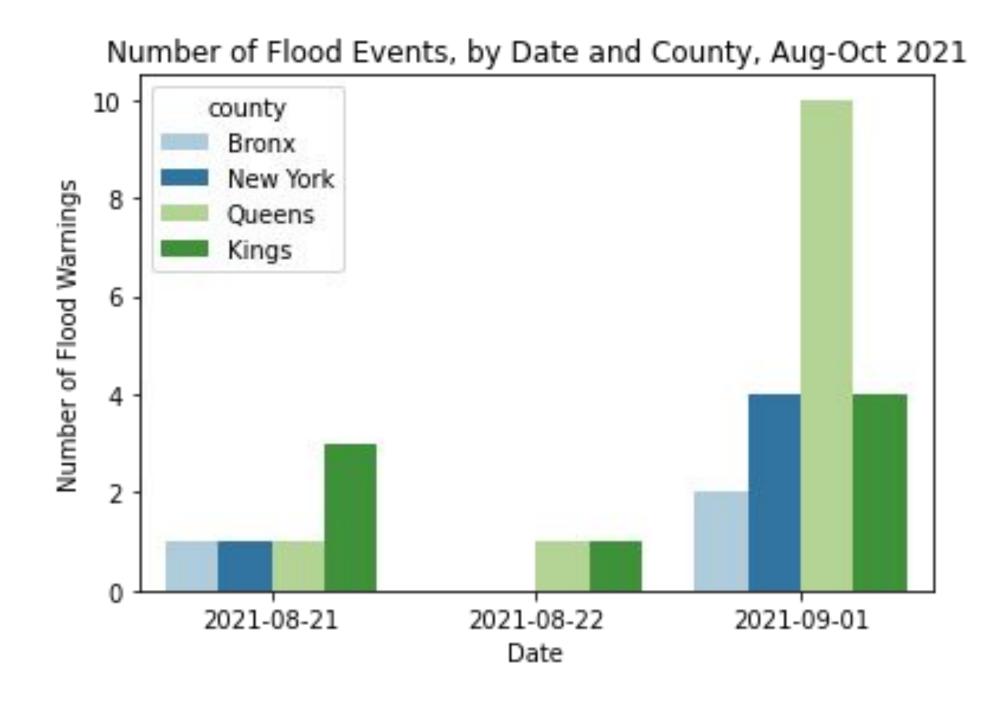
#### **METRICS**

- Flood warning description data by county to ID counties vulnerable to dangerous flash flood events
- Merge the NWS and MTA data to ID, aggregate, and compare storm weeks and non-storm weeks
- Develop line plots to show MTA entry trends by weekend (Su-Sa) and work week (M-F) and identify ridership trends during and after storm weeks
- Drilling down on three weeks (before, during, and after storm Ida) to develop % changes in ridership comparing:
  - o before- and during-storm weeks (showing acute impact), and
  - before- and after-storm weeks (showing more long-term impact)

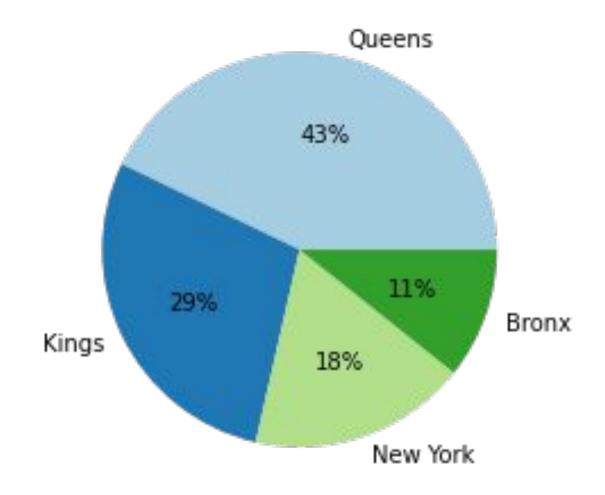


### Flash Flood Warnings, by County

- During the study period, there were two storm events that caused flash flooding, (a) Aug 21-22 and (b) Sep 1 (Tropical Storm Ida)
- While the first storm had more sustained flooding, Ida had more severe flooding
- More than two-thirds of flood events (72%) were located in Queens and Kings.

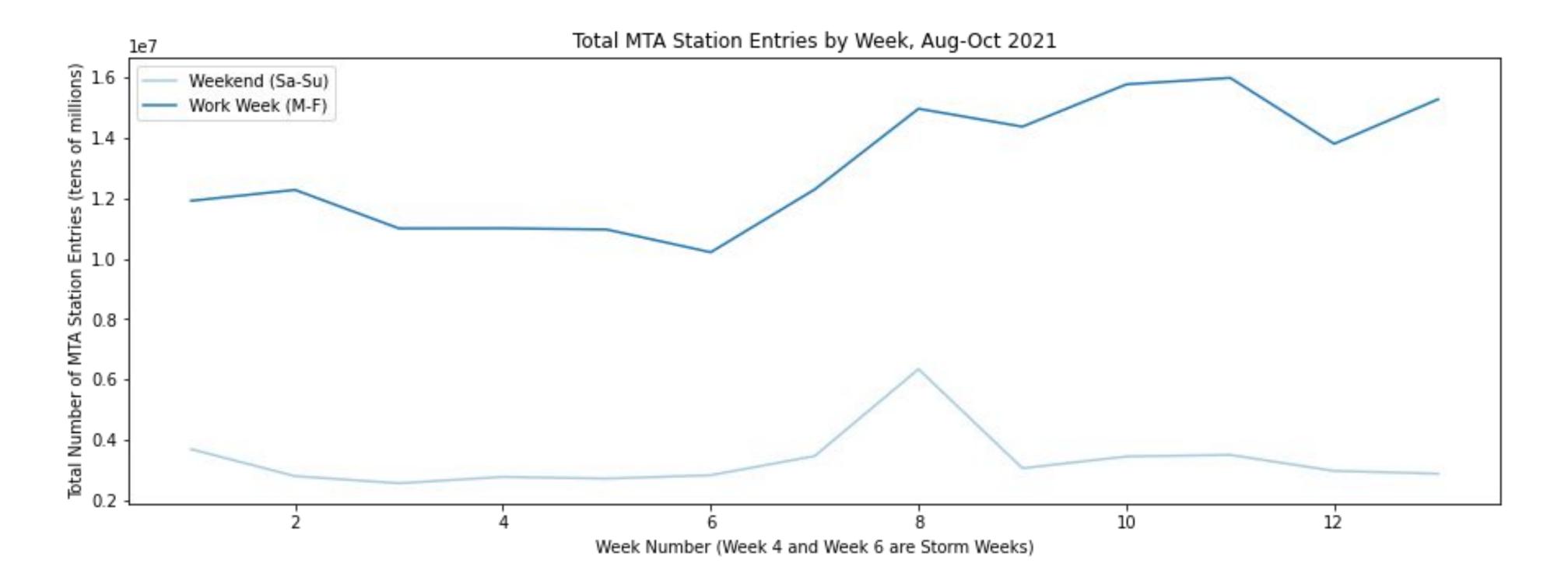


#### % Share of Total Flood Events, by County, Aug-Oct 2021



### Weekly entry trends during hurricane season, categorized by weekend and work-week

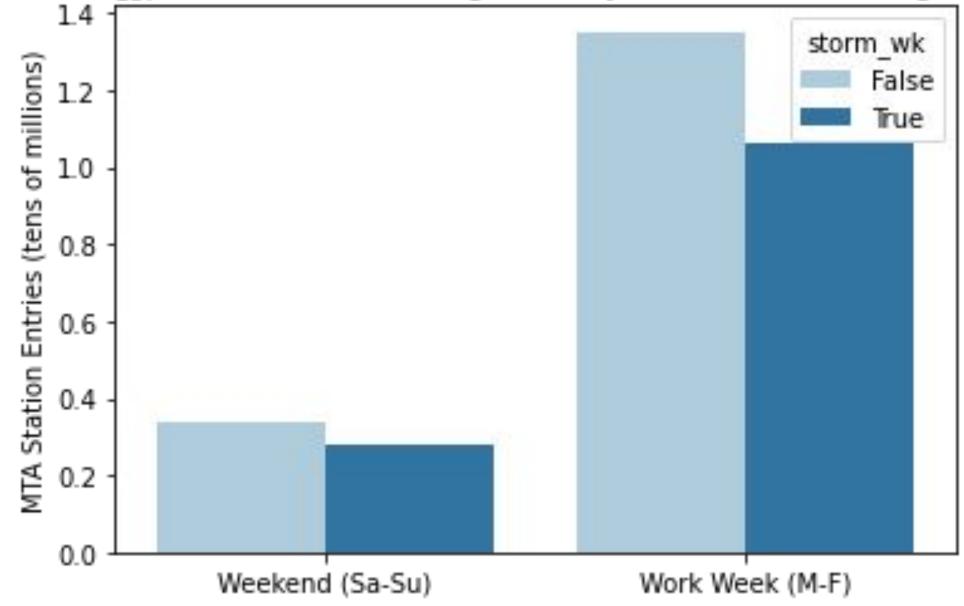
- Only storm Ida (wk 6) appears to have a drop in entries for the work week (Ida occurred on a Wednesday)
- Week 6 experienced a drop, followed by sustained increases over the following two weeks
- Weekend entries do not seem to be impacted by either storm
- Even though week 4's flooding occurred over a weekend, there does not appear to be any impact



### Weekend and work-week station entry averages, categorized by storm week and non-storm week

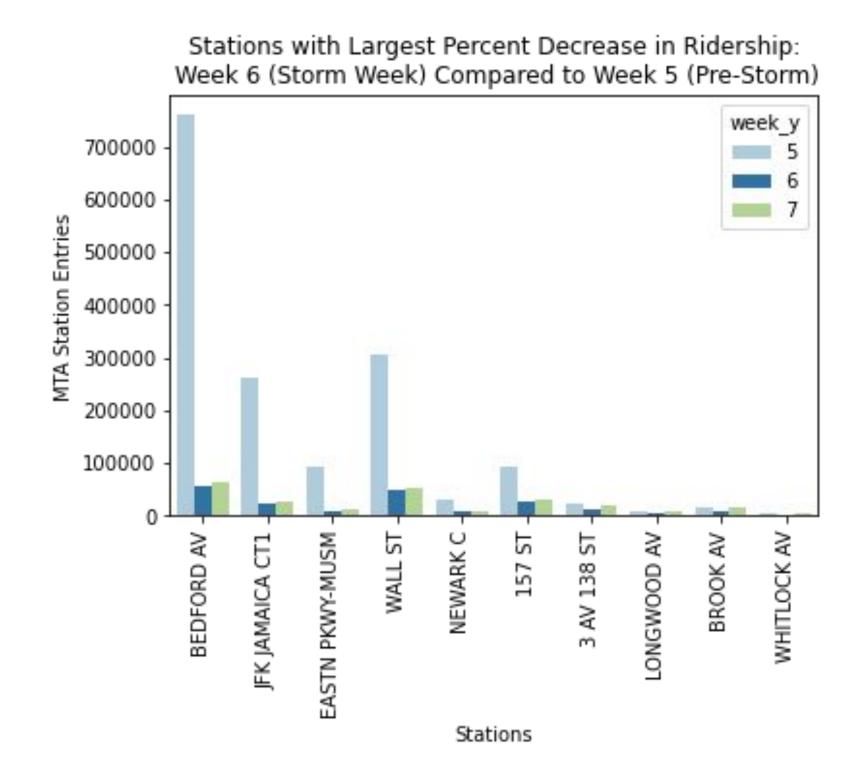
- Weekend average total MTA entries during non-storm weeks vs storm weeks is nearly the same
  - Difference = 600,000 entries, well below the standard deviation of 1.04 million
- The weekday average total MTA entries during non-storm weeks vs storm weeks appears to be significantly different
  - Difference = 12.5 million entries, well above the standard deviation of 1.89 million

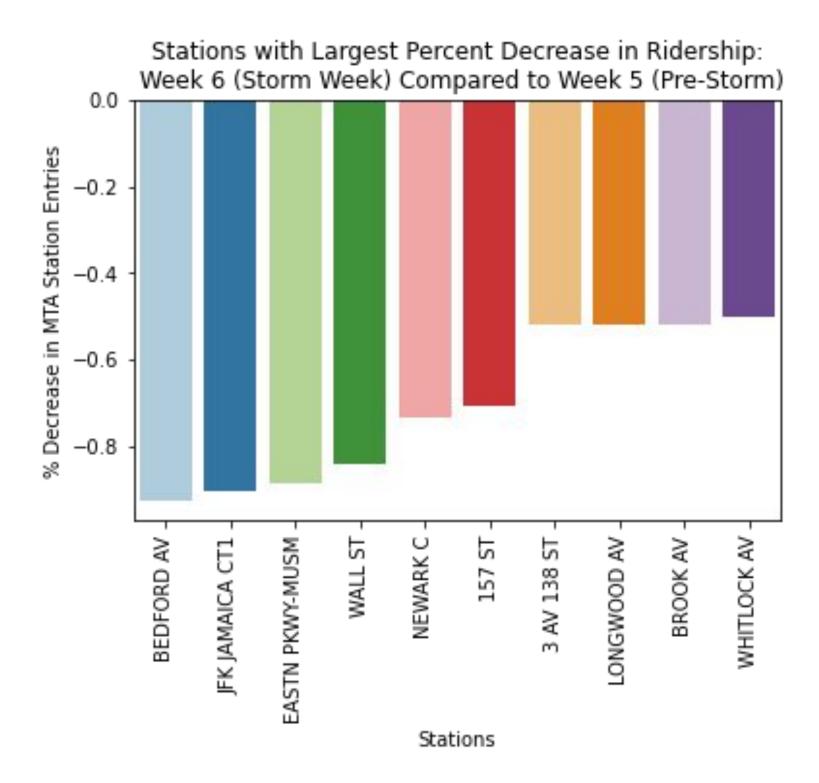
#### md Work Week Average Weekly Station Entries, Aug-Oct 2021 والمجارة Weekend



### Stations with the largest % decrease in ridership from week 5 (pre-Ida) to week 6 (during-Ida)

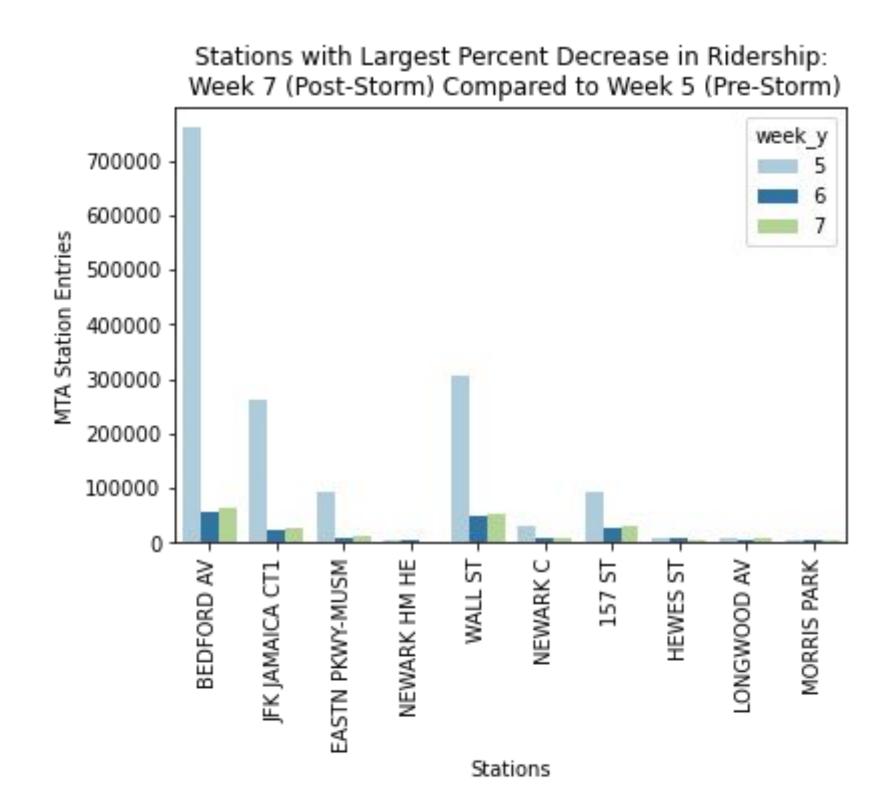
- The top ten stations shown have 43-94% decreases in weekly ridership
- These stations show highest acute impacts to ridership

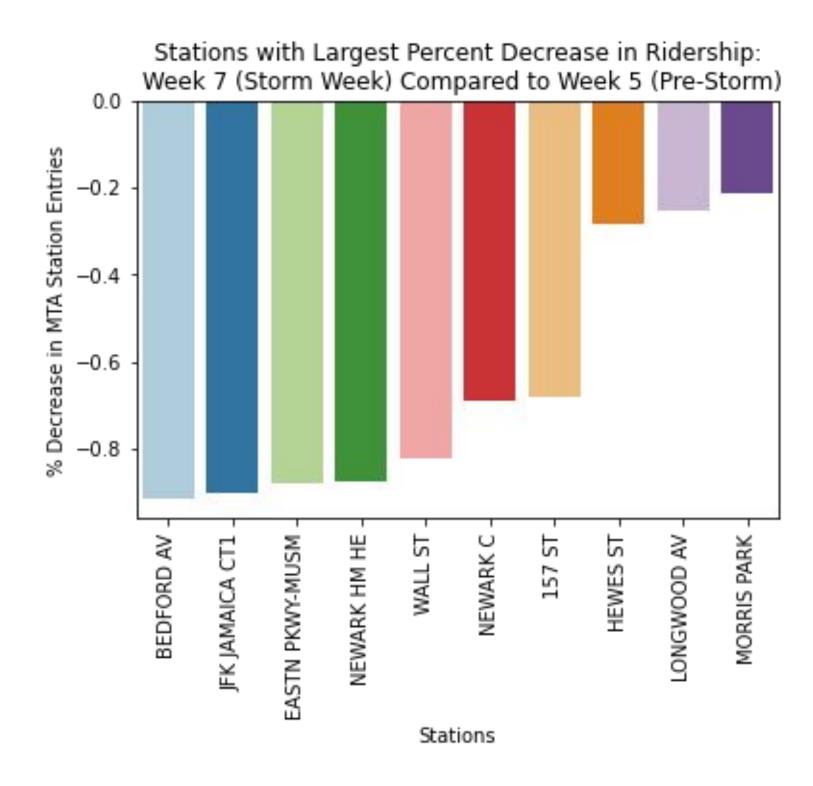




### Stations with the largest % decrease in ridership from week 5 (pre-Ida) to week 7 (post-Ida)

- The top ten stations shown have 20-94% decreases in weekly ridership
- These stations show the highest long-term impacts to ridership, likely ID'ing stations with critical infrastructure damage
- 7/10 of these stations appear on both lists: Newark Hm, Bedford Av, Jfk Jamaica, Eastn Pkwy-Musm, Wall St, Newark, St-Penn Sta





### CONCLUSIONS

- Flooding is heaviest in Queens and Kings counties, and these counties may generally be prioritized for flooding resilience capital improvements
- Work weeks (vs weekends) tend to experience the highest level of impact to ridership, possibly indicating needs for stations with heavy commuter flows to be prioritized for capital improvements
- The 7 stations that experience the highest % decreases in ridership during Ida as well as after Ida should be researched as high priority candidates for capital improvement planning

