Fresh Pond Reservation Census Program

2018 Data Collection Summary

Updated May 14, 2020

Program Outline

- Purpose
- Methods
  - Data collection
  - Quality control
  - Data exclusions
  - Data analysis
- Results
  - Annual overview
  - EcoCounter sensor data by site
  - Visual survey results
- Future Goals

Purpose

- To *quantify* and *qualify* users at Fresh Pond Reservation in order to inform management
  - Sensors at reservation entrances, the bike path, and perimeter road give an idea of user distribution throughout the day
  - Multi sensors differentiate between bike and pedestrian users

Methods

Methods • *Data Collection*

- Strategically-placed EcoCounter sensors at entrances and along perimeter road quantified Fresh Pond users
  - EcoCounter Pyro sensors count any heat producing body over 3ft tall
  - EcoCounter Multi sensors differentiate between pedestrians and cyclists
  - Sensors collect data in 15 minute intervals which is saved to an online database
- Visual surveys were conducted at sensor locations to further categorize users at Fresh Pond

EcoCounter Sensors

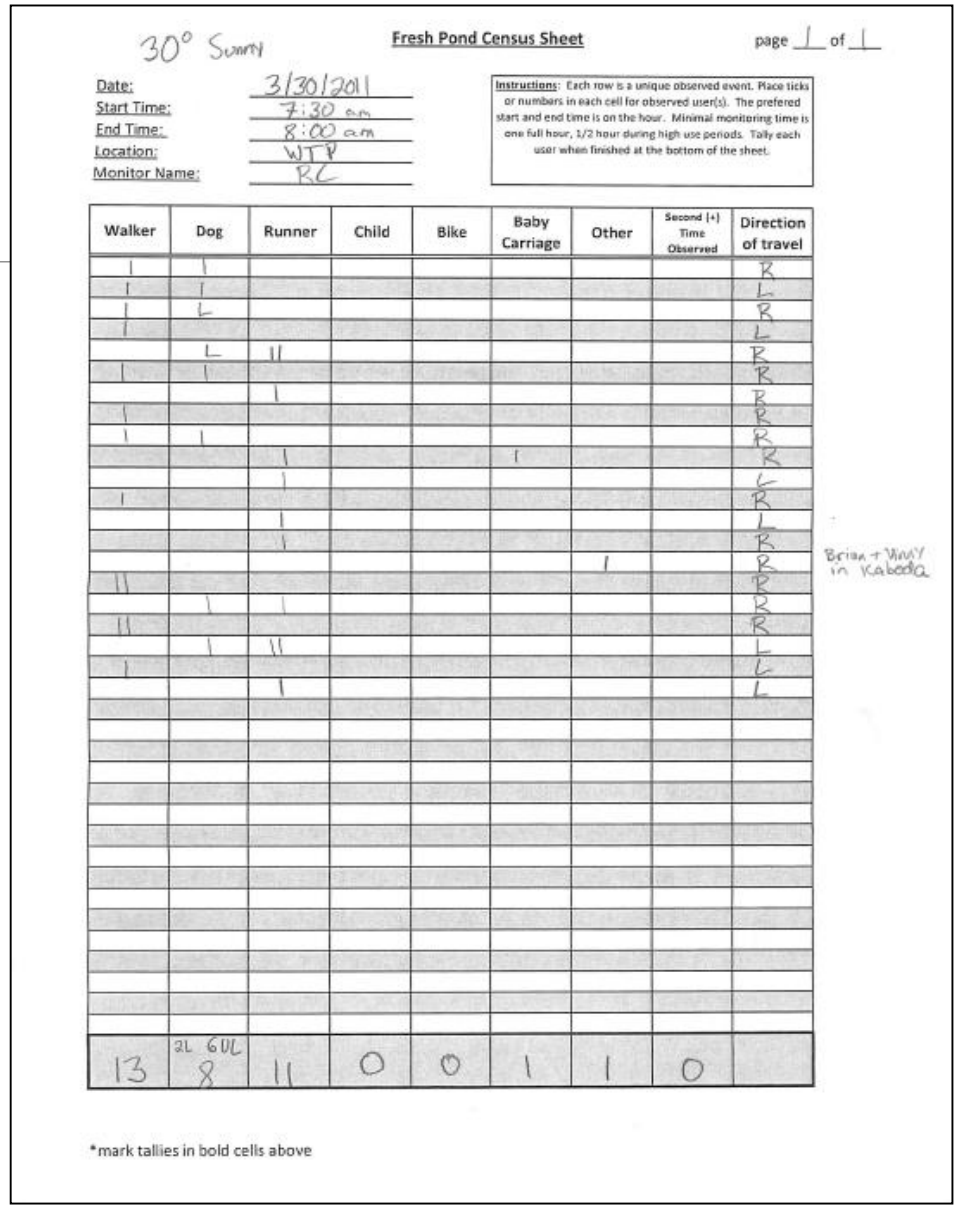
MULTI SENSOR

PYRO SENSOR

Visual Surveys

- Employee or volunteer conducted surveys next to sensor
- Recorded direction of travel and type of users
- Types of users included:
  - Pedestrians
  - Dogs (on/off leash)
  - Cyclists
  - Runners
  - Children
- Real-time feedback with the EcoCounter Android app helped to verify grouped events

Example Survey Datasheet



30° Sunny

Fresh Pond Census Sheet

page 1 of 1

Date: 3/30/2011
Start Time: 7:30 am
End Time: 8:00 am
Location: WTP
Monitor Name: RC

Instructions: Each row is a unique observed event. Place ticks or numbers in each cell for observed user(s). The prefered start and end time is on the hour. Minimal monitoring time is one full hour, 1/2 hour during high use periods. Tally each user when finished at the bottom of the sheet.

Walker	Dog	Runner	Child	Bike	Baby Carriage	Other	Second (+) Time Observed	Direction of travel
13	2L 6UL 8	11	0	0	1	1	0	

Brian + Vinny in Kabbala

*mark tallies in bold cells above

EcoCounter Sensor Locations

Entrances:

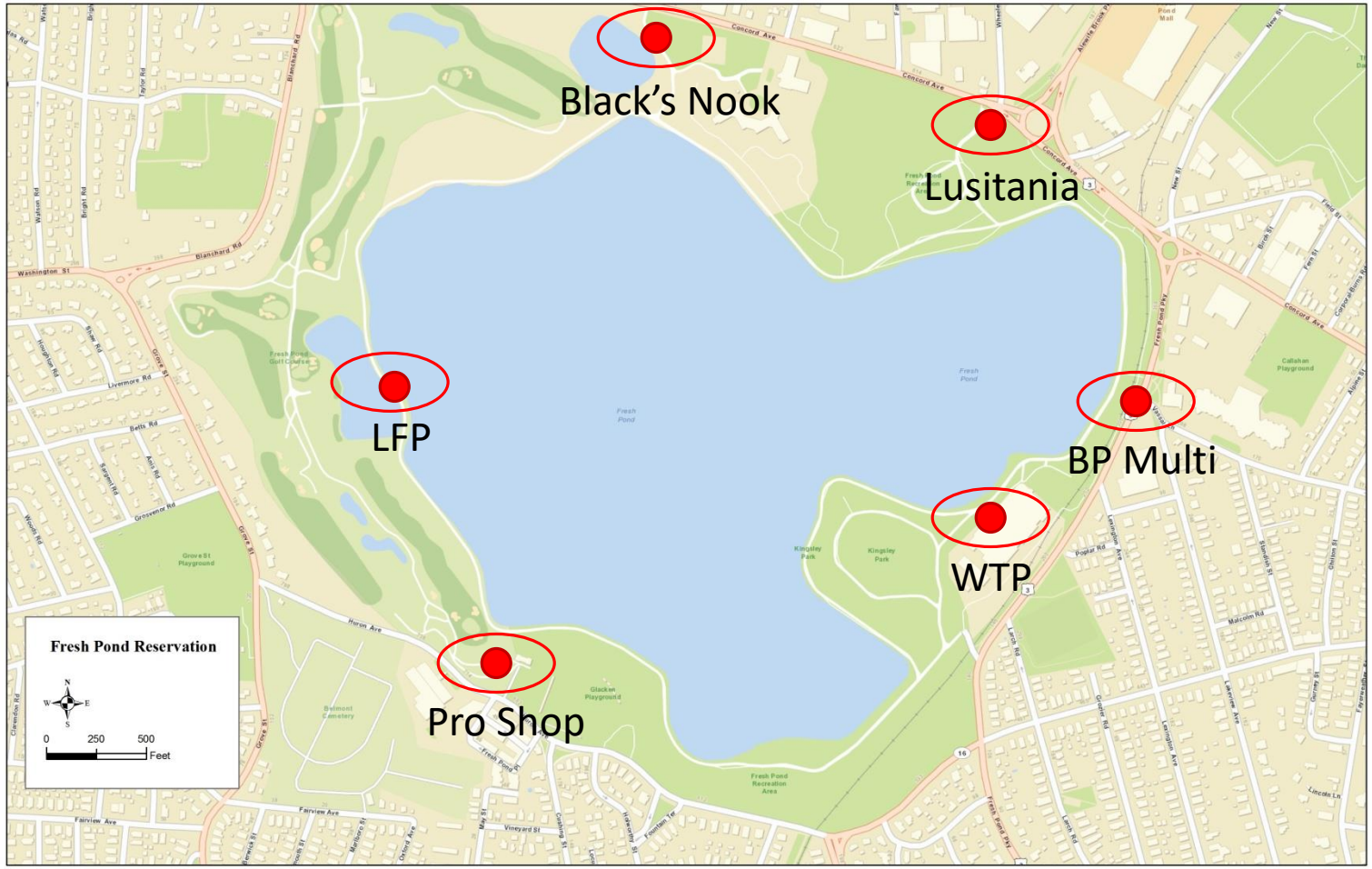
Black's Nook, Lusitania, and Pro Shop

Perimeter Road:

LFP and WTP

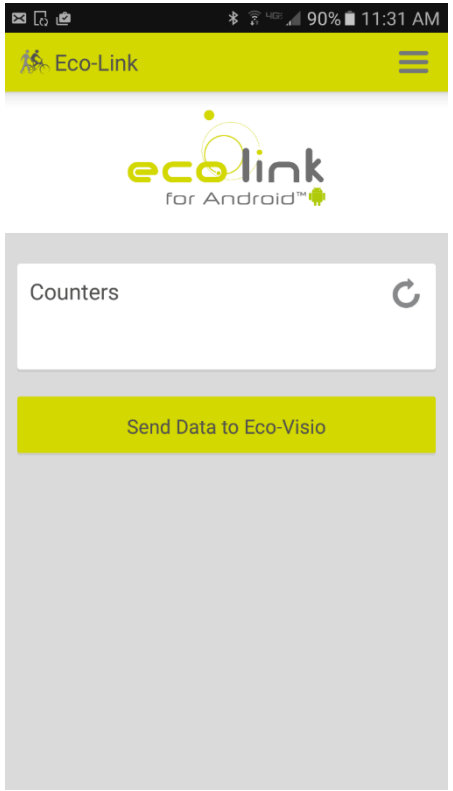
Multi Sensors:

WTP and BP Multi



Methods • *Quality Control*

- Sensors were visited weekly and checked for physical damage or environmental changes
- Data were downloaded and screened for anomalies weekly
- Sensor data were compared against visual survey data to identify any incongruities



EcoCounter Data Collection App

Methods • *2018 Data Exclusions*

Site	Exclusion Dates	Explanation
Black's Nook	3/8, 10/1	Brief abnormally high counts, likely someone standing in front of sensor or snow interference
BP Multi	6/14 – 6/15	Higher than expected usage
Lusitania	1/11, 1/30, 3/8, 6/3, 6/7	interference from snow storms and other unexplained spikes
WTP Multi	1/4/2018-1/8, 3/8, 3/19, 5/23, 5/25, 5/31, 6/1, 6/2, 6/13, 6/14-6/15, 6/17, 6/20, 6/29-6/30, 7/1-7/27 (periodic removal of anomalous bike data), 10/26, 12/10, 12/11	This sensor is located over aeration lines for the pond, which emit low amount of high frequency sonic waves. We suspect these may be interfering with the sensor, specifically for bike counts, which are the cause for data exclusion for the majority of these dates.

Anomalous data were removed for specific hours or the entire day, depending on the duration of the anomalous pattern, on the above listed dates.

Methods • *Data Exclusions or Errors, Past Years*

Sensor	2011	2012	2013	2014	2015	2016	2017
LFP	• Installed 1/6 • 8/1-9/28	• 11/13-1/2	• 2/4-2/19	• 1/17-1/22 • 4/15-4/23	• 2/2-2/4 • 2/9-2/11		
WTP	• Installed 1/7 • 11/7-12/1	• 6/29-7/26 • 11/15-12/3	• Bike counter installed 11/18	• 2/16-3/21 (Out counts only. Total counts unaffected.) • 7/1-10/31 • 11/4-11/6	• 1/27 • 2/2-2/4 • 2/9-2/11 • 2/15-2/17 • 2/19 • 6/30	• 2/2-3/3 (periodic anomalous bike counts excluded) • 7/3 • 7/5 • 11/14-12/14 (periodic anomalous bike counts excluded)	• 1/11-1/13 • 8/23
Black's Nook		• Installed 10/26 • 12/3-12/31	• 1/1-1/2 • 4/4-5/8	• 16-Apr			• 11/30
Lusitania				• Installed 4/11	• 2/9-2/11		• 1/8-1/10 • 2/10-2/11 • 6/28-7/5 • 12/26-1/11/18
BP Multi			• Installed 11/19	• 4/16	• 2/2-2/4 • 2/15-2/17 • 2/19 • 8/4-8/5 • 8/24	• 7/11 • 8/15 • 9/26	• 2/28 • 4/20-5/25
Pro Shop				• Installed 6/27	• 2/9-2/11		

Methods • *Data Analysis*

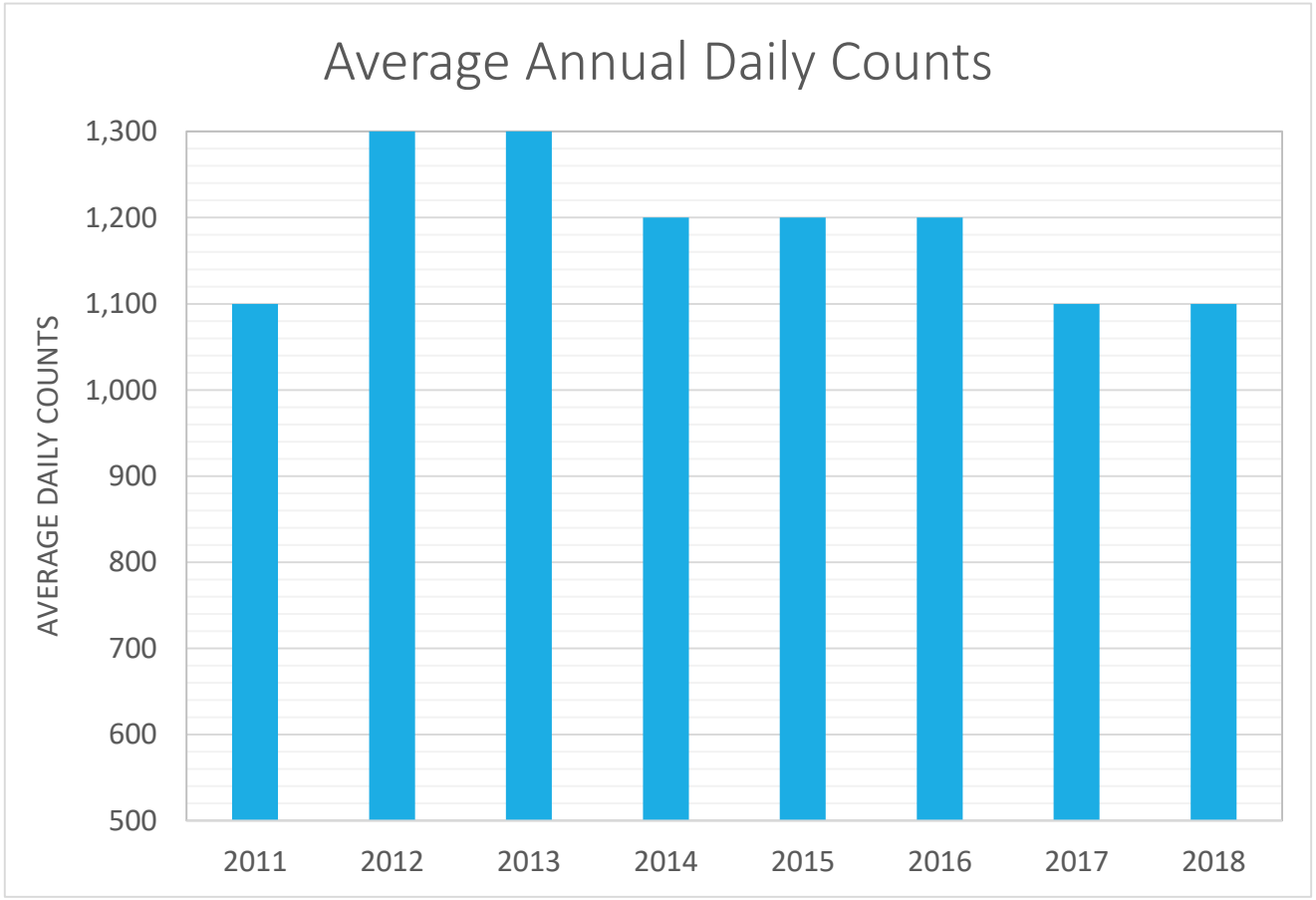
- Sensor results were grouped by location as being representative of the Entrances or the Perimeter Road
- Multi sensors were used to quantify cyclists separately from pedestrians
- Data were analyzed on yearly, monthly, daily, and hourly time scales to understand trends
- Data were presented as total counts (total of In and Out counts)
  - Counts may include users who pass sensors multiple times
- Visual surveys were compared to EcoCounter data to estimate sensor error and to characterize types of users

Results· *Annual Overview*

Results • *Daily Overview*

Year	Average Annual Daily Counts*
2011	1,100
2012	1,300
2013	1,300
2014	1,200
2015	1,200
2016	1,200
2017	1,100
2018	1,100

*Average of the daily (Sunday-Saturday) averages of WTP Multi (pedestrians and cyclists) and LFP

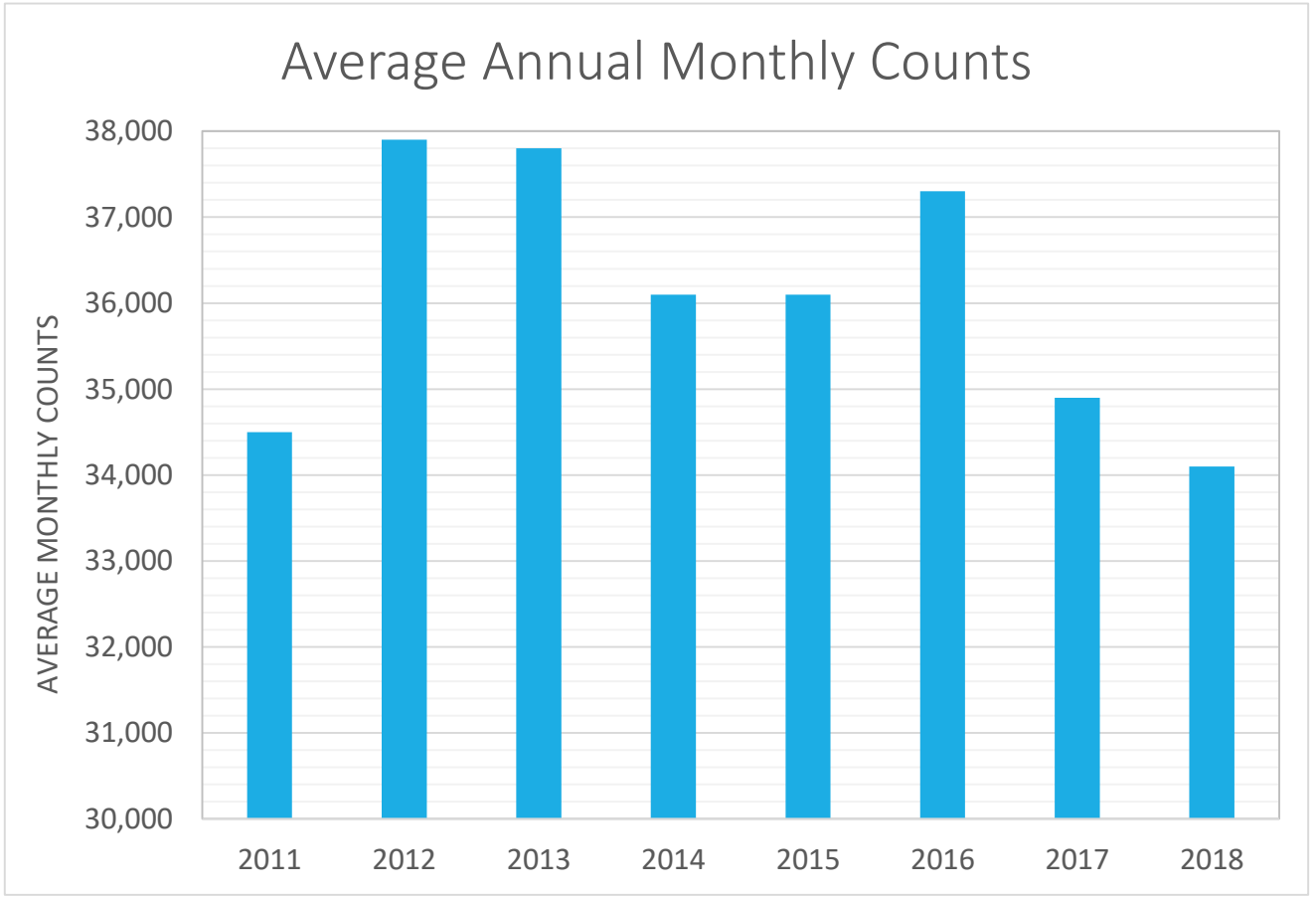


Results • *Monthly Overview*

Year	Average Annual Monthly Counts*
2011	34,500
2012	37,900
2013	37,800
2014	36,100
2015	36,100
2016	37,300
2017**	34,900
2018**	34,100

*Average of the monthly averages of WTP Multi (pedestrians and cyclists) and LFP

**WTP and LFP monthly averages were not calculated May 2017 – June 2018 due to the construction bike path construction detour, which reduced the number of users at WTP. Monthly total counts at LFP were used as proxy data in the calculation of the annual monthly average.

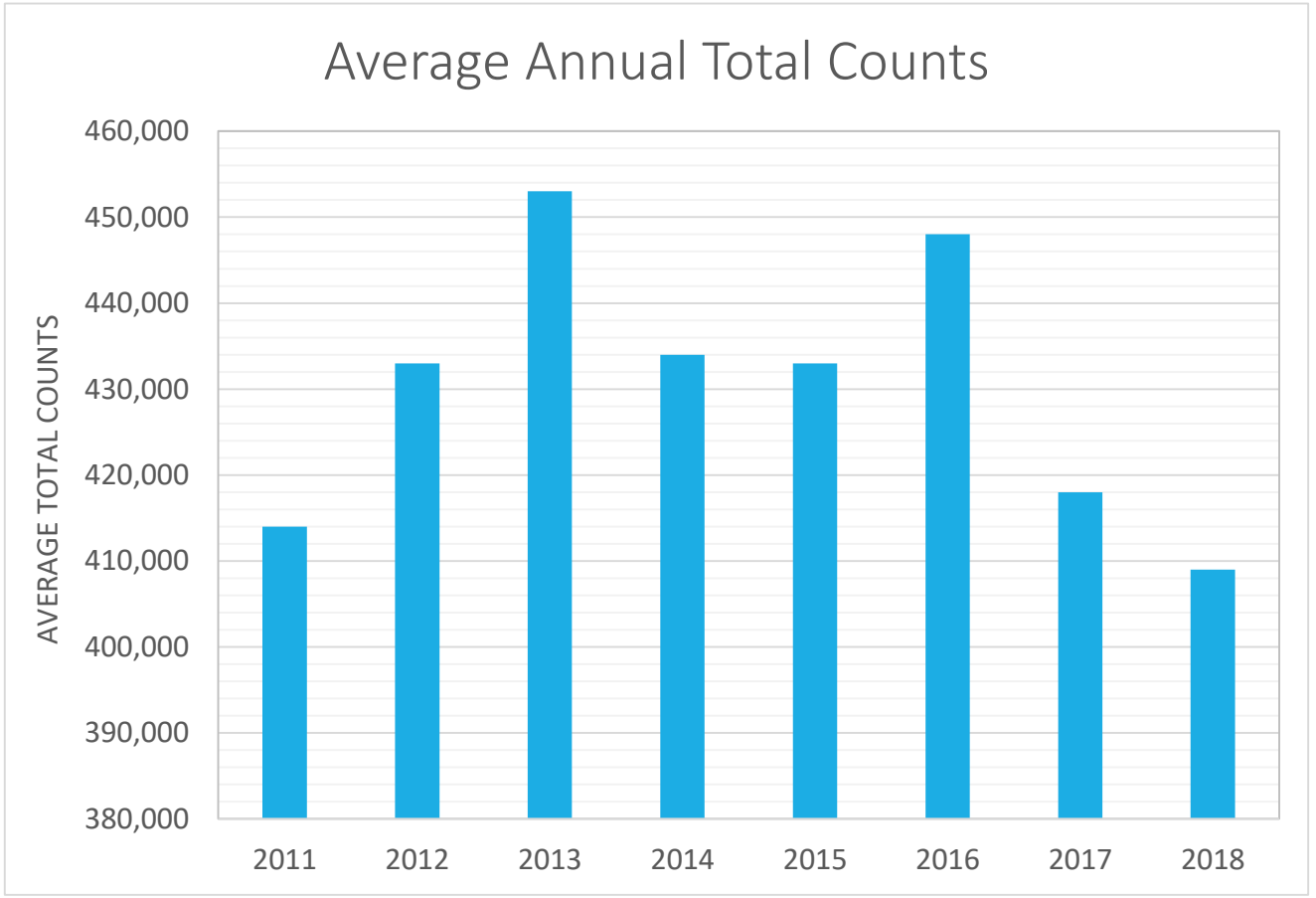


Results • *Annual Overview*

Year	Average Annual Counts*
2011	414,000
2012	433,000
2013	453,000
2014	434,000
2015	433,000
2016	448,000
2017**	418,000
2018**	409,000

*Sum of the monthly averaged total counts of WTP Multi (pedestrians and cyclists) and LFP

**Monthly totals from LFP were used in place of the LFP and WTP monthly averages during the Bike path construction detour May 2017-May 2018



Results • *Overview Summary*

- 2018 usership data suggest fewer users on average at Fresh Pond Reservation than in previous years.

- Construction of the new apartment complexes does not seem to have increased overall usership of the reservation.

- Data from the sensors and anecdotal evidence from Reservation Rangers suggest a change in user patterns due to the Perimeter Road and Community Gardens construction detour. This was noticed in 2017 when the detour was first put in place, and was active from May 2017 to early June 2018.
  - Users likely often used the bike path and treatment plant driveway to walk between the upper and lower parking lots, instead of the Perimeter Road, decreasing total counts at the WTP Multi sensor
  - This conclusion is also supported by the fact that monthly usership at WTP was lower than LFP during the detour and higher than LFP after the detour ended (see Perimeter Road Sensor Results).
  - Therefore, WTP monthly data were excluded from the calculation of total annual users and annual monthly averages while the detour was in effect.

Results • *Perimeter Road Sensors*

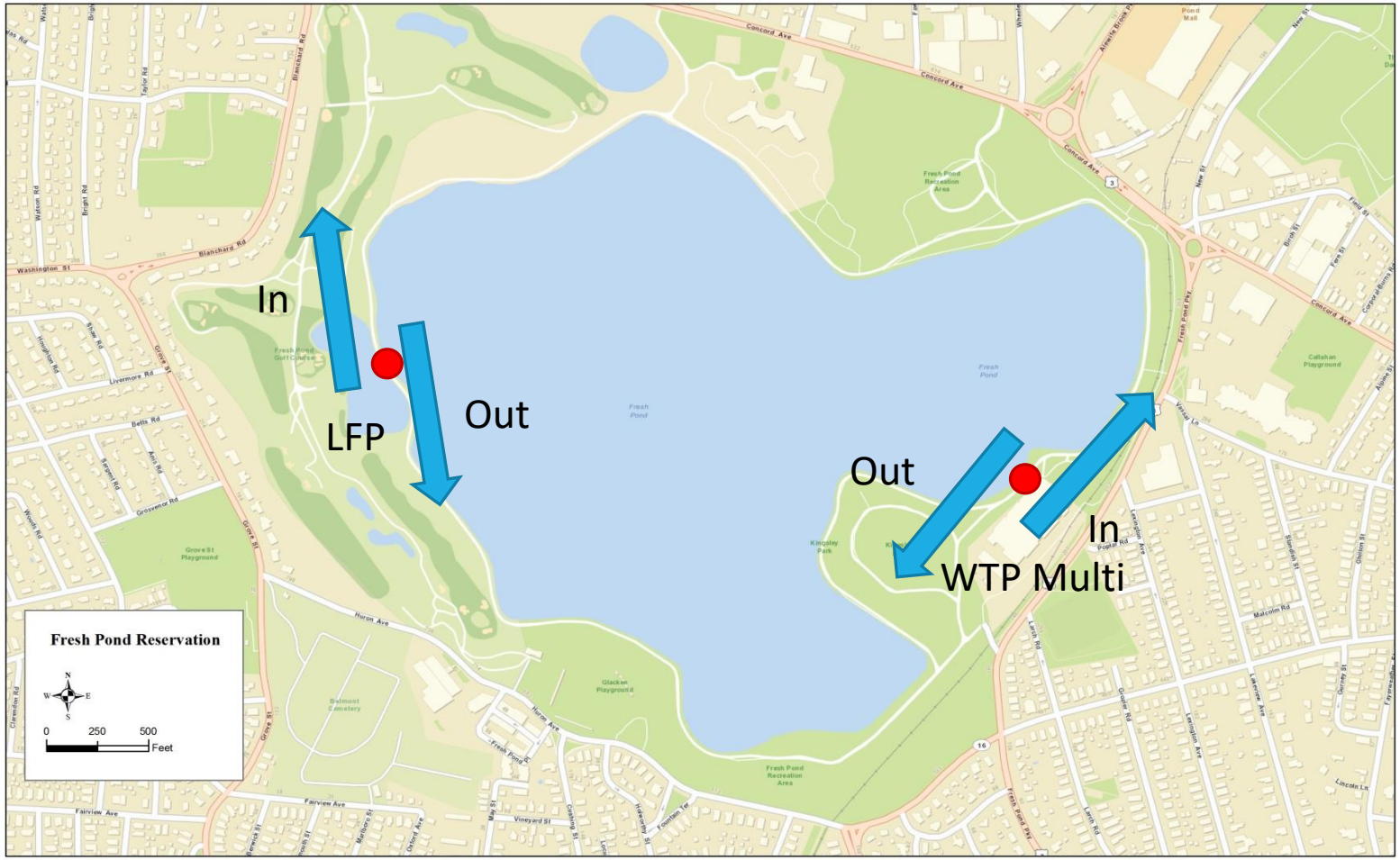
Perimeter Road EcoCounter Sensors

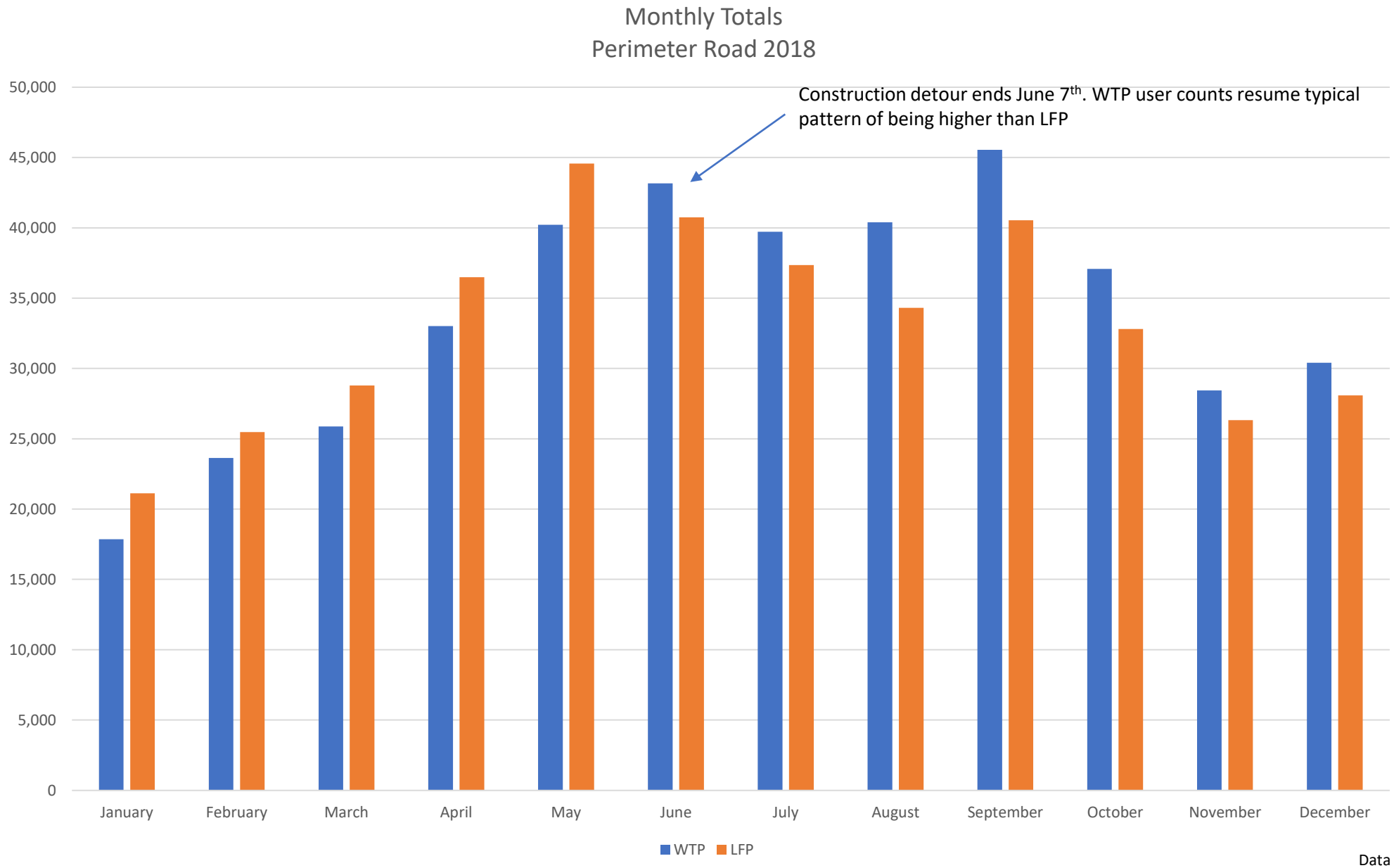
Little Fresh Pond (LFP)

- Directional

Water Treatment Plant Multi (WTP)

- Directional
- Differentiates between pedestrians and cyclists





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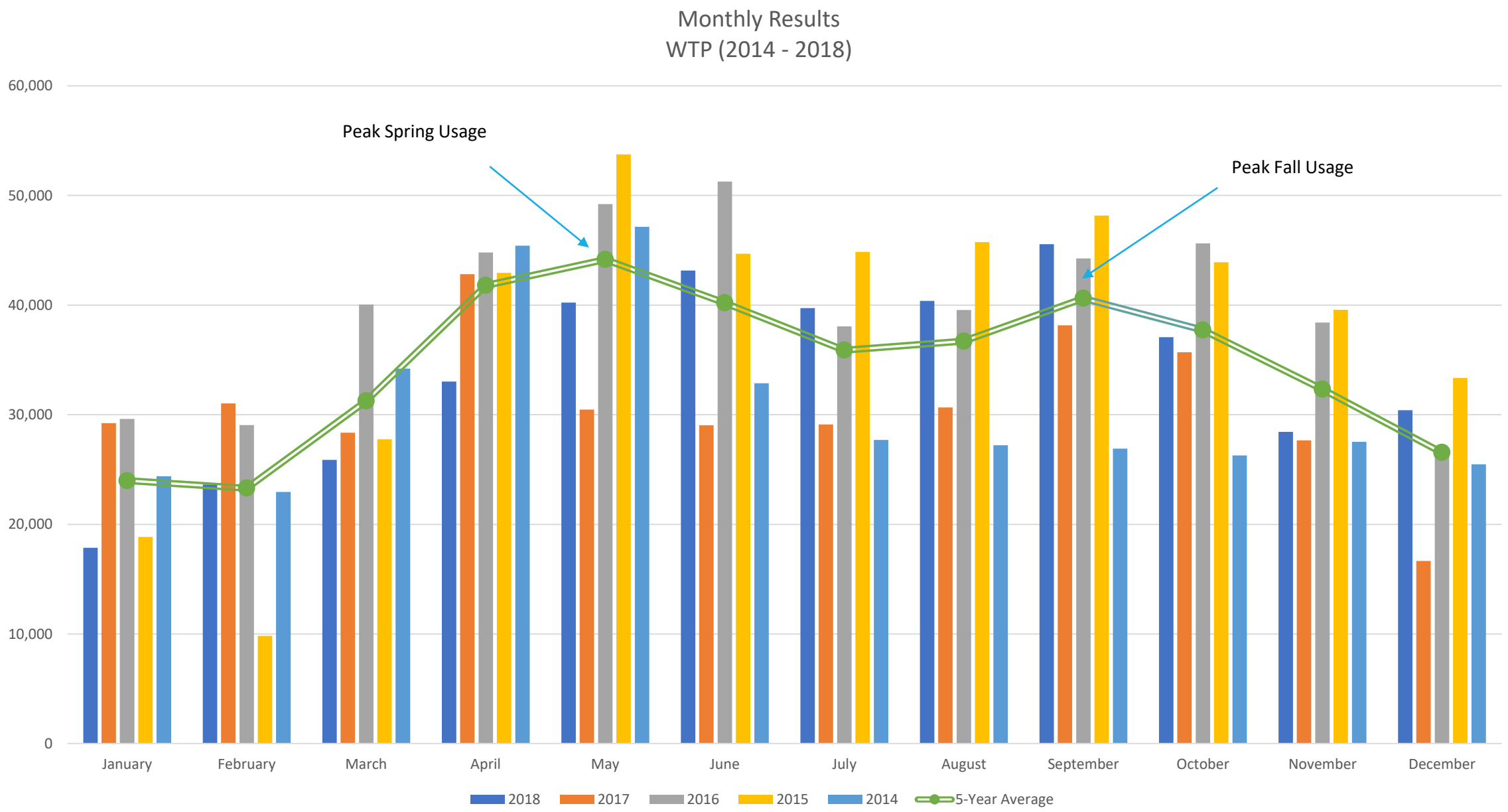

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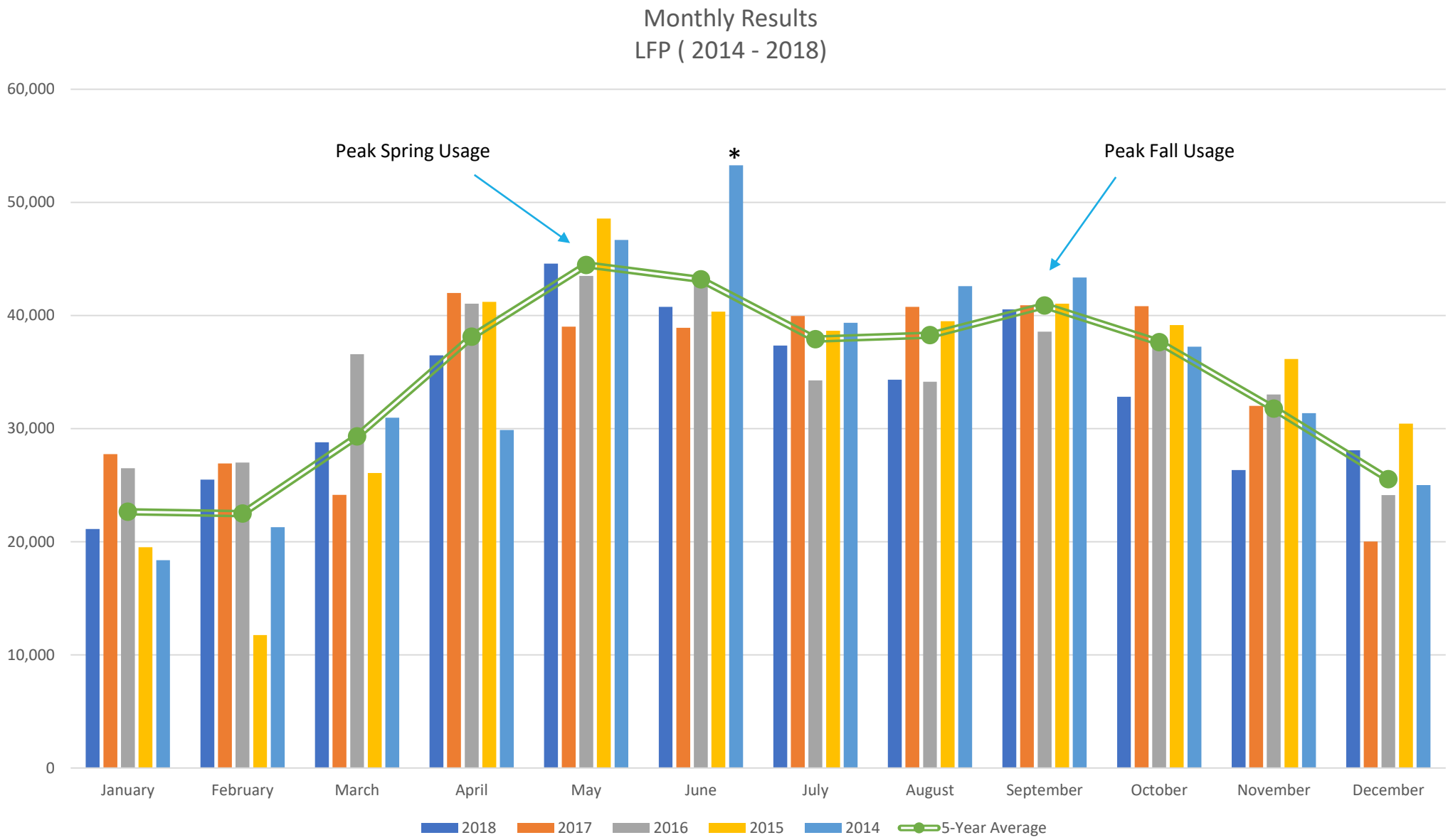
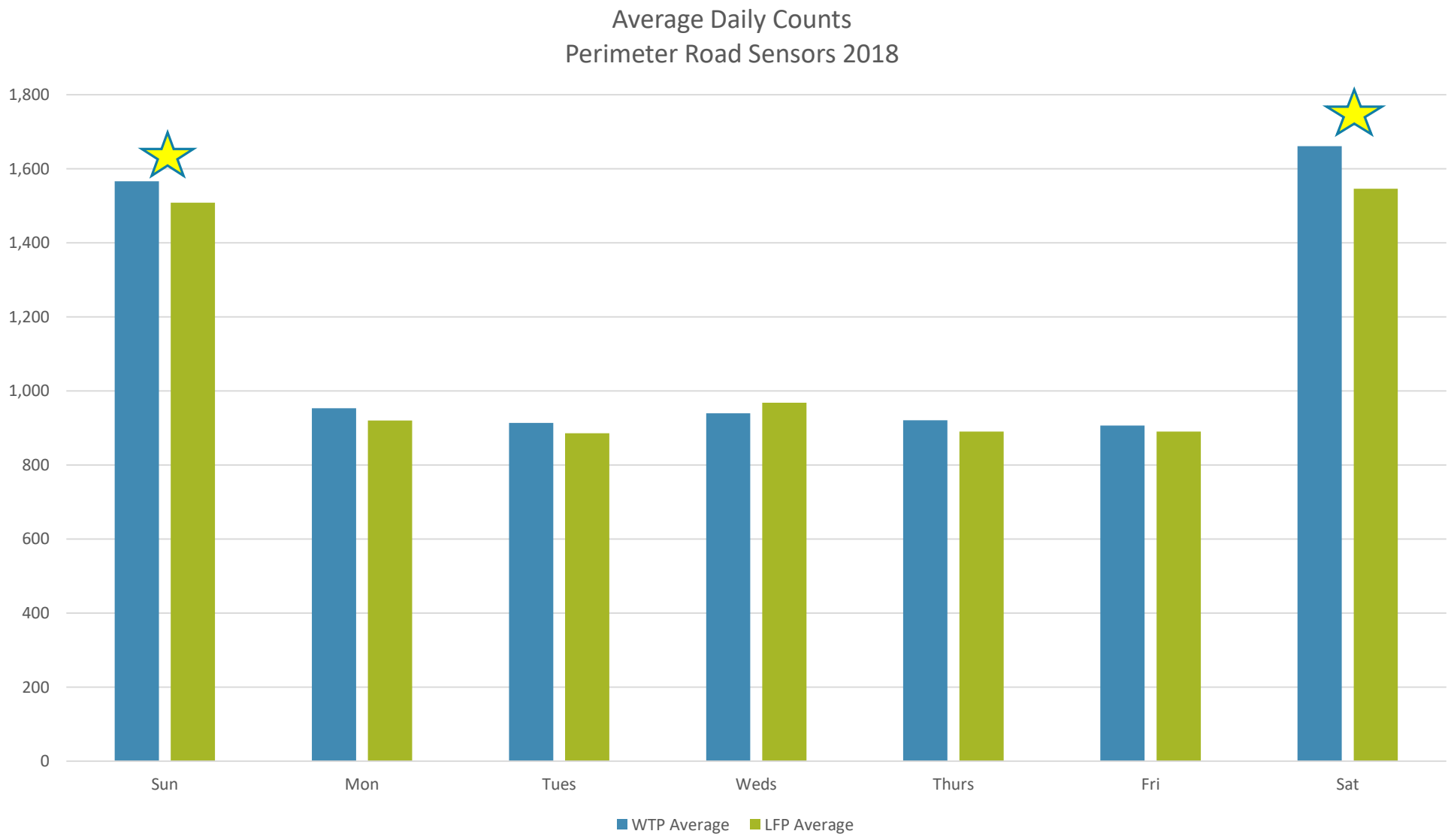


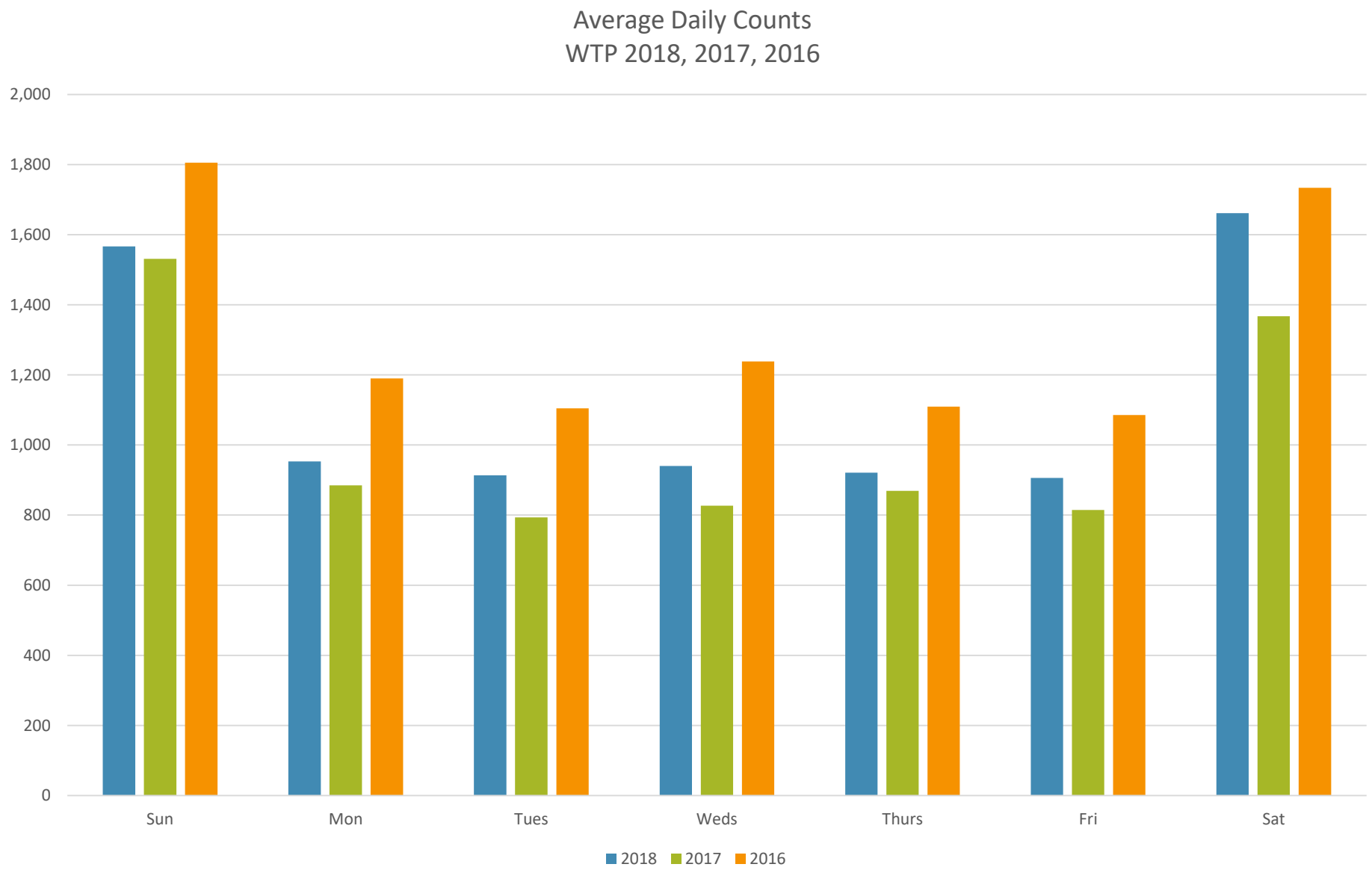
*Likely overestimate due to undocumented sensor error

Data errors detailed on slides 10 & 11



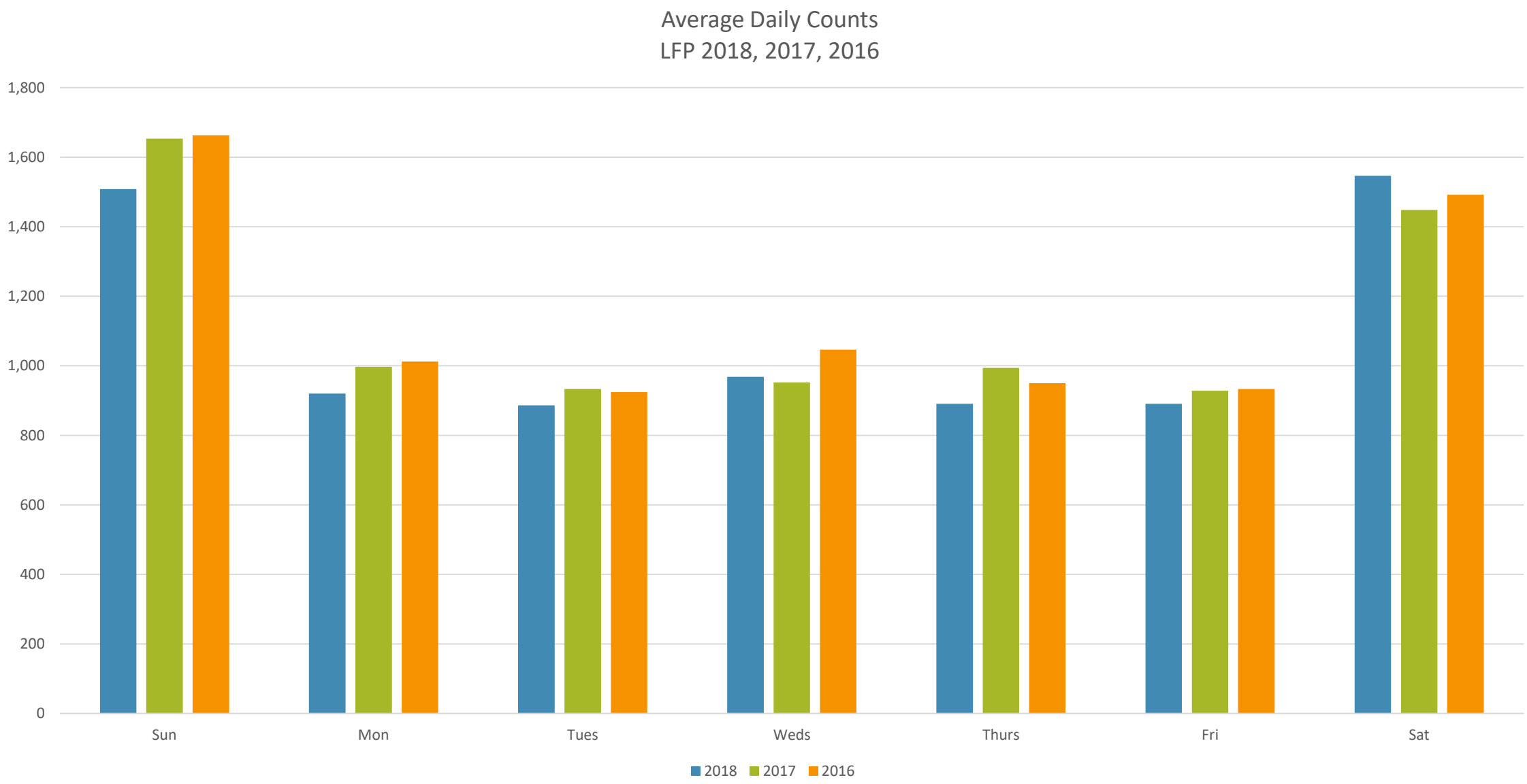
Weekends are the most popular days to use the reservation.

Data errors detailed on slides 10 & 11



WTP counts lower in 2018 and 2017 than 2016 due to a construction detour that lasted from May 2017 – June 2018.

Data errors detailed on slides 10 & 11



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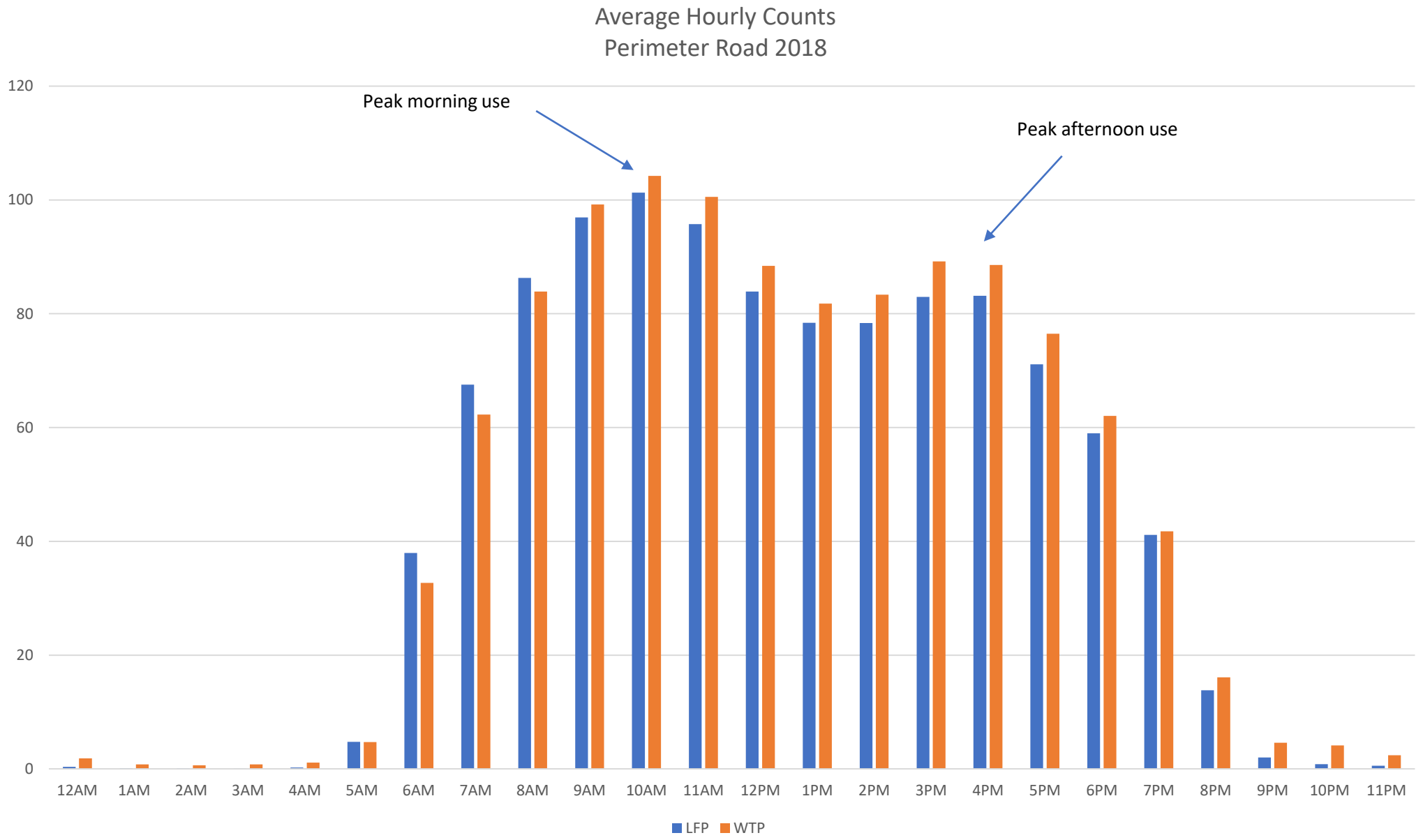

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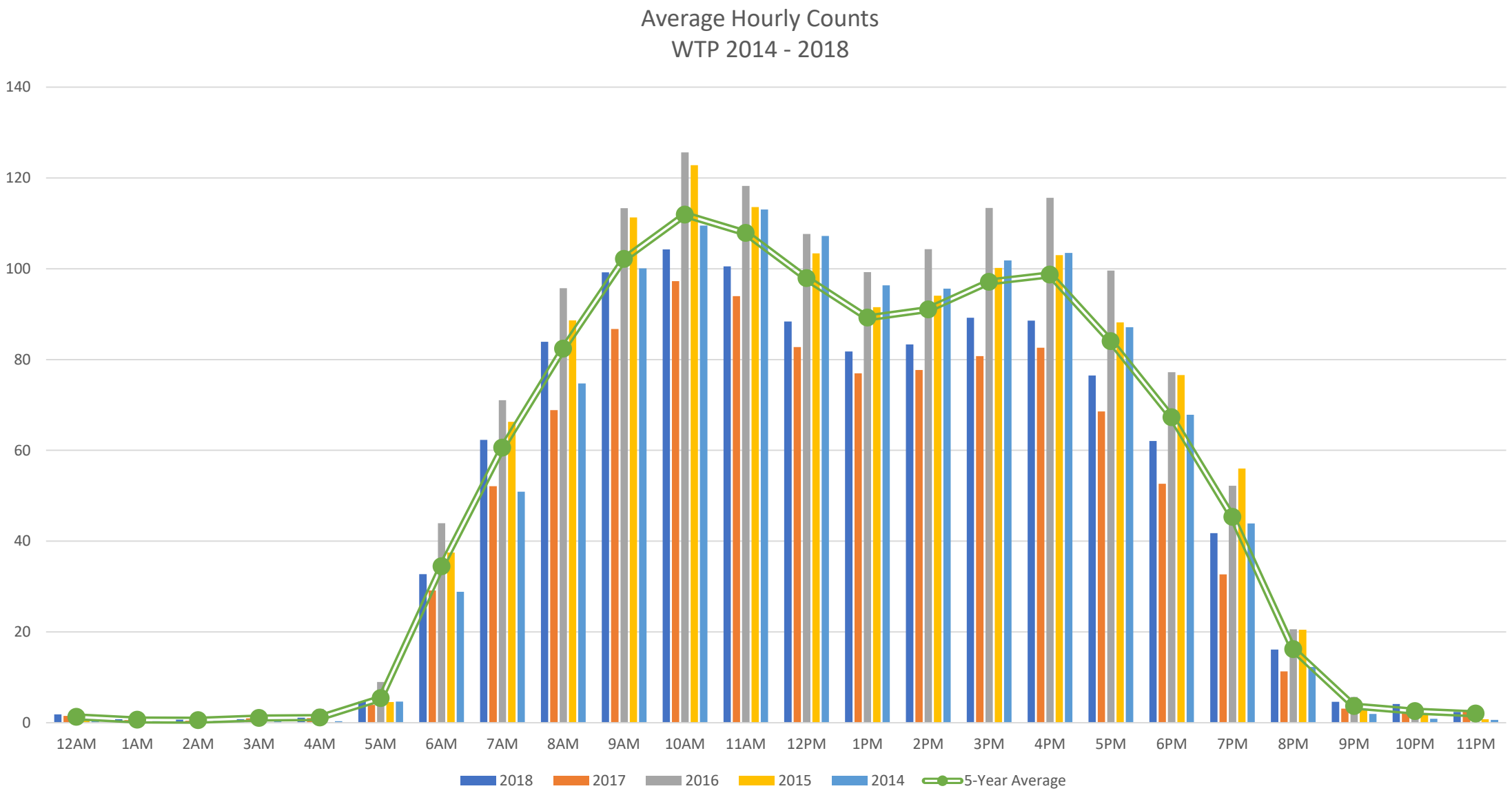

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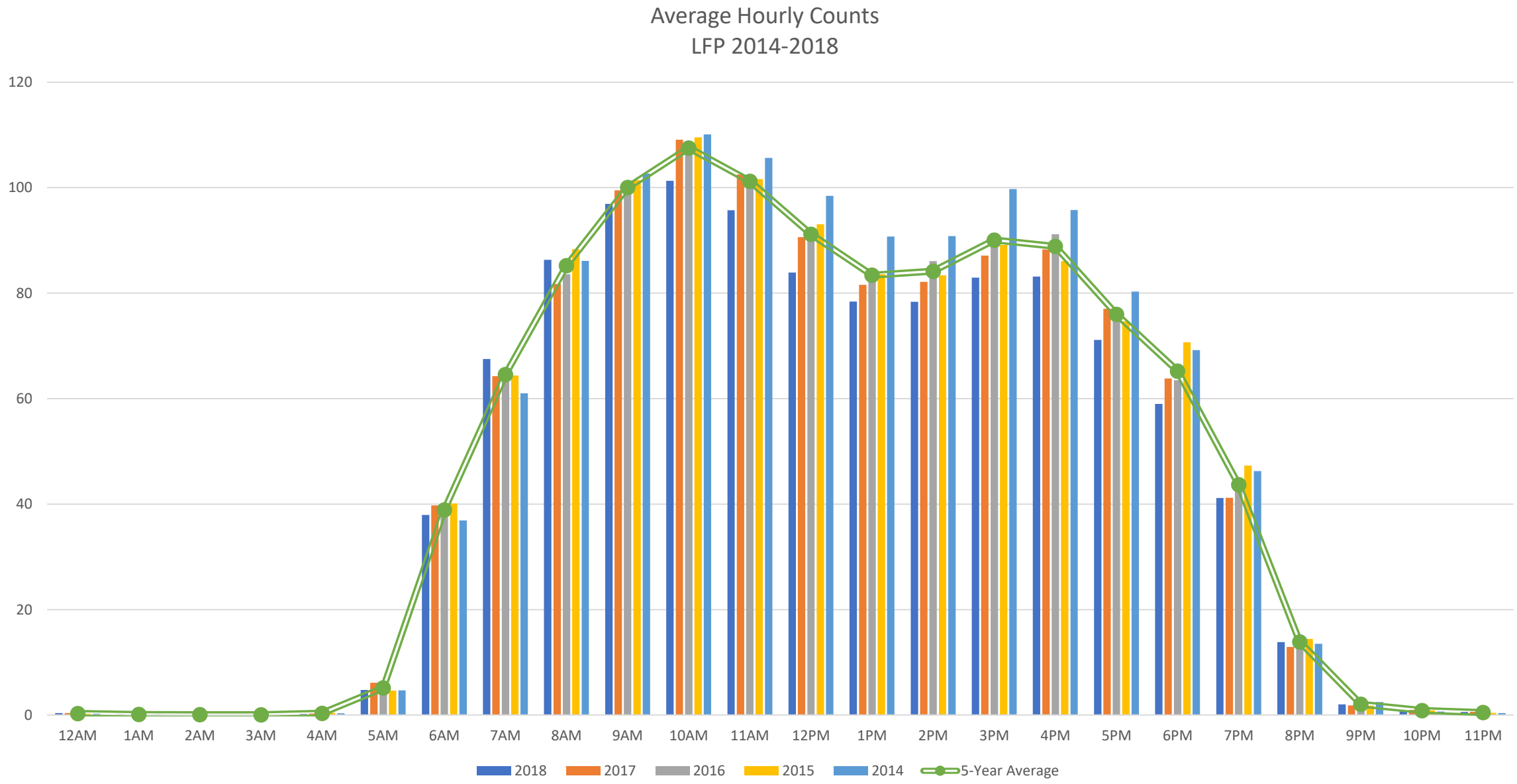


Data errors detailed on slides 10 & 11

2018 Perimeter Road Summary

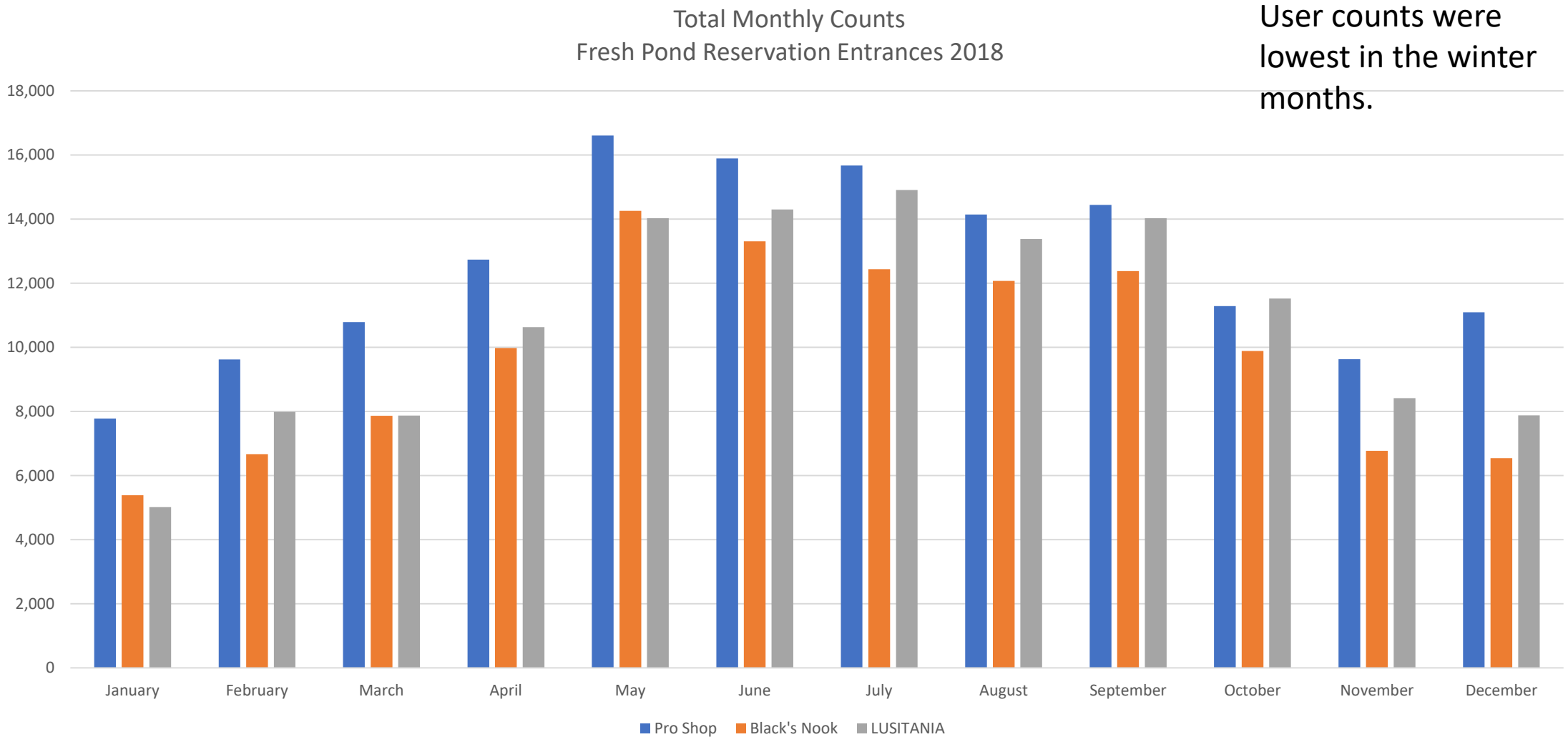
- May and September were the busiest months, similar to previous years
- July and August had a lower number of users than other warm months, likely due to people being away on vacations
- Winter months had the lowest number of users
- Saturdays and Sundays had more users than weekdays
- Mid morning (9:00-12:00) and afternoon (15:00-17:00) were the busiest times of day
- LFP had higher user counts during the construction detour; WTP counts were higher after the detour ended

Results • *Entrance Sensors*

Reservation Entrance EcoCounter Sensors

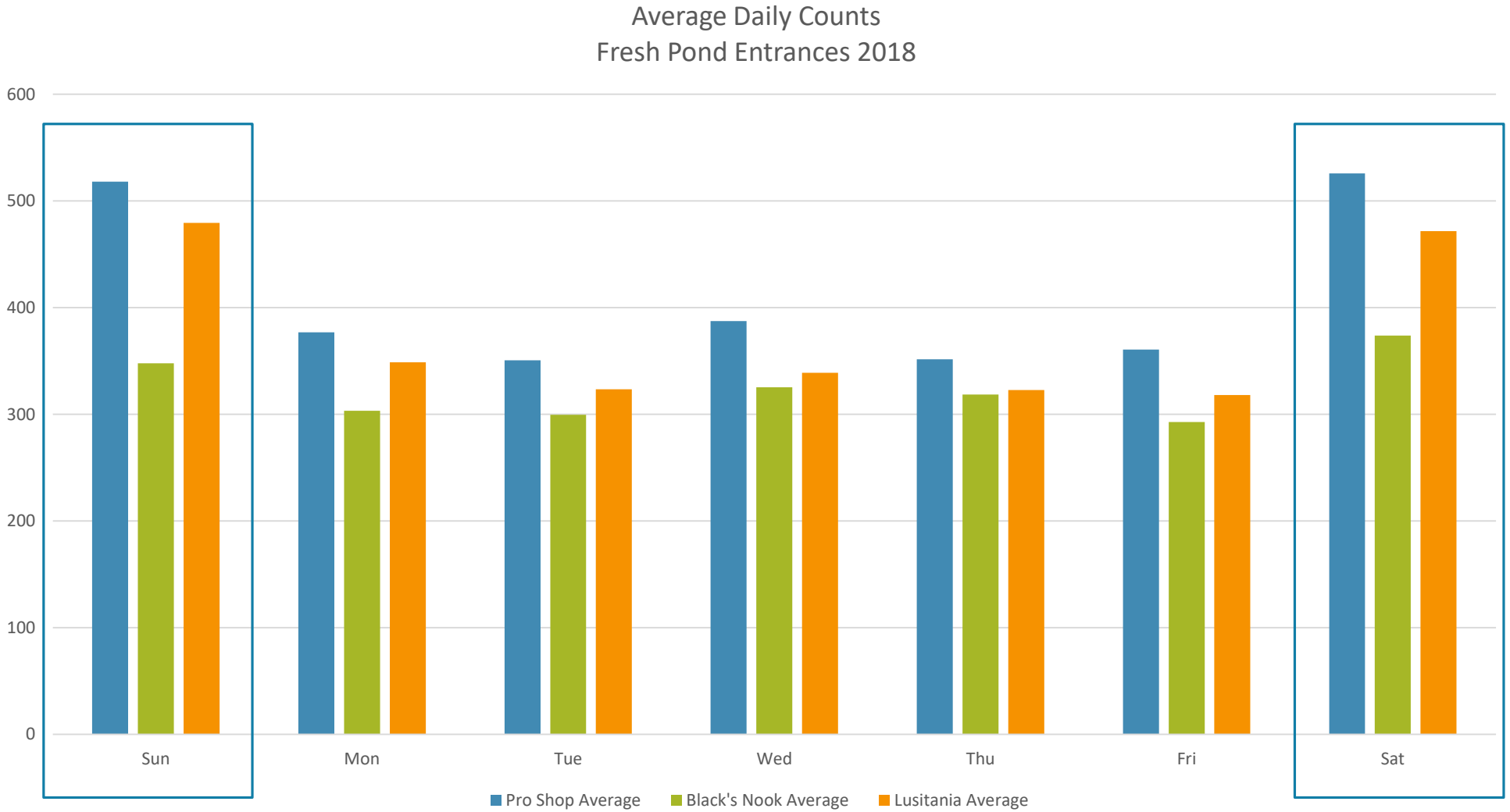
Black's Nook, Lusitania, and Pro Shop

- Directional



User counts were lowest in the winter months.

Data errors detailed on slides 10 & 11

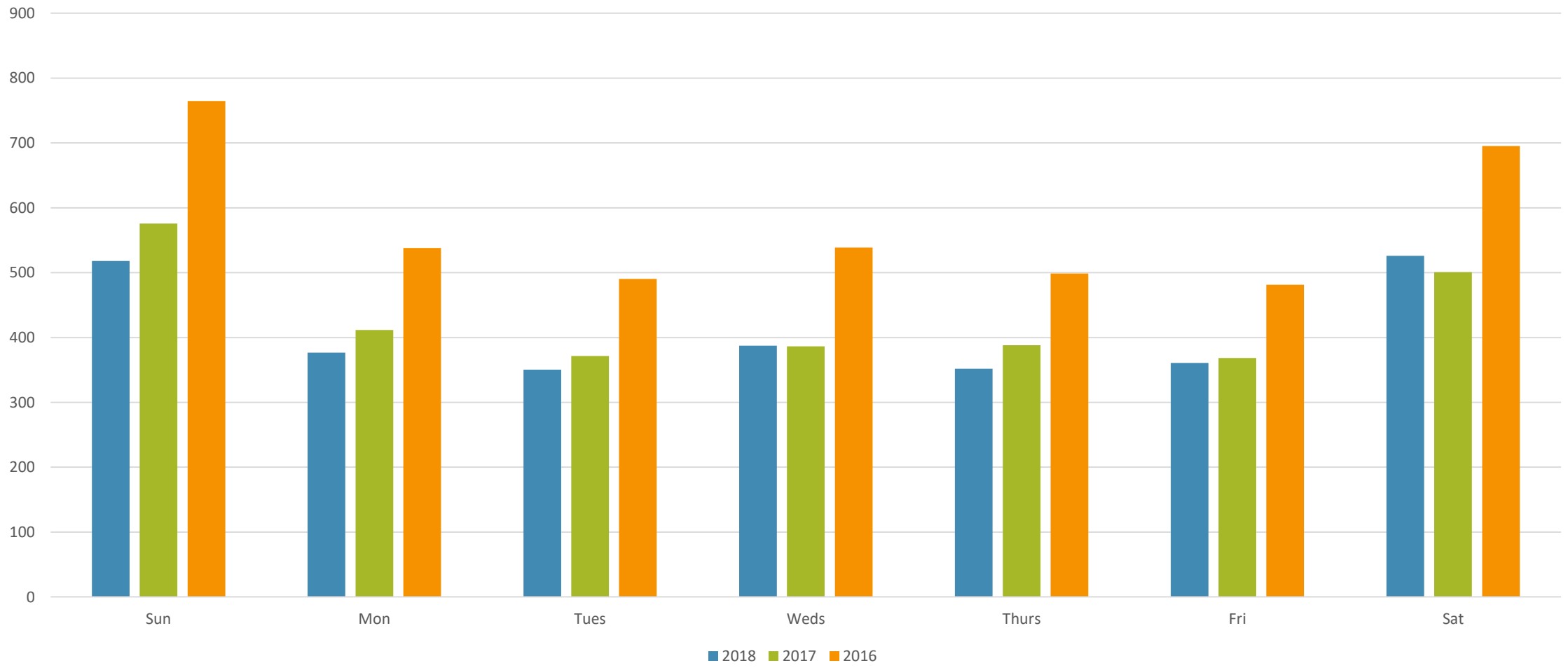


Weekends had more users than weekdays at Pro Shop and Lusitania.

Users at Blacks Nook were more consistent throughout the week.

Data errors detailed on slides 10 & 11

Elevated counts in 2016 due to the Glacken Slope detour



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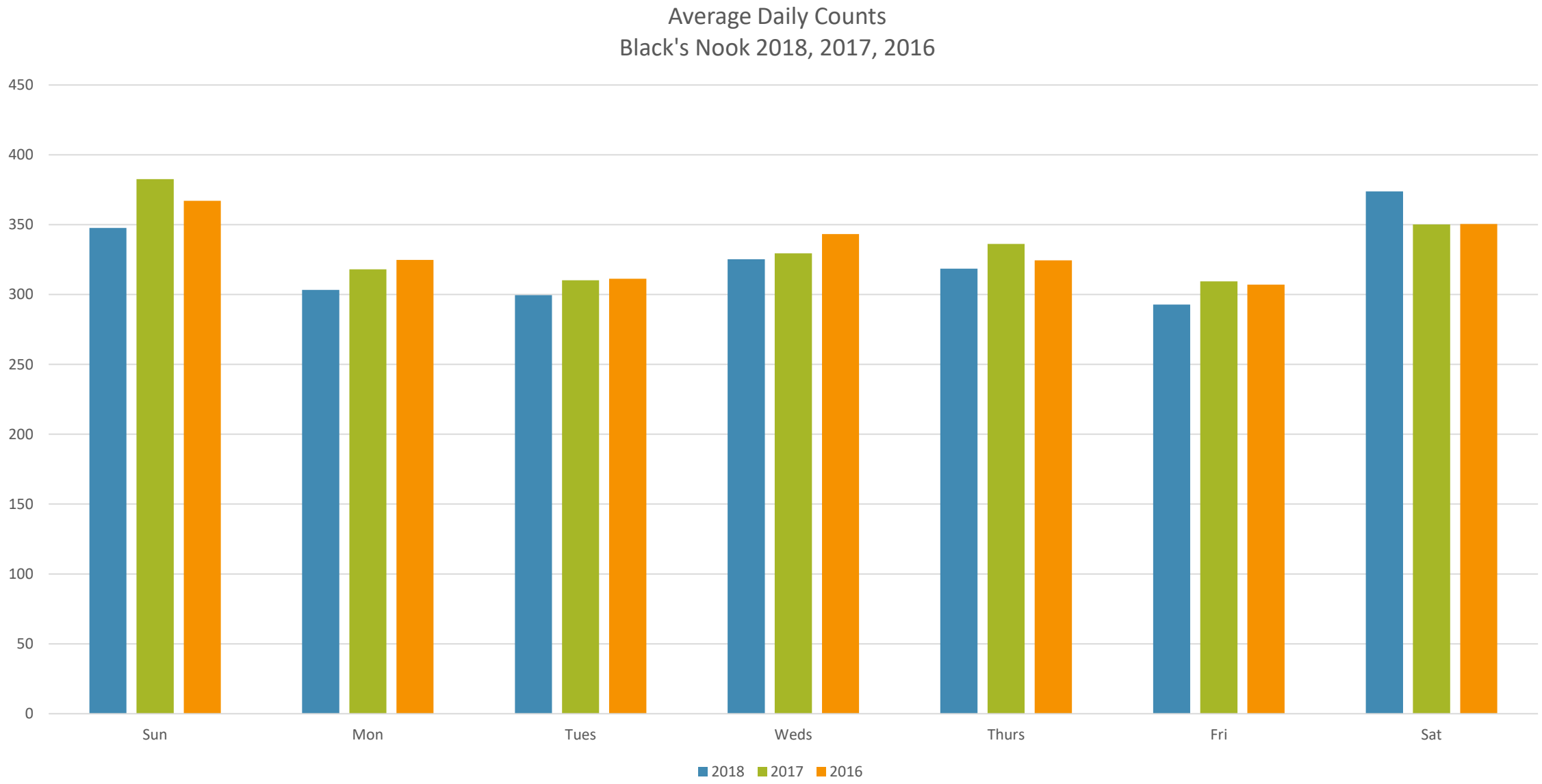

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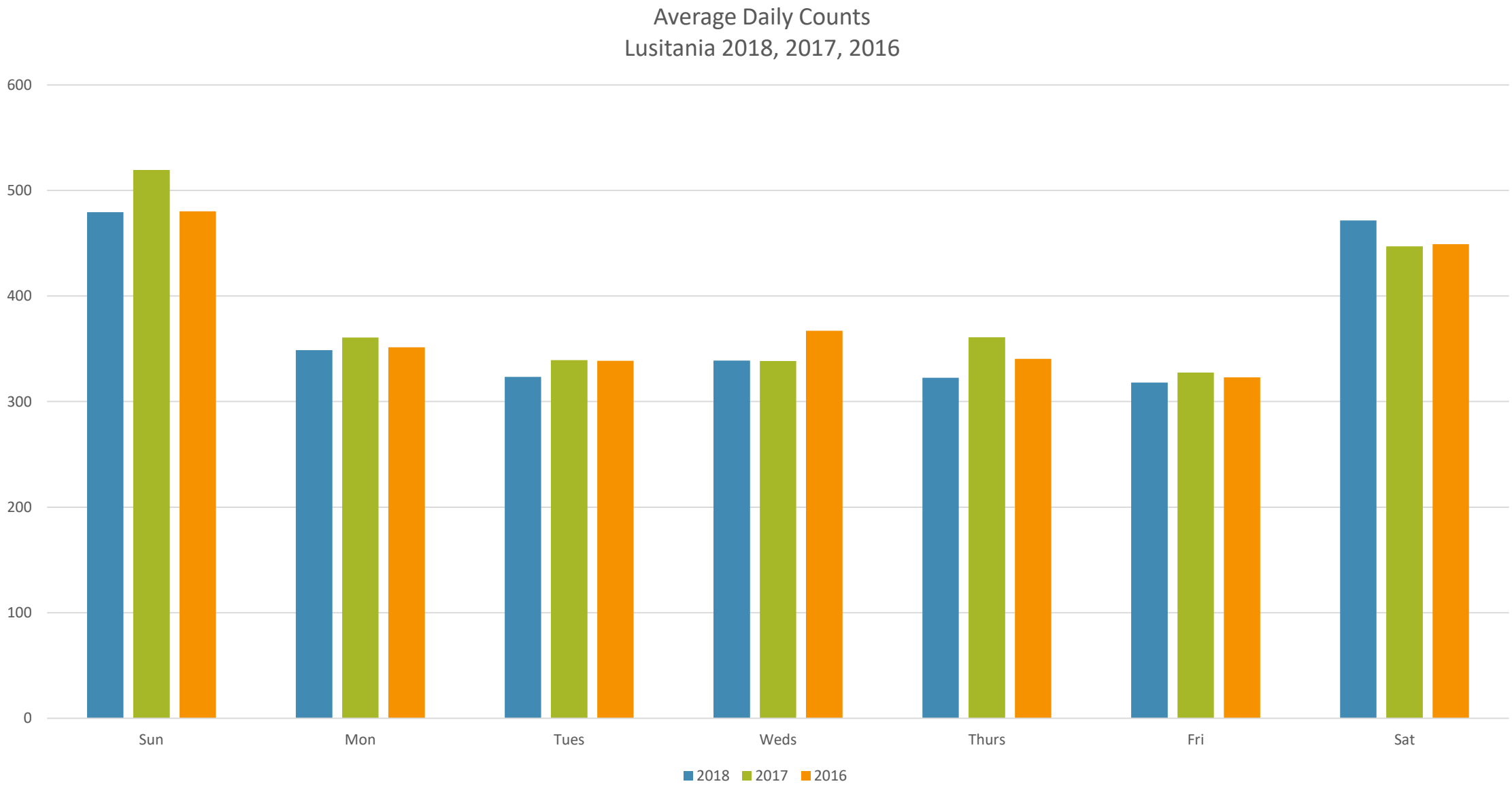

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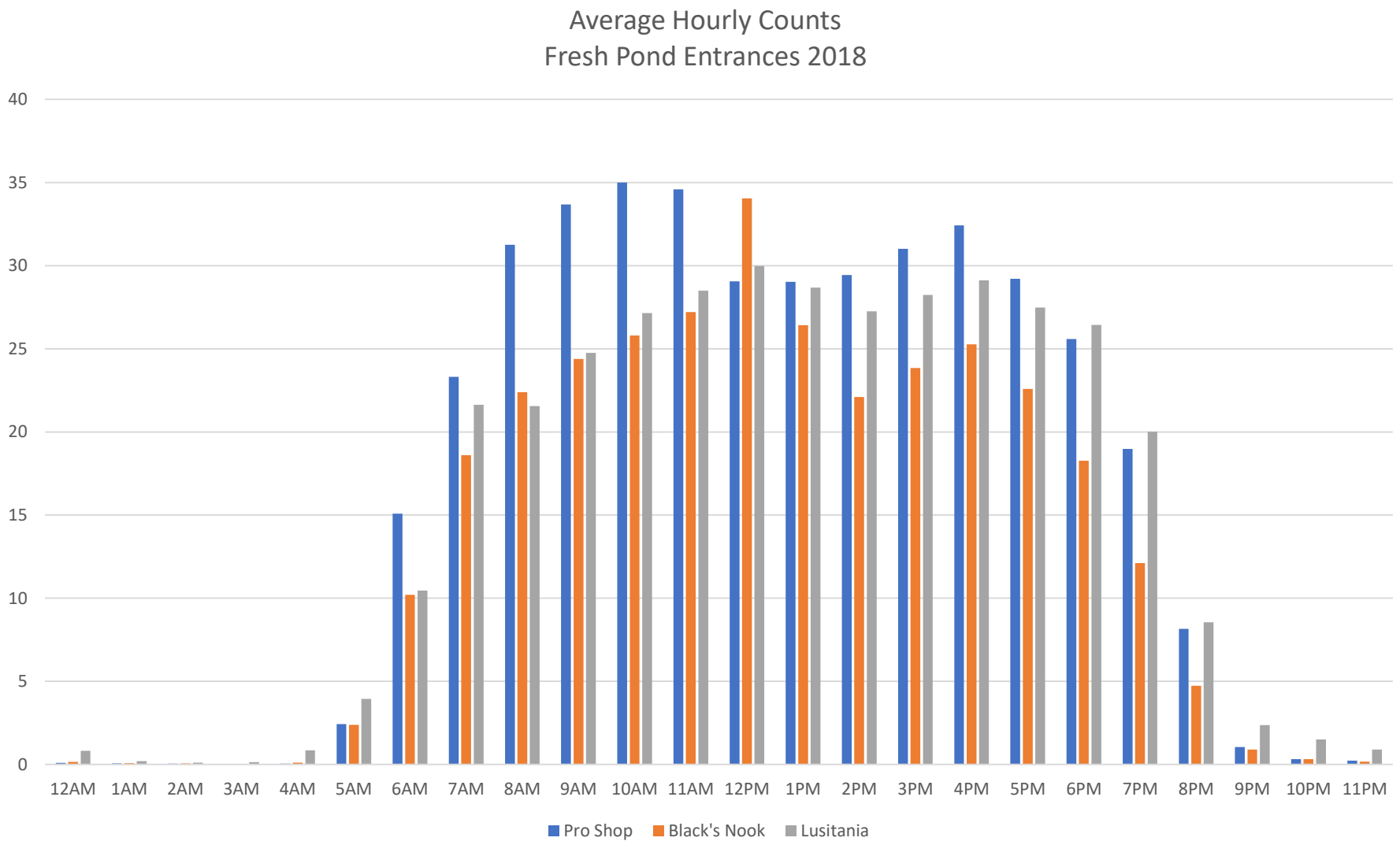


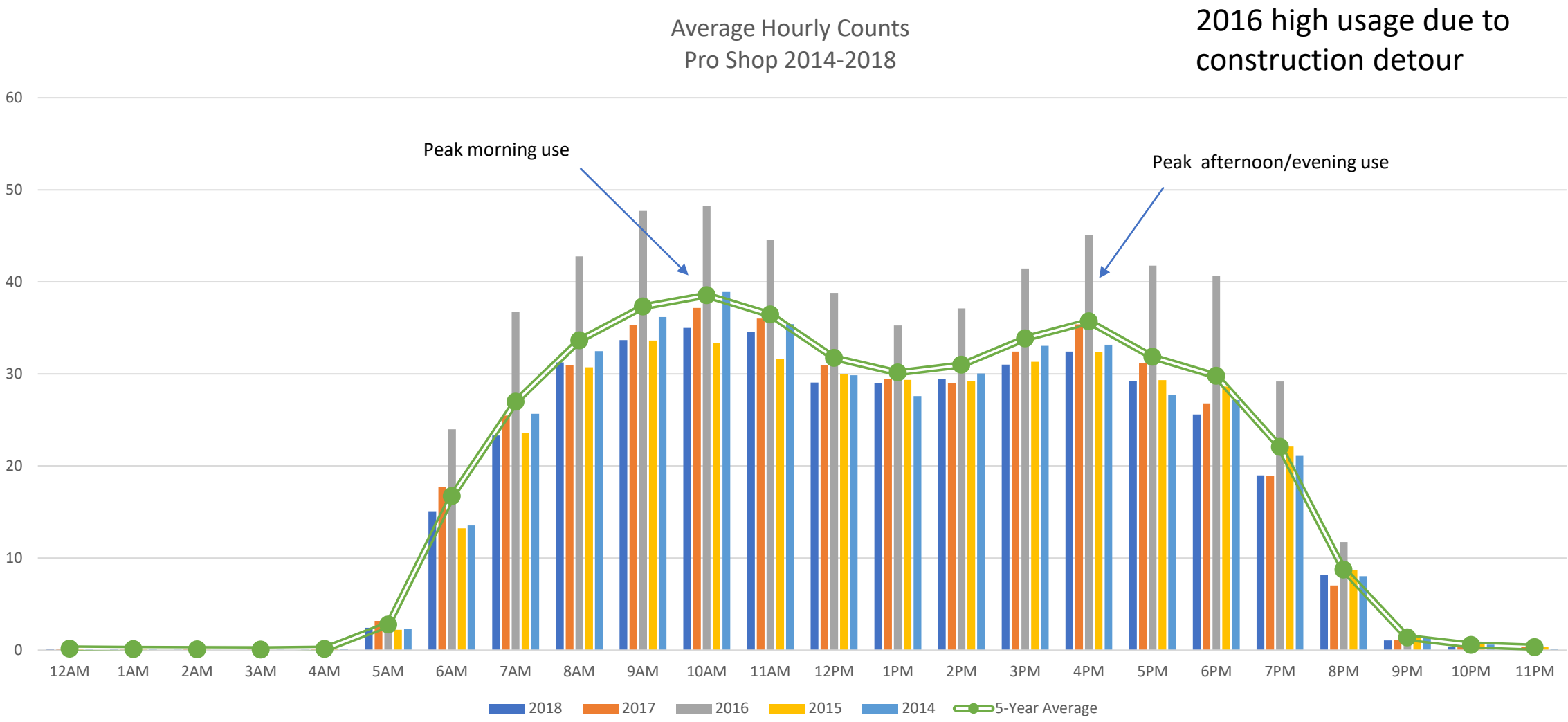
Peak usage occurs during different points in the day.

Proshop peak use = mid morning (9:00-12:00) and late afternoon (3 pm-5:00 pm)

Lusitania and Blacks Nook peak use = lunchtime

Data errors detailed on slides 10 & 11

2016 high usage due to construction detour



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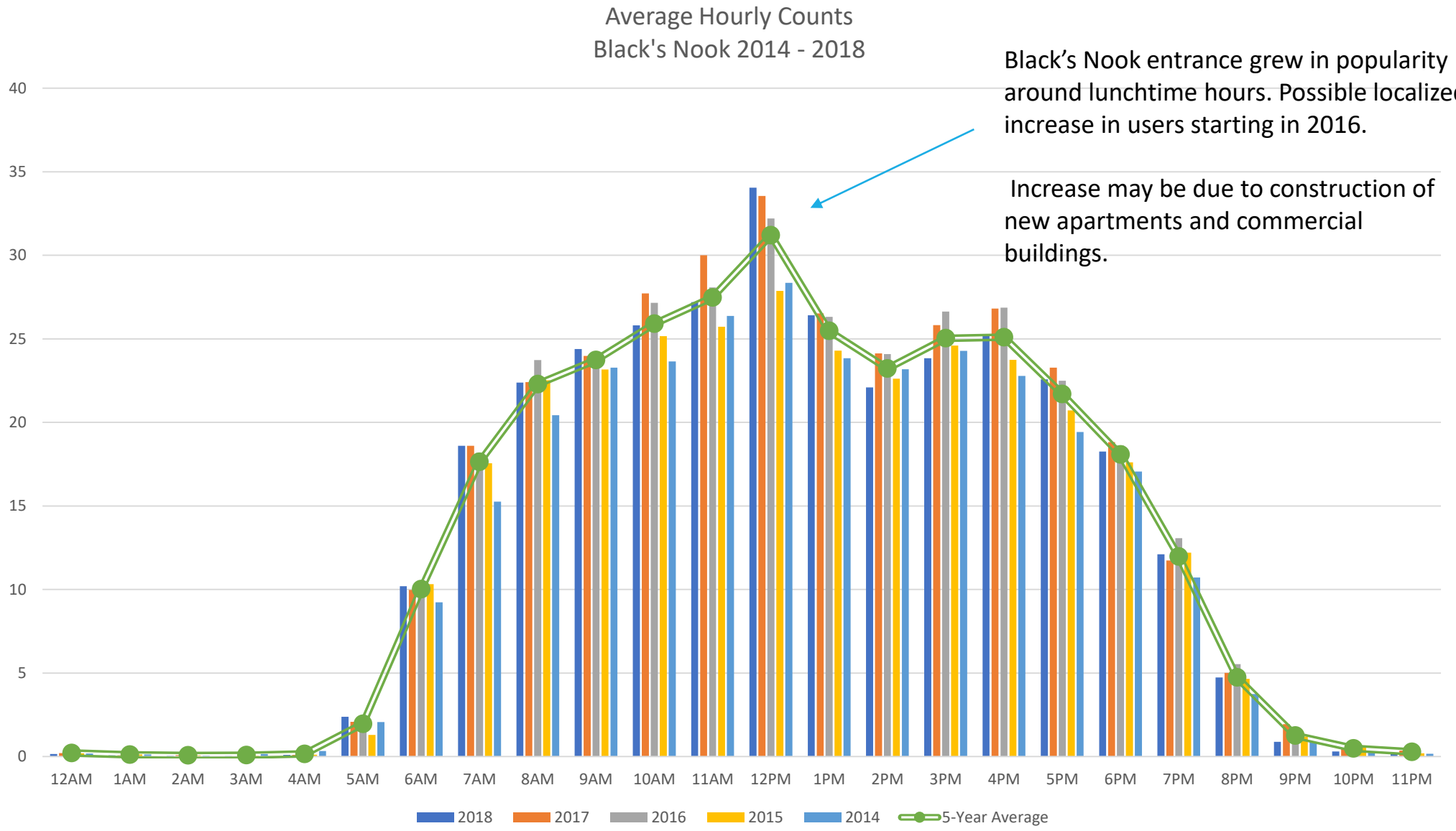
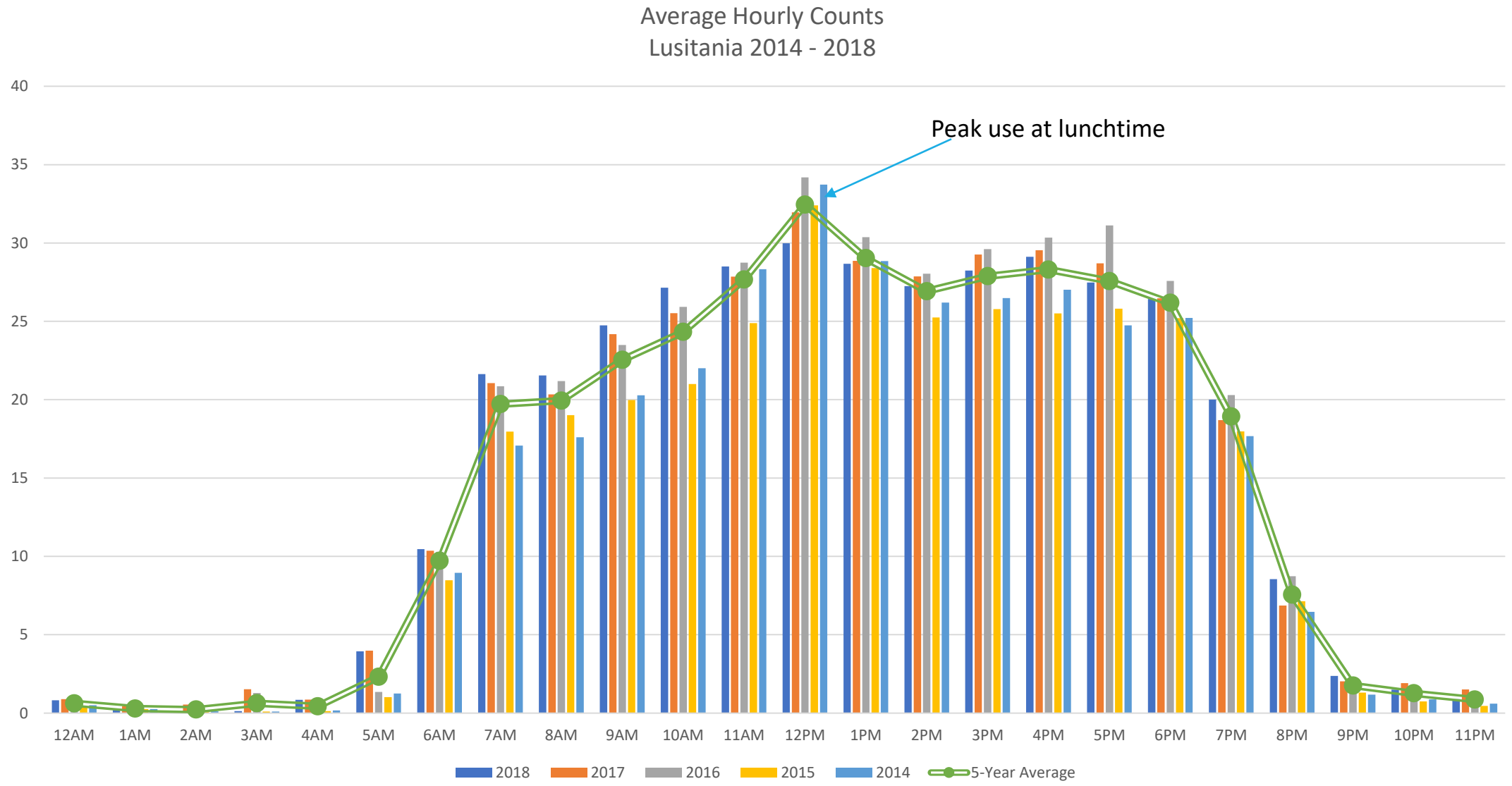


Black's Nook entrance grew in popularity around lunchtime hours. Possible localized increase in users starting in 2016.

Increase may be due to construction of new apartments and commercial buildings.

Data errors detailed on slides 10 & 11



Data errors detailed on slides 10 & 11

2018 Entrance Summary

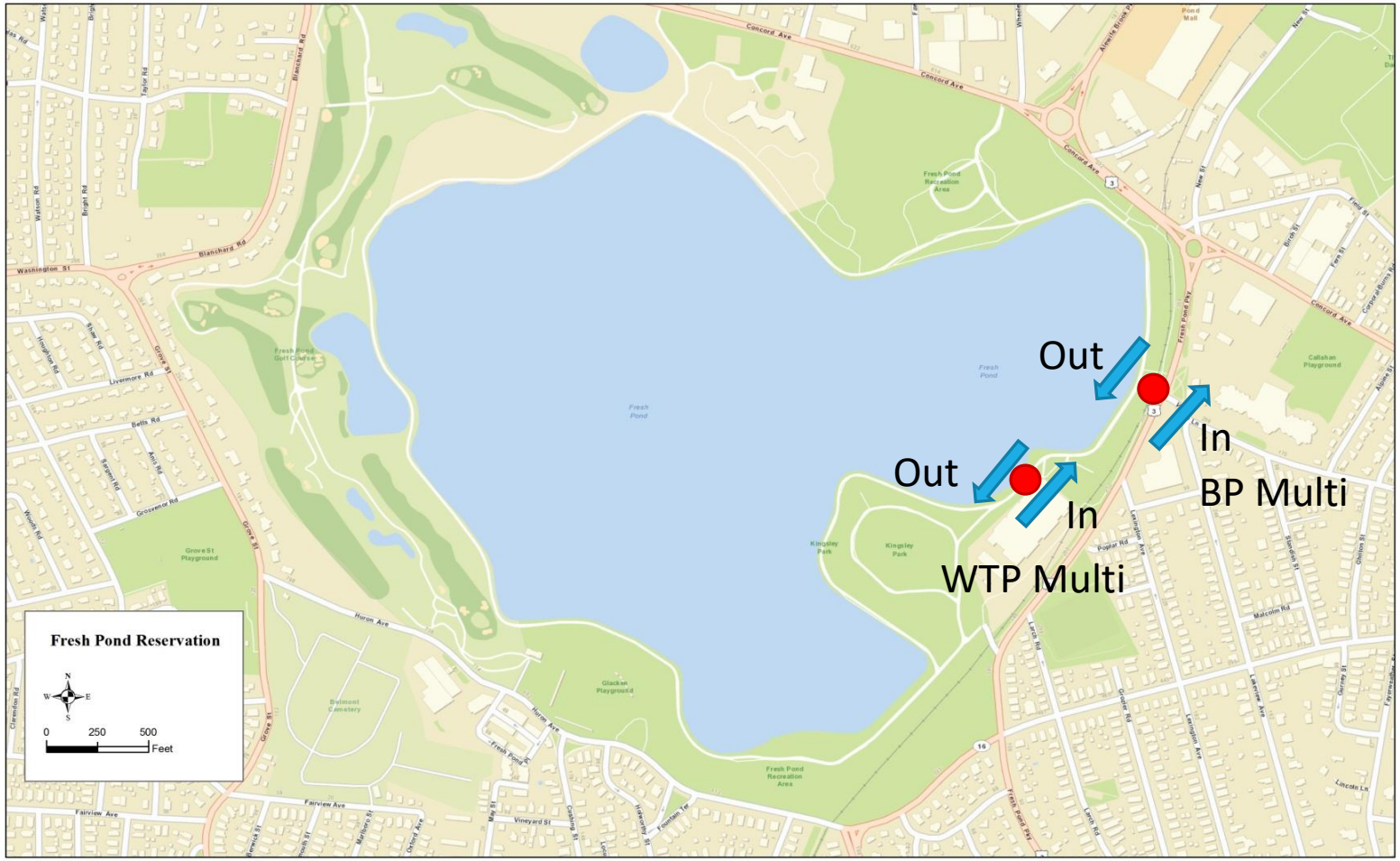
- Winter months had the lowest number of users for all three sensors
- Weekends had more users than weekdays at Pro Shop and Lusitania, while the number of users at Black's Nook was only slightly higher on Weekends than weekdays
- Mid morning (9:00-12:00) and afternoon to early evening (15:00-17:00) were the busiest times of day at Pro Shop
- Black's Nook and Lusitania had peak counts around lunchtime (12:00)
- Pro Shop counts follow the trend of being lower than 2016 because the Glacken Slope detour was no longer in effect
- Black's Nook and Lusitania had similar numbers of users to 2016

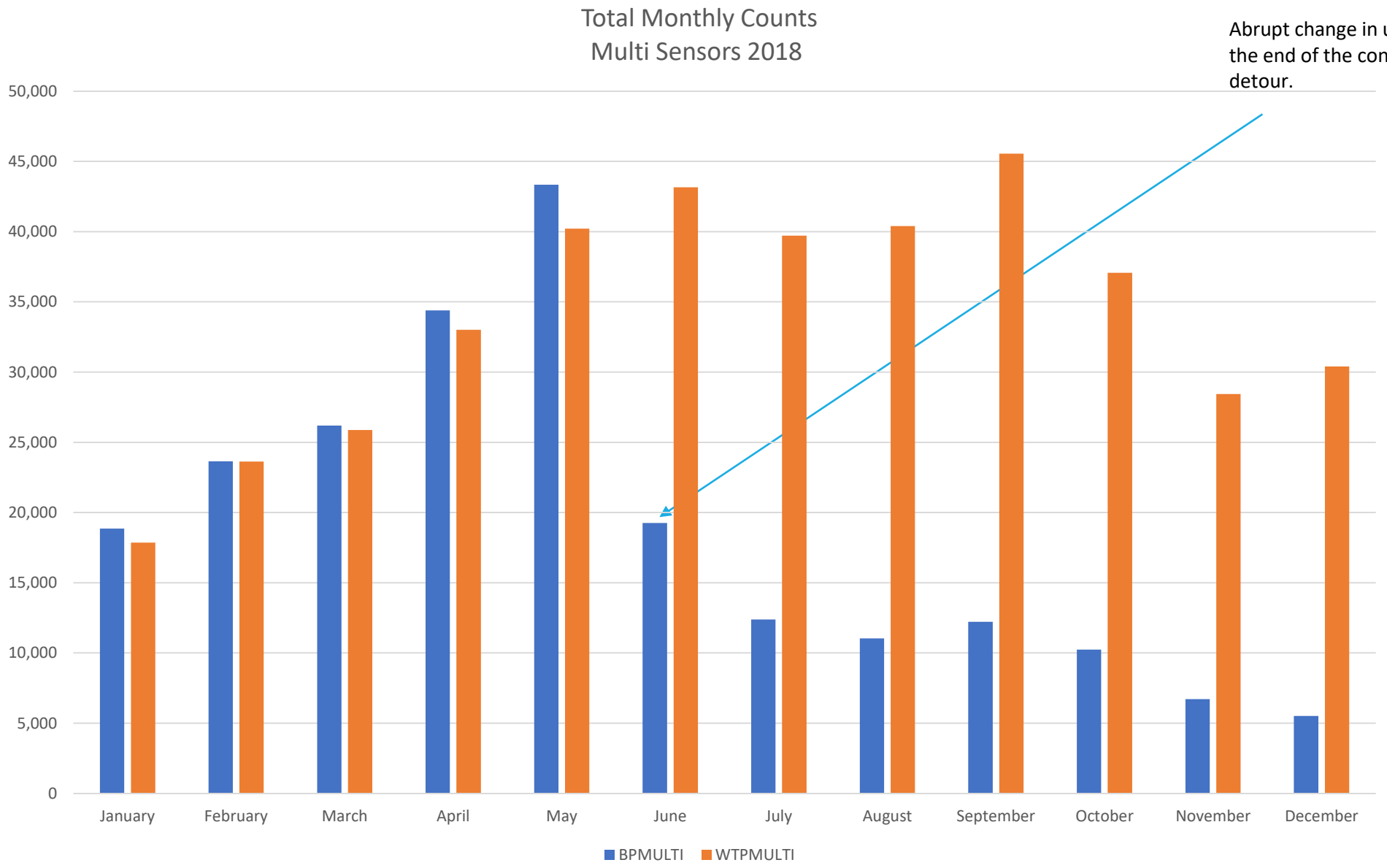
Results • *Multi Sensors*

Multi Sensor EcoCounter Sensors

Water Treatment Plant Multi (WTP Multi) and Bike Path Multi (BP Multi)

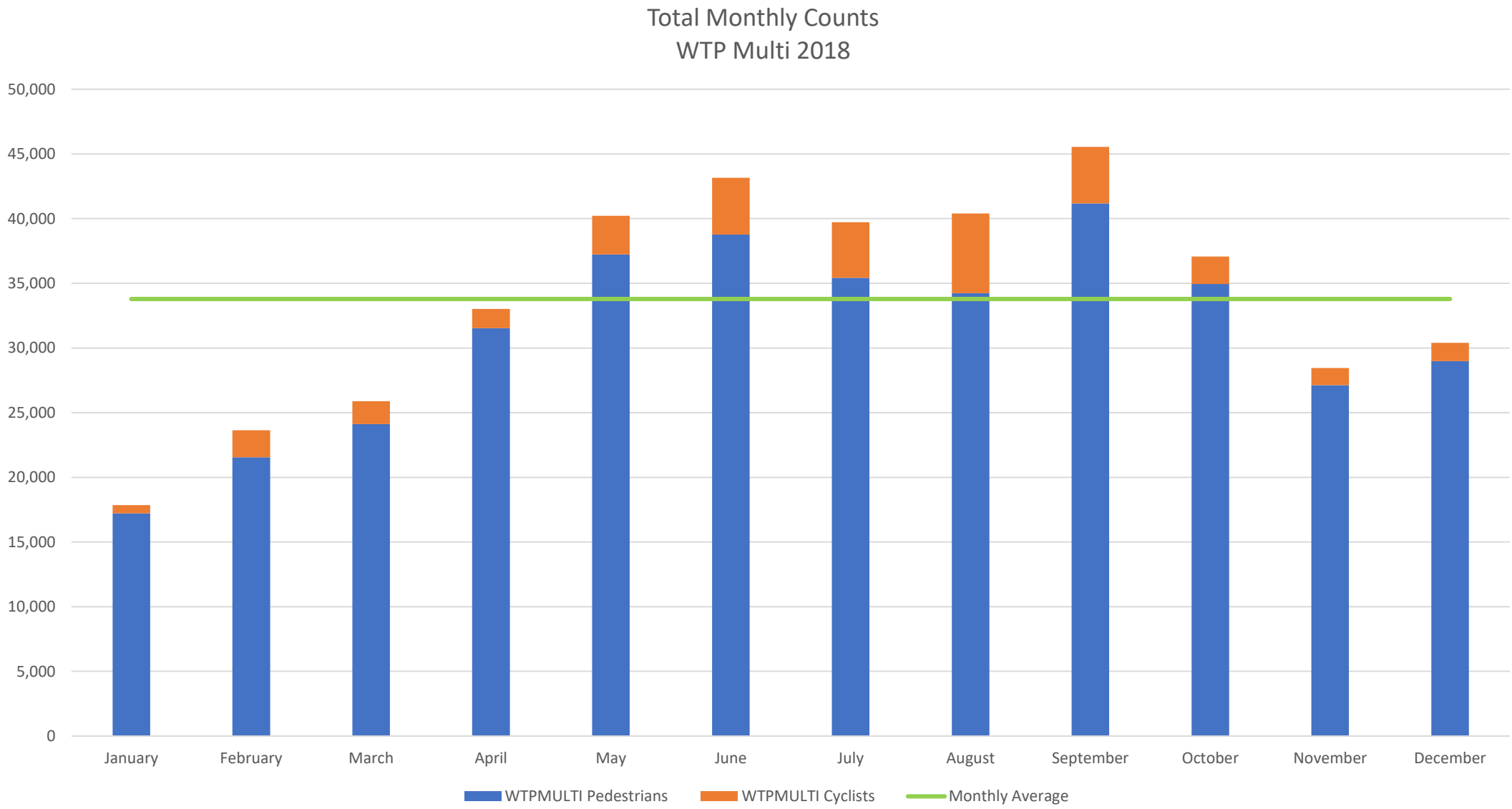
- Directional
- Differentiates between pedestrians and cyclists





Abrupt change in users is due to the end of the construction detour.

Data errors detailed on slides 10 & 11



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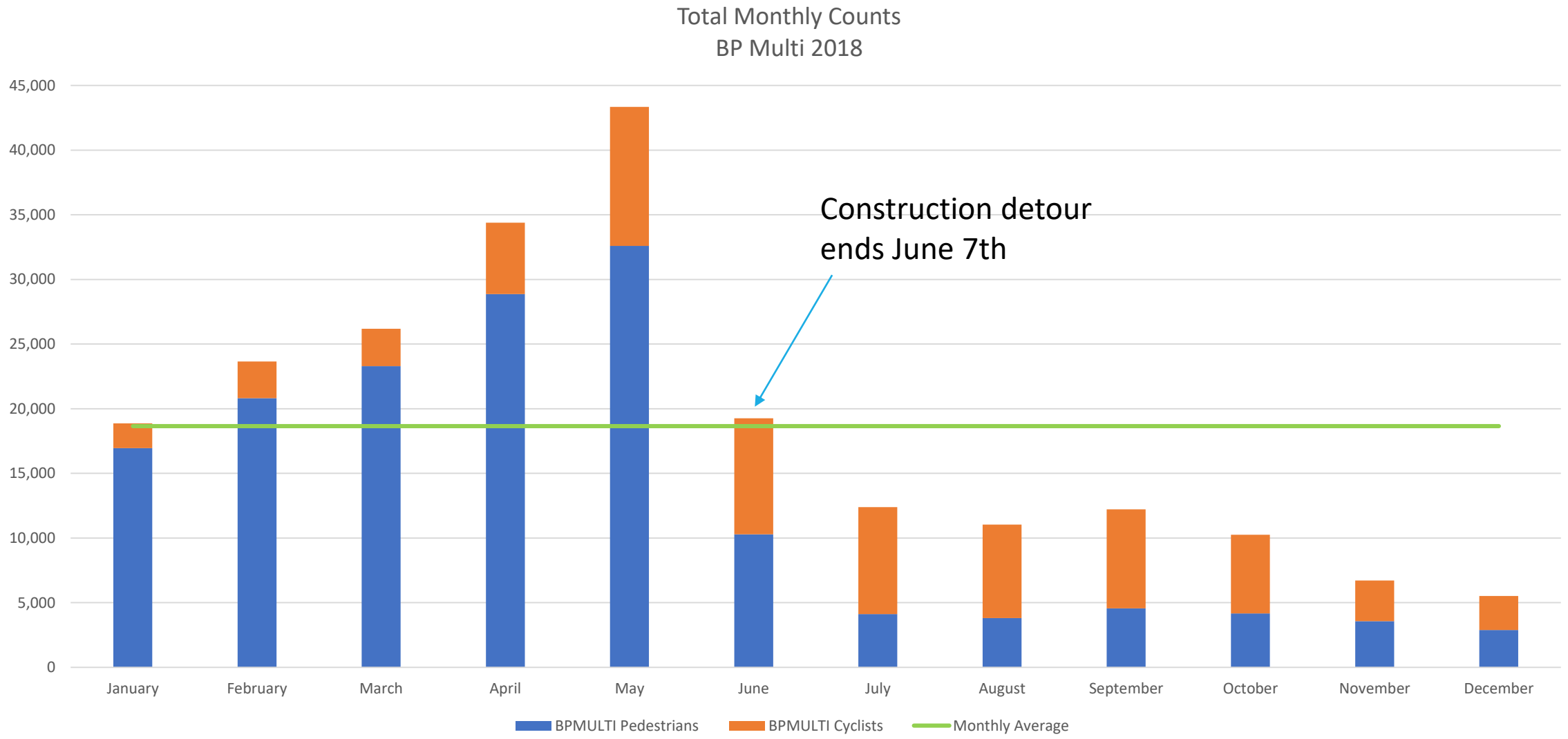
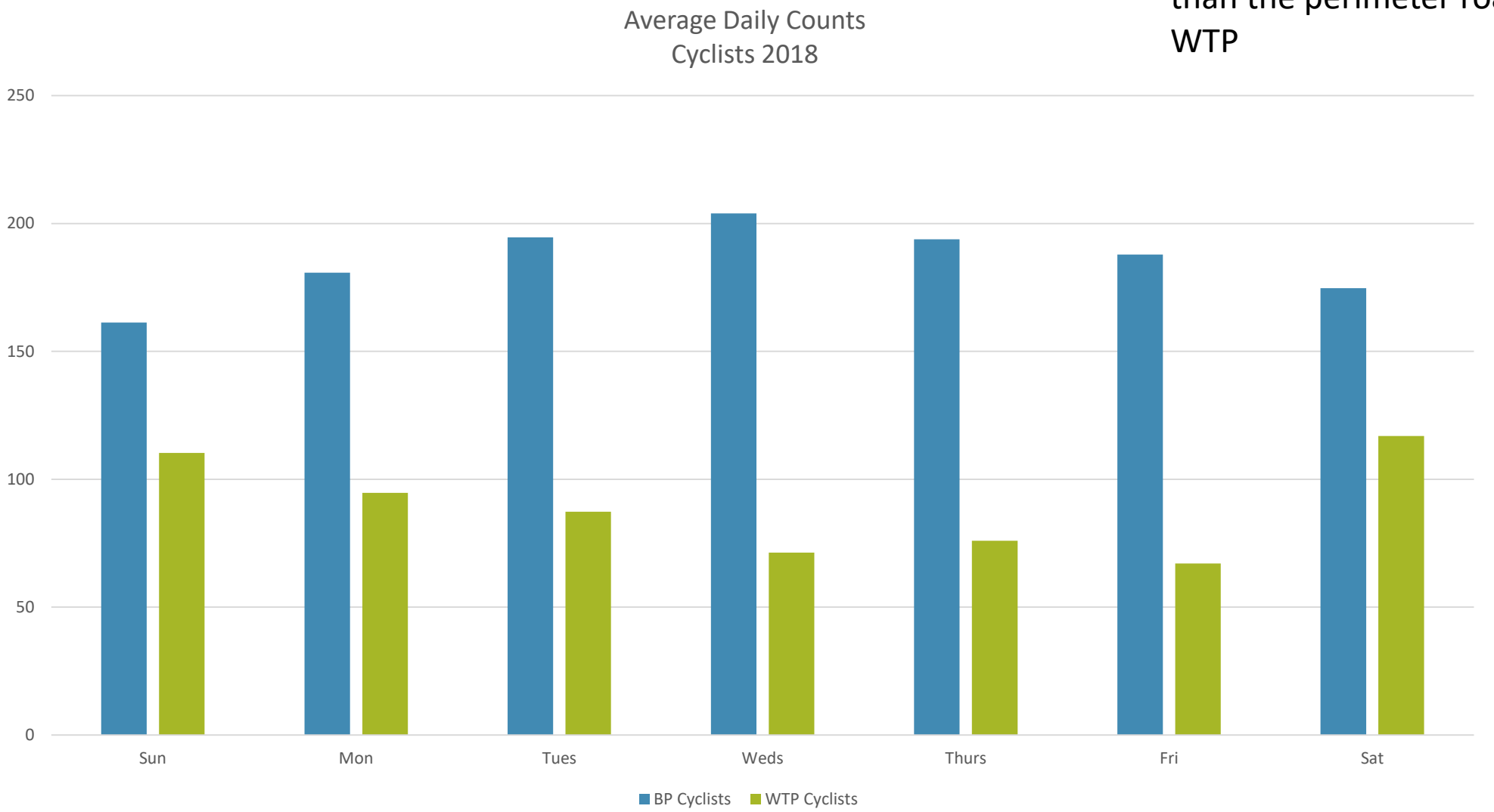


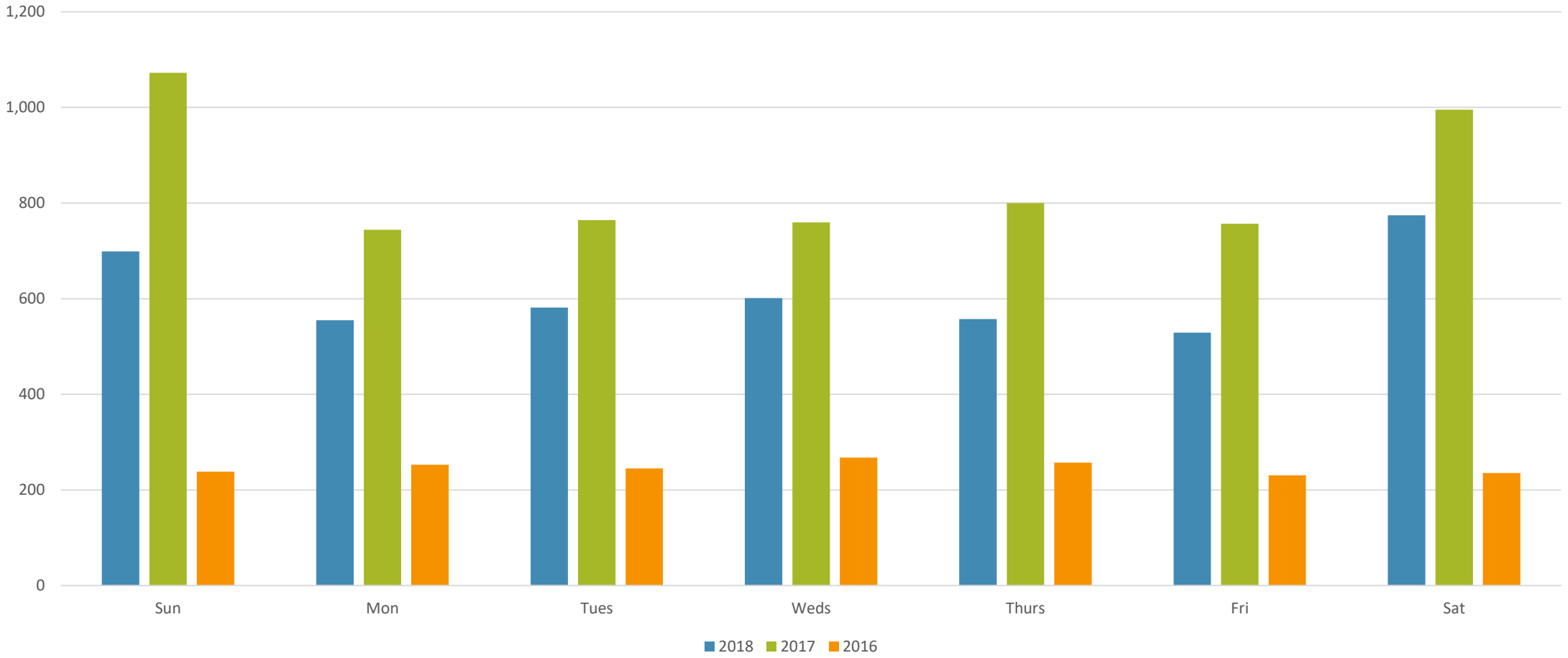
Data errors detailed on slides 10 & 11

More cyclists use the bike path than the perimeter road at WTP



Data errors detailed on slides 10 & 11

Elevated counts in 2017 and 2018 due to construction detour



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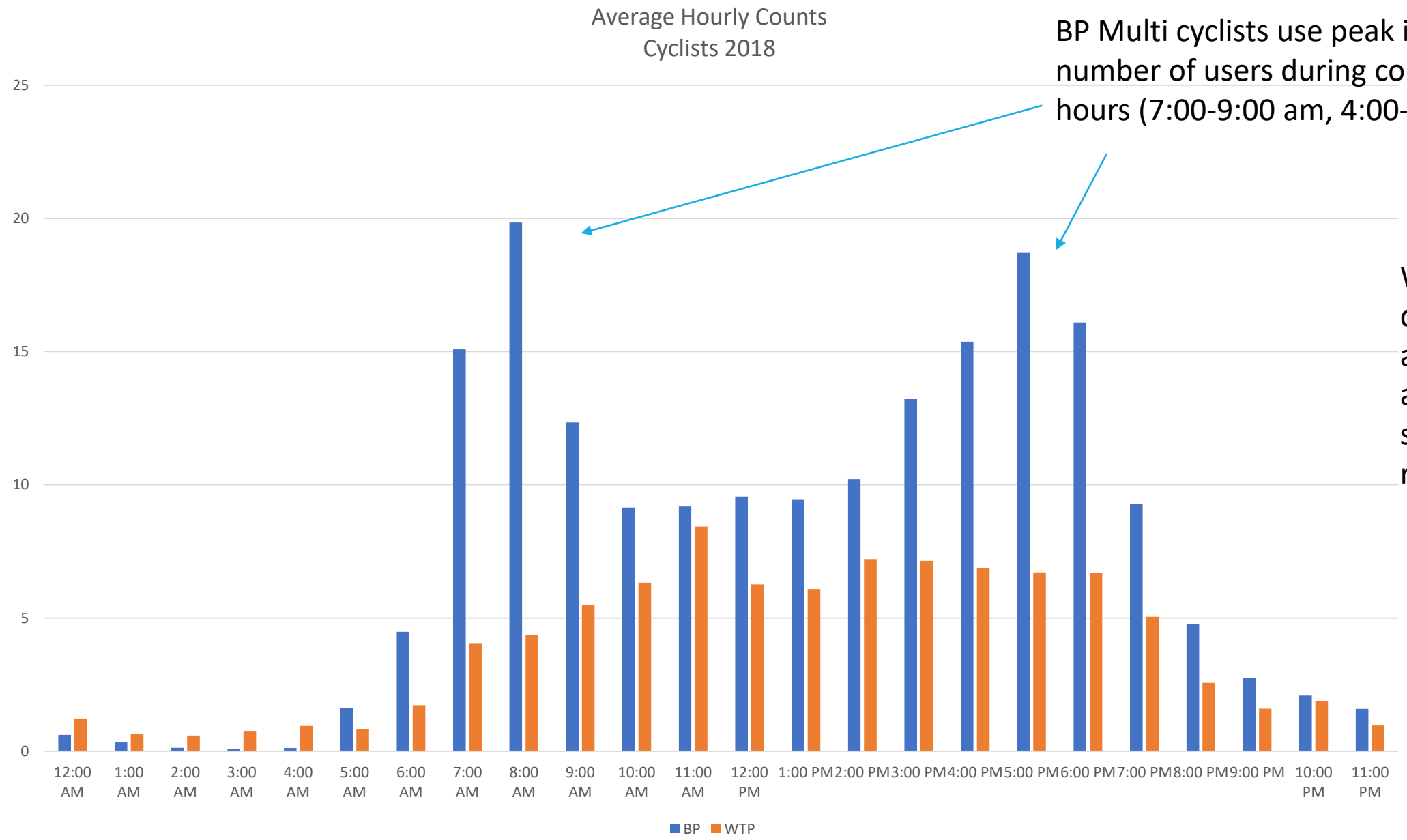
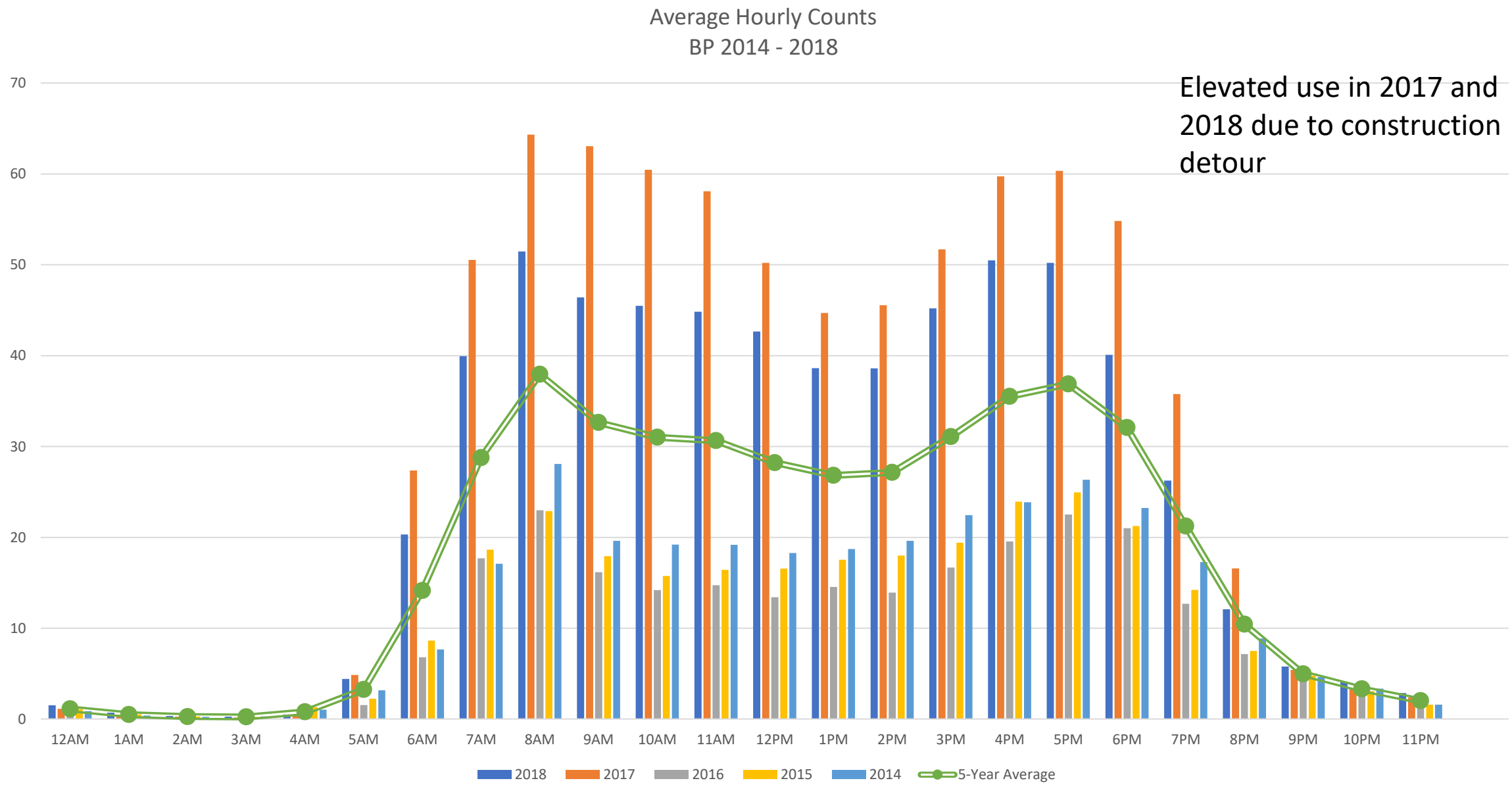


BP Multi cyclists use peak in the number of users during commuting hours (7:00-9:00 am, 4:00-7:00 pm)

WTP peak use during morning and mid afternoon, suggesting leisure rides.

Data errors detailed on slides 10 & 11



Data errors detailed on slides 10 & 11

2018 Multi Sensor Summary

- Both sensors had the lowest number of users in winter months
- Both WTP Multi and BP Multi had more users on the weekends than on weekdays
  - BP Multi has had a more even distribution of users across days in the past, but the construction detour likely caused this shift
- With cyclist data specifically, BP Multi had peaks in the number of users during commuting hours (7:00-9:00, 16:00-19:00), while WTP Multi had peaks in the mid morning and afternoon (10:00-12:00, 15:00-17:00). This seems to suggest that people use the outer path to commute, and the inner path for more leisurely rides.
- BP Multi had an overall decrease in hourly users from last year, while WTP had a slight increase. This could be due to the timing of the detour, starting in May 2017 and ending in June 2018.
- Both BP Multi and WTP Multi had far more pedestrian users than bike users. However, at BP Multi, this was caused by an influx of pedestrians due to a construction detour.

Methods • *Visual Survey Data*

2018 Visual Survey Methods

- The goal of visual surveys was to quantify different types of users at Fresh Pond (for example, runners, walkers, dogs, children, bikes)

- Surveys were conducted for 1-hr increments at LFP and Lusitania sites according to a stratified simple random sampling design. For each sensor, 6 – 8 hours were randomly selected from four strata (S1-S4) to survey:
  - S1 - Weekends- Saturday and Sunday 7:00 AM – 5:00 PM, 6:00 PM, or 7:00 PM (end time varied by seasonal changes in daylight)
  - S2 - Weekday mornings- 7:00 AM – 10:00 AM
  - S3 - Weekday mid-days- 11:00 AM – 2:00 PM
  - S4 - Weekday afternoons- 3:00 PM – 6:00 PM or 7:00 PM (end time varied by seasonal changes in daylight)

- Surveys at other sensors were only conducted to assess errors in EcoCounter sensor output. These survey results are not reported here.

- 2018 was the second year a formalized sampling design was used to estimate total usership and the proportion of user types

2018 Visual Survey Methods

- Surveyors stood at sensors and counted the number and type of users that crossed the sensors in both directions

Fresh Pond Census Sheet page ____ of ____

Date: 12/18/2017
Start Time: 4:00 PM
End Time: 5:00 PM
Location: BN
Observer: MD

Instructions: Each row is a unique observed event.Record count for observed user(s) in each cell. If multiple users pass *at same time* , record the number in one cell. For example, 3 runners passing together would be "3", whereas people passing one after another would be "1" for three rows. Please start exactly on the hour and count for one full hour or 1/2 hour during high use periods. Count user as 'child' if below sensor height. Tally each user type when finished at the bottom of the sheet. THANKS FOR YOUR HELP!

Weather: cloudy, 32 F

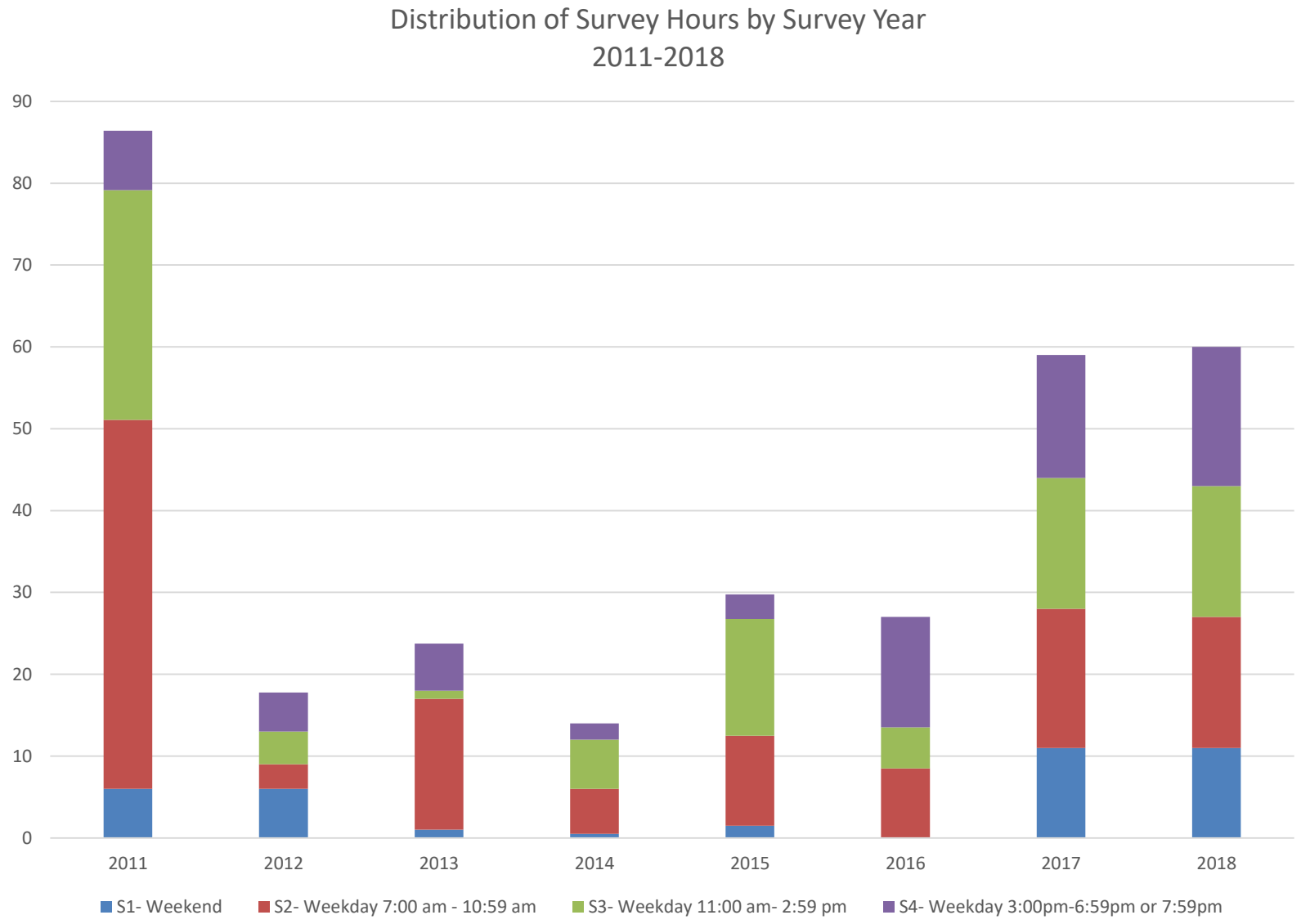
Direction of travel	Walker	Unleashed Dog	Leashed Dog	Runner	Child	Bike	Baby Carriage	Other	Ecocounter Count	Notes
L	1									
L	1	1								
L	1									
L	1									
R	1	1								
R	1									
R	1									
L	1									
L				1						
R	2									
R	1									
R	2									

Example survey data collection form

Methods

Survey Hours by Time Period

- In 2017 and 2018, surveys were randomly selected from four strata to obtain representative samples of users.
- Note: 2011-2016 are calendar years. 2017 and 2018 represents 2/1 -1/31



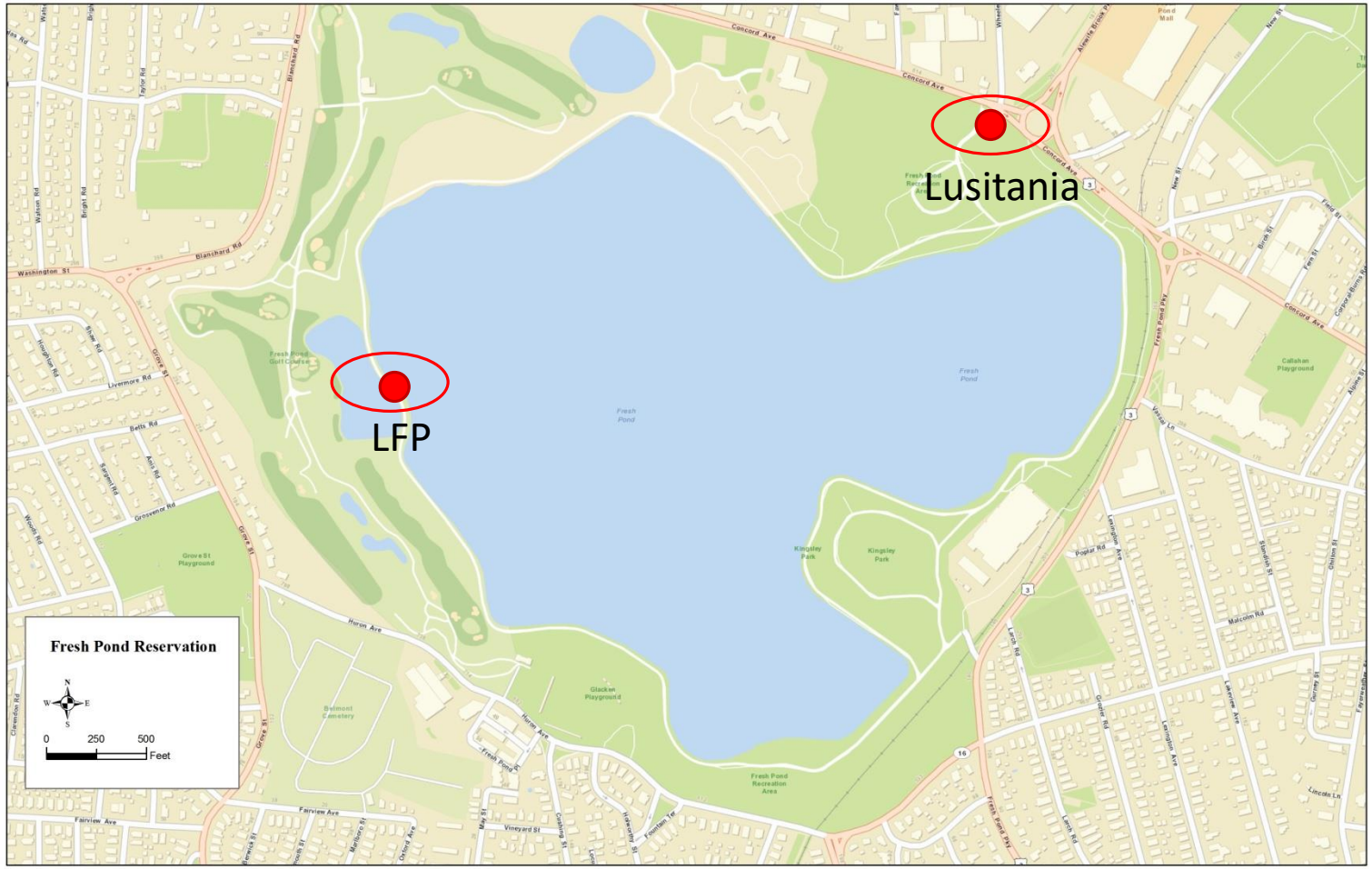
EcoCounter Census Survey Locations

Entrances:

Lusitania

Perimeter Road:

LFP



Results • *Visual Survey Data*

Results

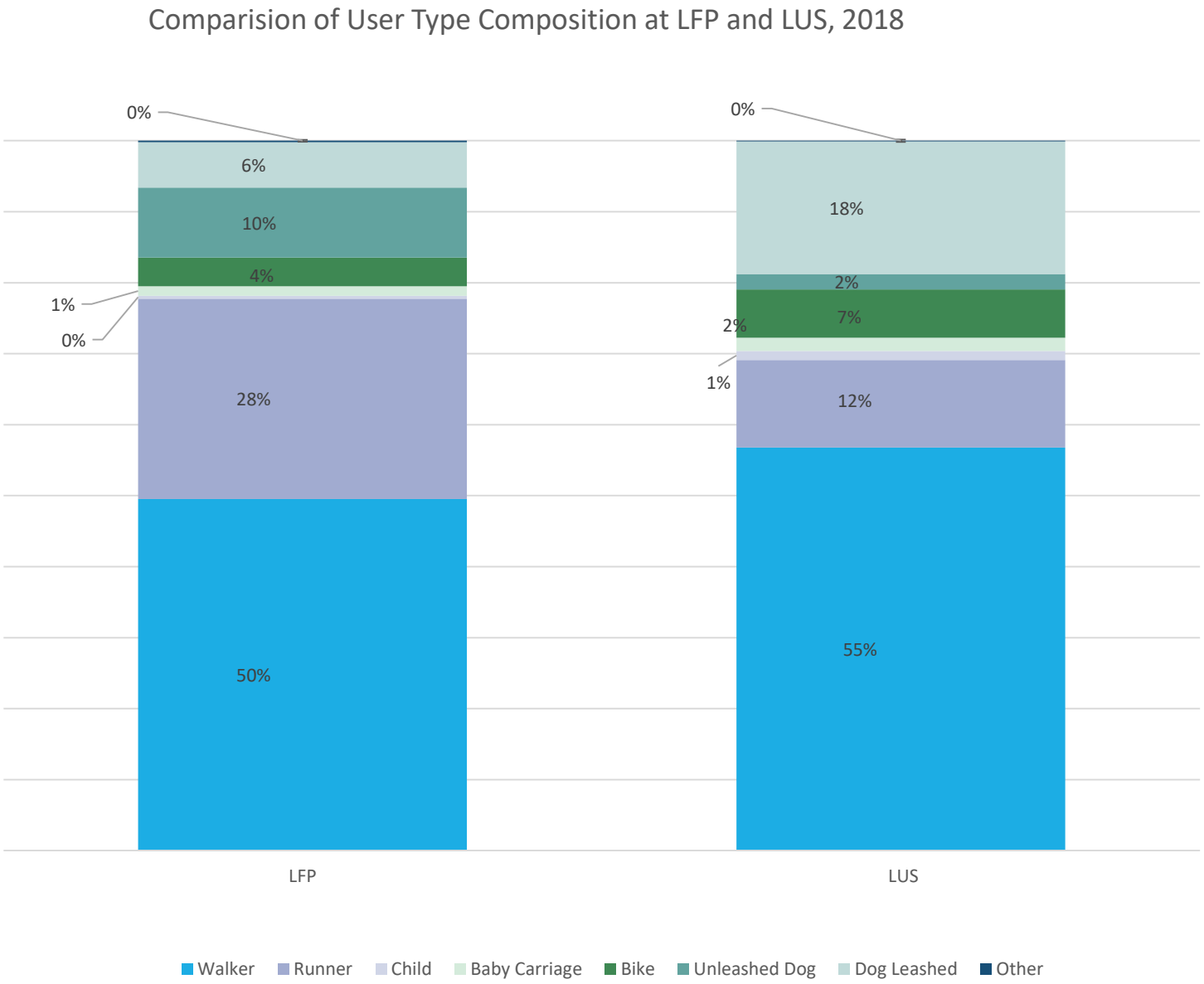
- The proportion of users for 2018*

	LFP		LUS	
User Type	**Percentage of users**	**Margin of Error (+/-)**	**Total**	**Margin of Error (+/-)**
Walker	50%	3%	55%	3%
Unleashed Dog	10%	1%	2%	1%
Leashed Dog	6%	1%	18%	3%
Runner	28%	4%	12%	4%
Child	0%	0%	1%	1%
Bike	4%	1%	7%	2%
Baby Carriage	1%	0%	2%	1%
Other	0%	0%	0%	0%
Total Users	**100%**		**100%**	

*2018 survey year spanned from 2/1/2018 – 1/31/2019

Results
User Type Composition

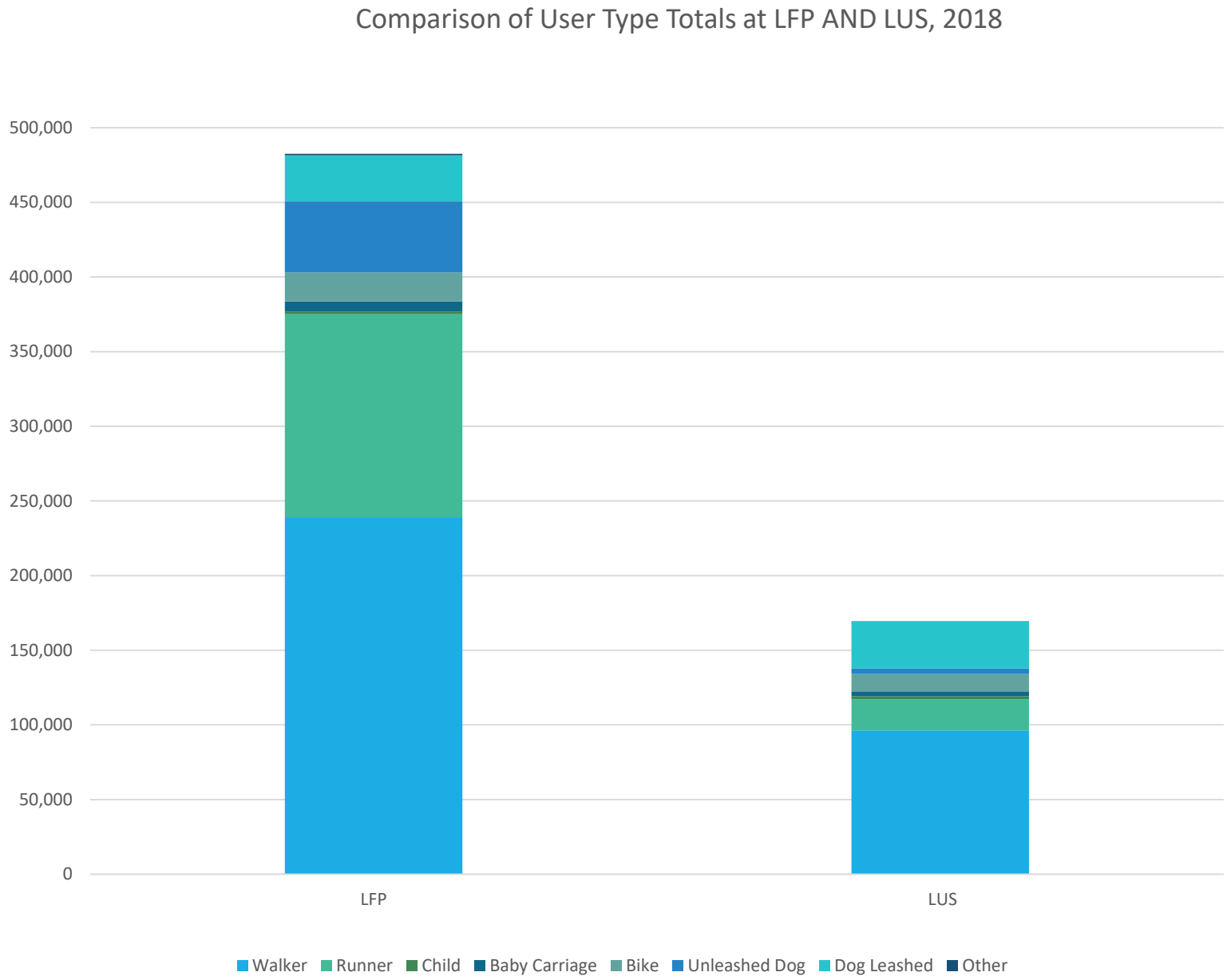
- Overall, proportions are similar
- Walkers made up around 50% of the users at both sites
- There were more runners at LFP than at Lusitania
  - This could be that people don't start running right at the entrances
- Dog usage between 15-20%.
  - There was a larger proportion of leashed dogs at the Lusitania entrance
- Bikers < 10 % of users
  - Slightly higher % of bikers at Lusitania than at LFP, though margins of error overlap
- Small children and baby carriages made up very small parts of the users at both sites



User Type totals at LFP and LUS

Survey Results - Estimated Totals Types				
	LFP		LUS	
User Type	Total	MoE (+/-)	Total	MoE (+/-)
Walker	236,963	34,430	97,206	20,857
Unleashed Dog	47,184	10,762	3,827	2,678
Dog Leashed	30,649	7,060	32,142	6,266
Runner	135,113	38,133	21,252	9,889
Child	1,825	831	2,299	1,602
Bike	19,263	8,188	11,465	4,297
Baby Carriage	6,541	2,563	3,233	1,272
Other	913	547	167	284
Total Users	**478,452**	**83,700**	**175,631**	**33,141**
Totals for Sensor Comparison	**391,339**	**69,299**	**129,923**	**28,660**
EcoCounter Sensor Total	**328,720**		**114,888**	

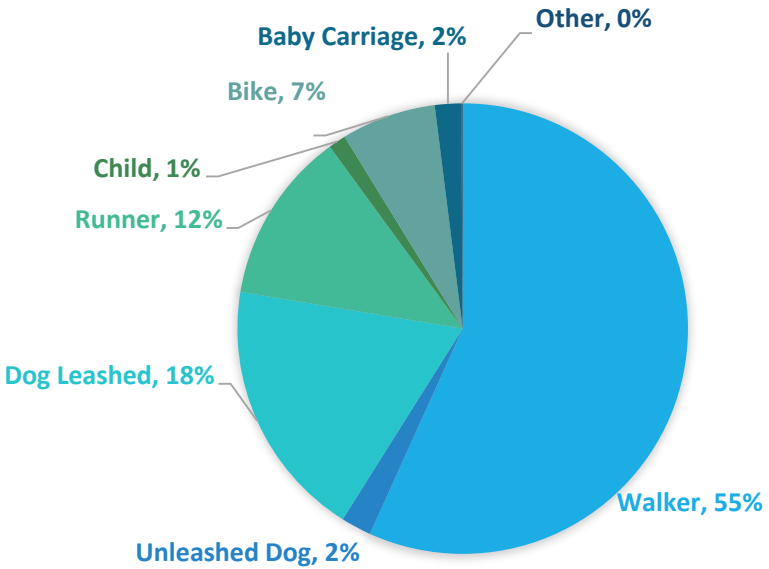
- EcoCounter sensor totals for the time period of the sample frame are within margin of error.
- Sensor undercounting likely at both sites



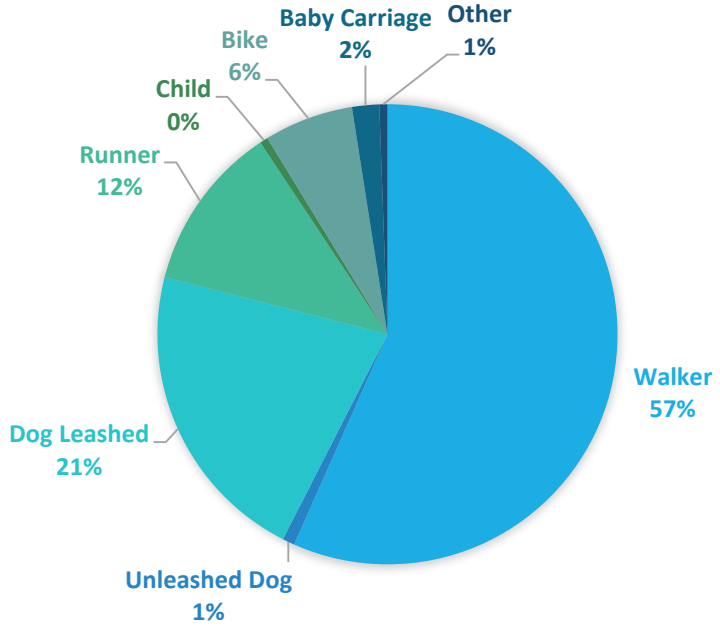
RESULTS
Lusitania Entrance Survey

- Previous survey data was available from 2014 – 2016, before the formal survey methodology we use now was in place.
  - 17.5 hours of data were available.
- The observed user type composition of the site was largely the same in 2018 as in previous years.
- The site is dominated by walkers and leashed dogs.
- Visual surveys documented a net of 2% more users than the EcoCounter sensors during the hours surveyed.

2018 LUS SURVEY
ESTIMATED USERS BY TYPE



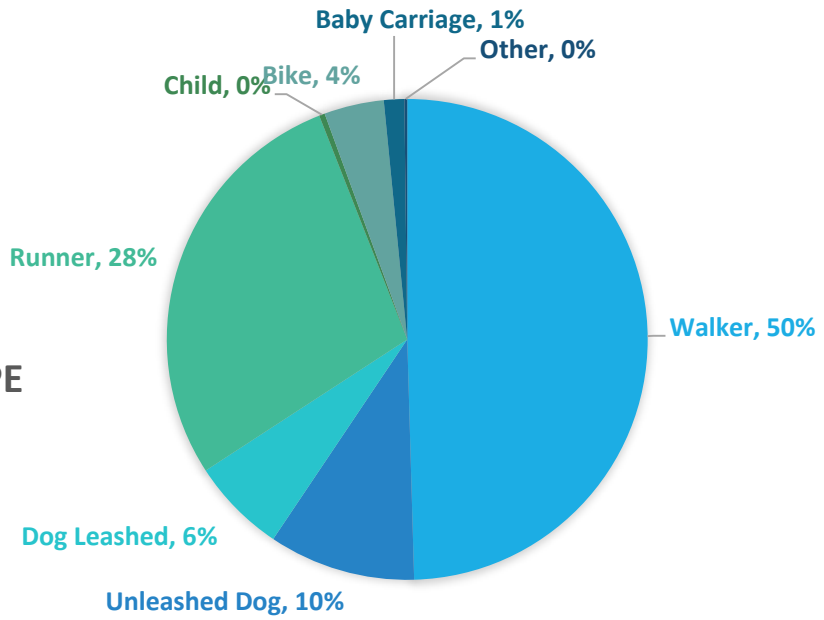
2014-2016 LUS SURVEY
ESTIMATED USERS BY TYPE



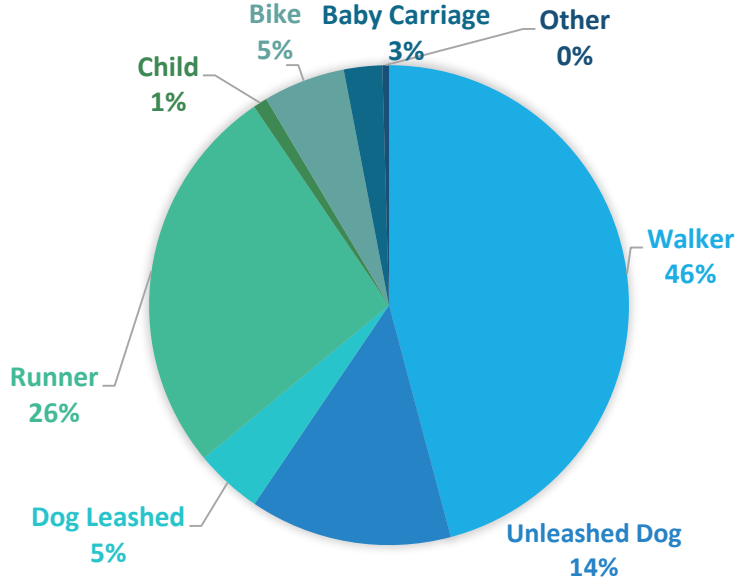
RESULTS
Little Fresh Pond Survey

- Informal survey data was available from 2011 – 2015
  - 62.4 hours of data were available.
- The observed user type composition of the site was largely the same in 2018 as in previous years.
- The site is dominated by walkers and runners. Unleashed dogs are more common here than leashed dogs.
- Visual surveys documented a net of 17% more users than the EcoCounter sensors during the hours surveyed.
- Undercounting by the sensors at LFP was likely more common than LUS due to more grouped events

2018 LFP SURVEY
ESTIMATED USERS BY TYPE



2011 - 2015 LFP SURVEY
ESTIMATED USERS BY TYPE



Future Goals

Future Goals

- Continue to track long term trends
- Add “Dog Walker” and “Dog Runner” Section to census sheet
- Inform Shared Use plan
- Use senor and survey data to better understand impacts on Fresh Pond Reservation from neighborhood development projects
- Relocate WTP Sensor
- Add sensor for new bike path

If you would like to volunteer to collect surveys at Fresh Pond, contact Tim Puopolo tpuopolo@cambridgma.gov!