O'ROURKE
ENGINEERING & PLANNING

November 16, 2020

Mr. Joseph Schulke
Schulke, Bittle & Stoddard LLC
1717 Indian River Boulevard, Ste. 201
Vero Beach, Florida 32960

Re: Kiwi Carwash Traffic Queueing Analysis and Rezoning

Dear Mr. Schulke:

O'Rourke Engineering & Planning has completed the analysis of the proposed express tunnel carwash to be located south of S.W. Gatlin Boulevard and west of S.W. Fondura Road in Port St. Lucie, Florida. This project is located within a parcel that also contains an existing AutoZone store. **Exhibit A** illustrates the project Conceptual Site Plan. The analysis includes two components, the queueing for the car wash and analysis of the project driveways. Several steps were undertaken in support of the two primary analyses: trip generation, queuing analysis, and driveway volume assignment. Each component is discussed herein.

Trip Generation

The trip generation for the project was calculated using the ITE 10th edition rates and hourly distribution. ITE provides a PM Peak Hour Rate for the subject use but not an AM peak hour rate nor a daily rate. Therefore, the daily rate and AM peak hour rate were developed using the relationships shown in the hourly distribution. **Exhibit B** summarizes the project trip generation. **Exhibit C** summarizes the percent distribution as well as the resultant project trips by 15 - minute interval throughout the day. As shown, the project will generate 891 daily trips, 49 AM peak hour trips and 78 PM trips.

Queuing Analysis

The queuing analysis is conducted on the hour when the traffic is greatest. This hour is referred to as the peak hour of generator. According to the hourly distribution, the peak hour of the generator occurs at 2:15 PM and reflects 10.5% of Daily Traffic. 10.5 percent equates to 94 peak hour trips with 47 vehicles entering and 47 exiting.

In order to determine queue lengths within the site, the process time for the car wash menu boards and tunnel were considered. The maximum capacity of the tunnel can be computed as 215 cars per hour. This capacity includes the 108 second process time for the first car (calculated as 16.2 seconds for the car to travel from the menu-board to the beginning of the tunnel, 75 seconds for the car to travel via conveyance through the 138 foot tunnel, and another 16.2 seconds for the car to exit the tunnel) followed by another car leaving the menu-board and entering the tunnel every 16.2 seconds during the hour. Likewise, the total capacity at the menu boards is computed as 240 vehicles per hour. On average, the three (3) car wash menu boards are able to process four (4) cars in 45 seconds. Two boards will serve general public and one board/lane will serve members with accelerated processing. The tunnel is the controlling capacity at 215 vehicles per hour. Of course, if the conveyance speed is reduced, the processing rate would decrease as well. Because there is a big buffer of demand versus available capacity it is unlikely that the processing time would ever be lower than the anticipated demand.

The total tunnel capacity of 215 cars per hour is greater than the 47 cars per hour that are expected to arrive during the peak hour of the generator. Therefore, there is no queue associated with the processing times falling behind demand. But to ensure sufficient queuing, mean queuing was calculated.

Queue = traffic intensity/ (1-traffic intensity), where traffic intensity is defined as the mean arrival rate/ mean service rate. The mean arrival rate is taken as 47 vehicles in one hour. The mean service rate is 215.

Therefore, the residual queue is (47/215)/ (1-47/215) = 3.6, say 4 vehicles.

The Kiwi car wash provides approximately 500 feet of storage. There are three lanes of storage of approximately 100 feet and another two lanes providing an additional 100 feet each lane. This storage can accommodate approximately 20 cars. The storage will more than accommodate the calculated queue.

Driveway Volumes

Kiwi Carwash will have three primary driveways, an existing right-in/right-out driveway on S.W. Gatlin Boulevard, a full access driveway (Driveway 1) on S.W. Domina Road, and an exit only driveway (Driveway 2) on S.W. Domina Road. The existing driveway on S.W. Gatlin Boulevard will share access with the existing AutoZone. The AutoZone traffic is assigned separately and shown in Exhibit **D** that illustrates the driveway volumes.

Based on the anticipated volumes from the Kiwi Car Wash with the AutoZone volumes, additional turn lanes are not recommended. There is an existing right turn lane on SW Gatlin Boulevard. At Driveway 1, the right turn volumes of 13 AM and 19 PM peak hour trips do not reach the standard volume threshold (using FDOT standards) of 75 turning movements. The left turn volume on S.W. Domina Road of 8 vehicles does not reach the industry standard threshold volumes of 30 to 35 turning movements. Therefore, turn-lanes are not recommended.

Conclusion

The proposed Kiwi Carwash together with the approximate 20-vehicle queue storage within the site will provide sufficient circulation for the project to prevent queuing onto S.W. Gatlin Boulevard. The operator should monitor the queues and processing time to allow adjustments to be made should queuing develop. Turn lanes at Driveway 1 on SW Domina Road are not required based on the low volumes.

It has been a pleasure working with you.

Respectfully submitted,

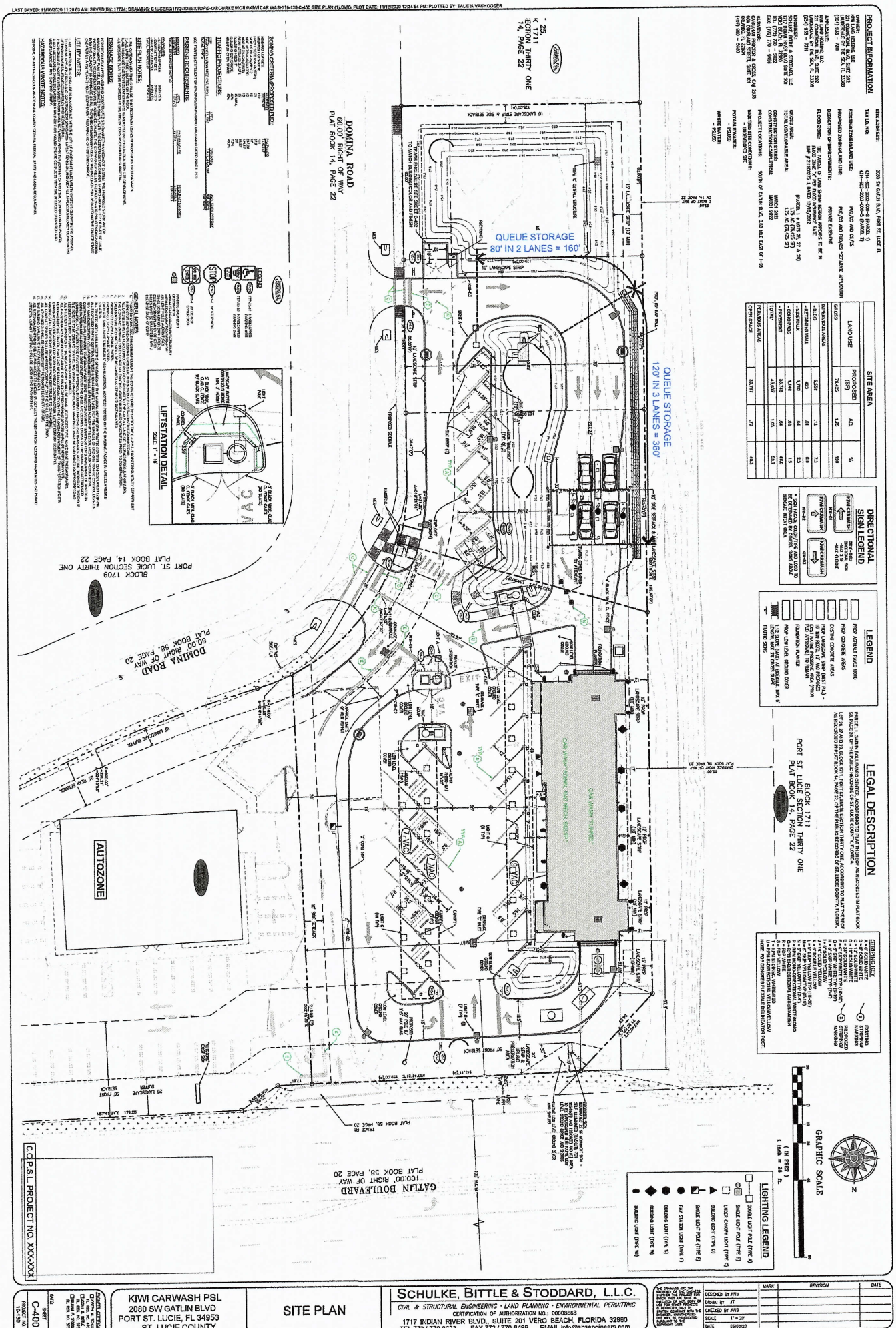
O'ROURKE ENGINEERING & PLANNING

Susan E. O'Rourke, P.E.

President

Prepared by: O'Rourke Engineering & Planning Certificate of Authorization: #26869 969 SE Federal Highway, Ste. 402 Stuart, Florida 34994 772-781-7918	Professional Engineer Susan E. O'Rourke, P.E. Date signed and sealed: 11/16/2020 License #: 42684

Exhibit A



PROJECT INFORMATION
SITE AREA
DIRECTIONAL SIGN LEGEND
LEGEND
LEGAL DESCRIPTION
LIGHTING LEGEND
GRAPHIC SCALE
DOMINA ROAD
60.00' RIGHT OF WAY
PLAT BOOK 14, PAGE 22
QUEUE STORAGE
80' IN 2 LANES = 160'
QUEUE STORAGE
120' IN 3 LANES = 360'
LIFTSTATION DETAIL
AUTOZONE
GATLIN BOULEVARD
100.00' RIGHT OF WAY
PLAT BOOK 58, PAGE 20
C.O.P.S.L. PROJECT NO. XXX-XXX
KIWI CARWASH PSL
2080 SW GATLIN BLVD
PORT ST. LUCIE, FL 34953
ST. LUCIE COUNTY
SITE PLAN
SCHULKE, BITTLE & STODDARD, L.L.C.
CIVIL & STRUCTURAL ENGINEERING · LAND PLANNING · ENVIRONMENTAL PERMITTING
CERTIFICATION OF AUTHORIZATION NO.: 00008668
1717 INDIAN RIVER BLVD., SUITE 201 VERO BEACH, FLORIDA 32960
TEL 772 / 770-9622 FAX 772 / 770-9496 EMAIL info@sbsengineers.com
C-400

EXHIBIT B

Daily

Land Use	ITE Code	Intensity	Units	Trip Generation Rate	Directional Split		Gross Trips		
					In	Out	In	Out	Total
Automated Car Wash	948	1	Lane	T = 891.00(X) (1)	50%	50%	446	445	891

(1) Daily Trips Calculated based on the PM peak hour being 8.7% of daily. PM rate divided by .087

AM Peak Hour

Land Use	ITE Code	Intensity	Units	Trip Generation Rate	Directional Split		Gross Trips		
					In	Out	In	Out	Total
Automated Car Wash	948	1	Lane	T = 49.00(X) (2)	50%	50%	25	24	49

(2) AM Peak Hour Calculated as 63% of PM Peak Hour

PM Peak Hour

Land Use	ITE Code	Intensity	Units	Trip Generation Rate	Directional Split		Gross Trips		
					In	Out	In	Out	Total
Automated Car Wash	948	1	Lane	T = 77.50 (X)	50%	50%	39	39	78

Source: ITE 10th Edition Trip Generation Rates

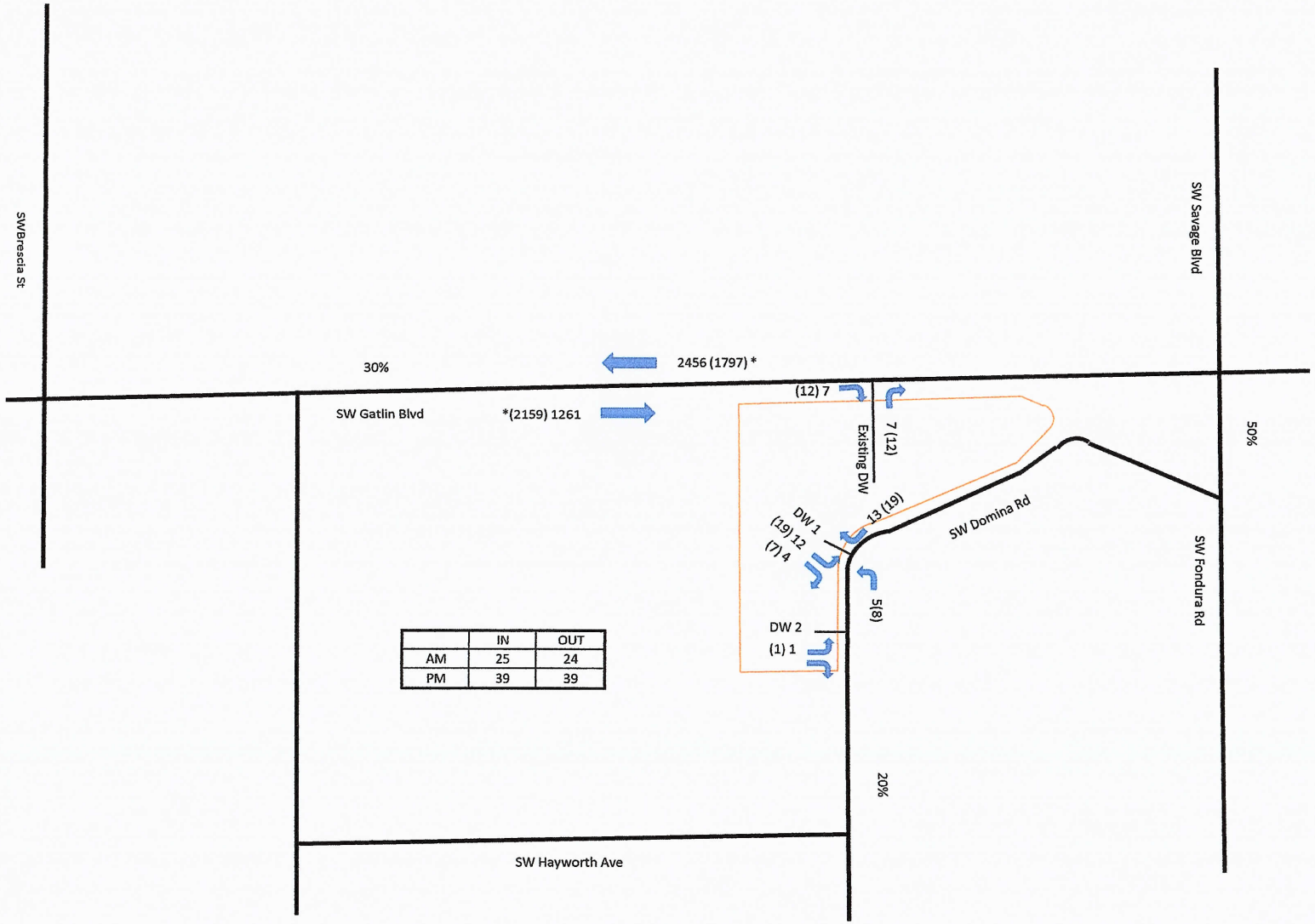
EXHIBIT C

AM Hourly Distribution

Hour Starting At	% of Daily per hour	% of daily in 15 minute	Phase 1 Hourly Volume	15 minute demand
			891	
12:00	0.0%	0.0%	0	0
12:15	0.0%	0.0%	0	0
12:30	0.0%	0.0%	0	0
12:45	0.0%	0.0%	0	0
1:00	0.0%	0.0%	0	0
1:15	0.0%	0.0%	0	0
1:30	0.0%	0.0%	0	0
1:45	0.0%	0.0%	0	0
2:00	0.0%	0.0%	0	0
2:15	0.0%	0.0%	0	0
2:30	0.0%	0.0%	0	0
2:45	0.0%	0.0%	0	0
3:00	0.0%	0.0%	0	0
3:15	0.0%	0.0%	0	0
3:30	0.0%	0.0%	0	0
3:45	0.1%	0.0%	1	0
4:00	0.1%	0.0%	1	0
4:15	0.3%	0.0%	3	0
4:30	0.4%	0.1%	4	1
4:45	0.3%	0.0%	3	0
5:00	0.3%	0.2%	3	2
5:15	0.1%	0.1%	1	1
5:30	0.0%	0.0%	0	0
5:45	0.0%	0.0%	0	0
6:00	0.1%	0.0%	1	0
6:15	1.0%	0.0%	9	0
6:30	1.3%	0.0%	12	0
6:45	2.1%	0.1%	19	1
7:00	3.3%	0.9%	29	8
7:15	4.2%	0.3%	37	3
7:30	5.2%	0.8%	46	7
7:45	5.5%	1.3%	49	12
8:00	5.5%	1.8%	49	16
8:15	5.4%	1.3%	48	12
8:30	5.6%	1.1%	50	10
8:45	6.1%	1.3%	54	12
9:00	7.4%	1.7%	66	15
9:15	7.5%	1.5%	67	13
9:30	7.4%	1.6%	66	14
9:45	7.7%	2.6%	69	23
10:00	7.6%	1.8%	68	16
10:15	8.3%	1.4%	74	12
10:30	9.1%	1.9%	81	17
10:45	9.5%	2.5%	85	22
11:00	9.7%	2.5%	86	22
11:15	9.5%	2.2%	85	20
11:30	9.3%	2.3%	83	20
11:45	9.3%	2.7%	83	24

PM Hourly Distribution

Hour Starting At	% of Daily	% of daily in 15 minute	Phase 1 Hourly Volume	15 minute demand
			891	
12:00	9.7%	2.3%	86	20
12:15	9.5%	2.0%	85	18
12:30	9.5%	2.3%	85	20
12:45	9.1%	3.1%	81	28
1:00	8.3%	2.1%	74	19
1:15	8.6%	2.0%	77	18
1:30	9.2%	1.9%	82	17
1:45	9.3%	2.3%	83	20
2:00	9.9%	2.4%	88	21
2:15	10.5%	2.6%	94	23
2:30	9.5%	2.0%	85	18
2:45	9.9%	2.9%	88	26
3:00	10.0%	3.0%	89	27
3:15	9.3%	1.6%	83	14
3:30	9.5%	2.4%	85	21
3:45	9.3%	3.0%	83	27
4:00	8.7%	2.3%	78	20
4:15	7.8%	1.8%	69	16
4:30	7.9%	2.2%	70	20
4:45	7.2%	2.4%	64	21
5:00	7.2%	1.4%	64	12
5:15	7.6%	1.9%	68	17
5:30	8.1%	1.5%	72	13
5:45	8.6%	2.4%	77	21
6:00	8.1%	1.8%	72	16
6:15	8.5%	2.4%	76	21
6:30	6.9%	2.0%	61	18
6:45	5.1%	1.9%	45	17
7:00	3.5%	2.2%	31	20
7:15	1.4%	0.8%	12	7
7:30	0.8%	0.2%	7	2
7:45	0.6%	0.3%	5	3
8:00	0.5%	0.1%	4	1
8:15	0.4%	0.2%	4	2
8:30	0.4%	0.0%	4	0
8:45	0.0%	0.2%	0	2
9:00	0.0%	0.0%	0	0
9:15	0.0%	0.0%	0	0
9:30	0.0%	0.0%	0	0
9:45	0.0%	0.0%	0	0
10:00	0.1%	0.0%	1	0
10:15	0.1%	0.0%	1	0
10:30	0.1%	0.0%	1	0
10:45	0.1%	0.1%	1	1
11:00	0.0%	0.0%	0	0
11:15	0.0%	0.0%	0	0
11:30	0.0%	0.0%	0	0
11:45	0.0%	0.0%	0	0



	IN	OUT
AM	25	24
PM	39	39

O'ROURKE ENGINEERING & PLANNING

969 SE Federal Hwy, Suite 402
Stuart, Fl, 34994

NTS

Job Number:

Date:

Legend

XX(XX) = AM (PM)

* FDOT Florida Traffic Online AM(PM)

EXHIBIT D

Driveway Volumes

Kiwi Car Wash