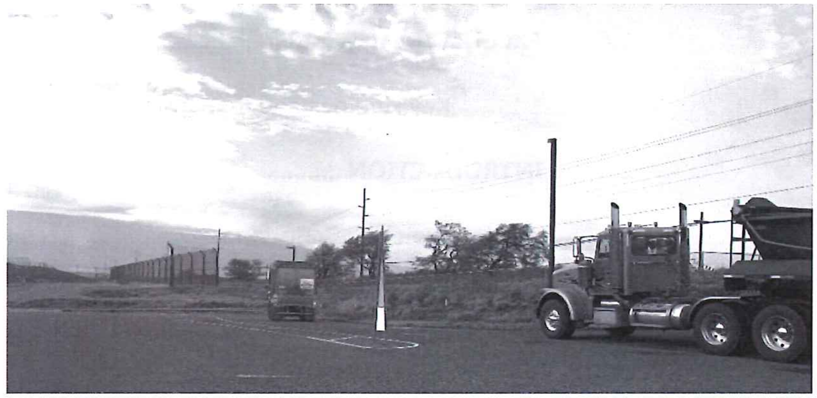
APPENDIX

TRAFFIC IMPACT ANALYSIS REPORT

I

FEHR & PEERS



Central Maui Landfill Facilities Project

Transportation Impact Analysis Report (TIAR)

October 2016
Prepared for Munekiyo Hiraga
SD16-0205

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1.0 EXECUTIVE SUMMARY

This report presents the results of the transportation impact analysis report (TIAR) for the proposed additional facilities of the Central Maui Landfill located in Maui. The proposed project will include ancillary uses and the consolidation of refuse operations that are currently occurring at various base yard locations on the island. The new uses include: an administrative office, a metals processing facility, an abandoned vehicle lot, and a construction and demolition materials recovery facility. Vehicle access to the site will be provided via two access driveways on Pūlehu Road, and the project is expected to be completed by 2020.

1.1 KEY FINDINGS AND CONCLUSIONS

The following findings resulted from the transportation assessment:

- Peak hour capacity analysis was conducted at four intersections in the vicinity of the project site based on projected travel patterns and paths of travel by project-generated traffic. The County of Maui and the Hawaii Department of Transportation strive to maintain LOS D as the minimum desirable operating level at intersections.
- Three of the four intersections currently operate acceptably at Level of Service (LOS) C or better. At the location closest to the site, Intersection 3: Pūlehu Road/Hansen Road, the worst-case movement operates at LOS F in the AM peak hour, and LOS C in the PM peak hour. Based on a preliminary evaluation, four of the eight standard traffic signal warrants are met at this intersection *without the proposed project*. It should be noted that the County of Maui makes the final determination on where and when traffic signals are installed on County-maintained roadways.
- The project is estimated to generate 356 net new daily vehicle trips, including 50 trips during the AM peak hour and 47 trips during the PM peak hour. These volumes are based on trip generation assumptions developed through information primarily provided by the County of Maui Department of Environmental Management (DEM), as well as field observations in some cases.
- Analysis of Future (2020) No Project Conditions indicates that Intersection 1: Pūlehu Road/Ho'okele Street and Intersection 3: Pūlehu Road/Hansen Road would operate at an overall intersection LOS E or F during the AM peak hour and/or PM peak hour.
- Analysis of Future (2020) plus Project Conditions indicates that the same two intersections noted in the previous bullet, would operate at an overall intersection LOS F during the AM peak hour, the PM peak hour, or both.
- Although the project would contribute to cumulative traffic operations impacts at Intersection 1: Pūlehu Road/Ho'okele Street and Intersection 3: Pūlehu Road/Hansen Road, it only comprises a maximum of 1% and 4% of the total peak hour traffic at these intersections, respectively.

- Mitigation strategies were developed and evaluated to address the identified deficiencies at the two intersections with projected undesirable peak hour operations (i.e., LOS E or F).
    - The improvement needed to return operations to pre-project conditions or better is the re-striping of northbound and southbound approaches at Intersection 1: Pūlehu Road/Ho'okele Street to include separate left-turn and shared through/right-turn lanes on each approach. With these improvements, the worst-case delays would be less than pre-project conditions, mitigating the project's impact. The project should be responsible for implementing this improvement.
    - At the 3: Pūlehu Road/Hansen Road, installation of an all-way stop control (AWSC) or a traffic signal are two viable improvements to provide operations that will be equal to or better than pre-project levels. Although the AWSC would improve vehicles seconds of delay experienced at this location compared to when it is side-street stop-controlled, the AM peak hour operation for the overall intersection would be at LOS F. A signal would provide LOS D operations under 2020 Plus Project conditions assuming existing lane configurations are maintained. As noted above, four traffic signal warrants are met at this intersection under existing conditions, and the project would contribute a maximum of 4% of the total traffic at this location under 2020 conditions. As such, the project should contribute a fair share towards the installation of a signal when warranted and approved for construction by the County. Additionally, there are trade-offs between implementation of an AWSC and signal. For example, implementation costs of an AWSC compared to a traffic signal is substantially less, but vehicles in the AM peak hour would still experience poor levels of service and high delay.
- Multi-modal and active transportation facilities (i.e. bicycle and pedestrian facilities and transit services) were assessed in the study area. Overall, the project is not expected to significantly impact the active travel modes and transit given its relatively remote location.
- The intersection operations analyses results are summarized in **Table 1**.

TABLE 1: EXISTING & FUTURE INTERSECTION LEVEL OF SERVICE SUMMARY

Intersection	Traffic Control	Peak Hour[1]	Existing (2016)		Future (2020)					Mitigated to:			
					No Project		Plus Project			Pre-Project or Better Conditions (≤ LOS D)		LOS D or Better Conditions	
			Del/Veh[2]	LOS[3,4]	Del/Veh[2]	LOS[3,4]	Del/Veh[2]	LOS[3,4]	Impact?[5]	Del/Veh[2]	LOS[3,4]	Del/Veh[2]	LOS[3,4]
1. Pūlehu Road/Ho'okele Street	SSSC	7:30-8:30 AM	15.2	C	22.6	C	23.7	C	NO	23.3	C	16.4	B
		4:15-5:15 PM	20.4	C	**52.0**	**F**	**55.6**	**F**	**Cumulative Impact**	**49.5**	**E**	11.0	B
2. Ho'okele Street/Hana Highway	Signalized	7:15-8:15 AM	12.4	B	15.3	B	15.6	B	NO	No Mitigation Required			
		3:45-4:45 PM	16.9	B	22.4	C	22.5	C	NO				
3. Pūlehu Road/Hansen Road	SSSC	7:00-8:00 AM	**172.8**	**F**	**>180**	**F**	**>180**	**F**	**Cumulative Impact**	**60.4**	**F**	10.1	B
		3:30-4:30 PM	23.3	C	**42.8**	**E**	**79.8**	**F**	**Cumulative Impact**	20.6	C	7.1	A
4. Mokulele Highway/Hansen Road	Signalized	7:00-8:00 AM	21.7	C	25.6	C	26.9	C	NO	No Mitigation Required			
		3:30-4:30 PM	15.0	B	16.5	B	17.3	B	NO				
5. Pūlehu Road/Access Road (South Project Driveway)	Signalized	N/A	Does Not Exist		Does Not Exist		11.1	B	NO	No Mitigation Required			
							9.4	A	NO				

Source: Fehr & Peers, June 2016

Notes:

[1] Weekday AM and PM peak hour for each intersection. Traffic volumes used in the intersection operations analysis were based on the individual intersection's peak hour.

[2] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop control intersections. The vehicular delay for the worst movement is reported for side street stop-controlled intersections.

[3] LOS calculations performed using the 2010 Highway Capacity Manual (HCM) method.

[4] Unacceptable seconds of delay per vehicle and LOS highlighted in **bold.**

[5] Each of the identified significant impacts is categorized as either a project impact or cumulative impact. A project-specific impact is when the addition of project-related traffic degrades intersection operations from LOS D or better to LOS E or F. When an intersection is already operating at LOS E or F without the project and the project adds traffic to this location, causing the delay to increase by 5% or more, then this would be characterized as a cumulative impact.

2.0 INTRODUCTION

Fehr & Peers has completed a transportation impact analysis for the proposed additional facilities of the Central Maui Landfill (i.e., the "project") located in the Pu'unēnē area outside Kahului on the island of Maui. The purpose of this analysis is to identify the potential transportation impacts associated with the additional landfill facilities as part of the project team's environmental assessment (EA) process. This analysis is to also be used to address potential concerns about traffic that may be raised by agencies, the public, and County of Maui decision-makers. This first chapter describes the project and traffic methodologies used, while the remainder of this report describes existing conditions, the project's potential vehicle trip generation and distribution, and potential areas of impact.

2.1 PROJECT DESCRIPTION

The County of Maui Department of Environmental Management (DEM) Solid Waste Division is responsible for the planning, operation, and maintenance of the County's landfills, including the Central Maui Landfill located on Pūlehu Road southeast of Hansen Road in the Pu'unēnē area of Central Maui. **Figure 1** illustrates the study area of the proposed project.

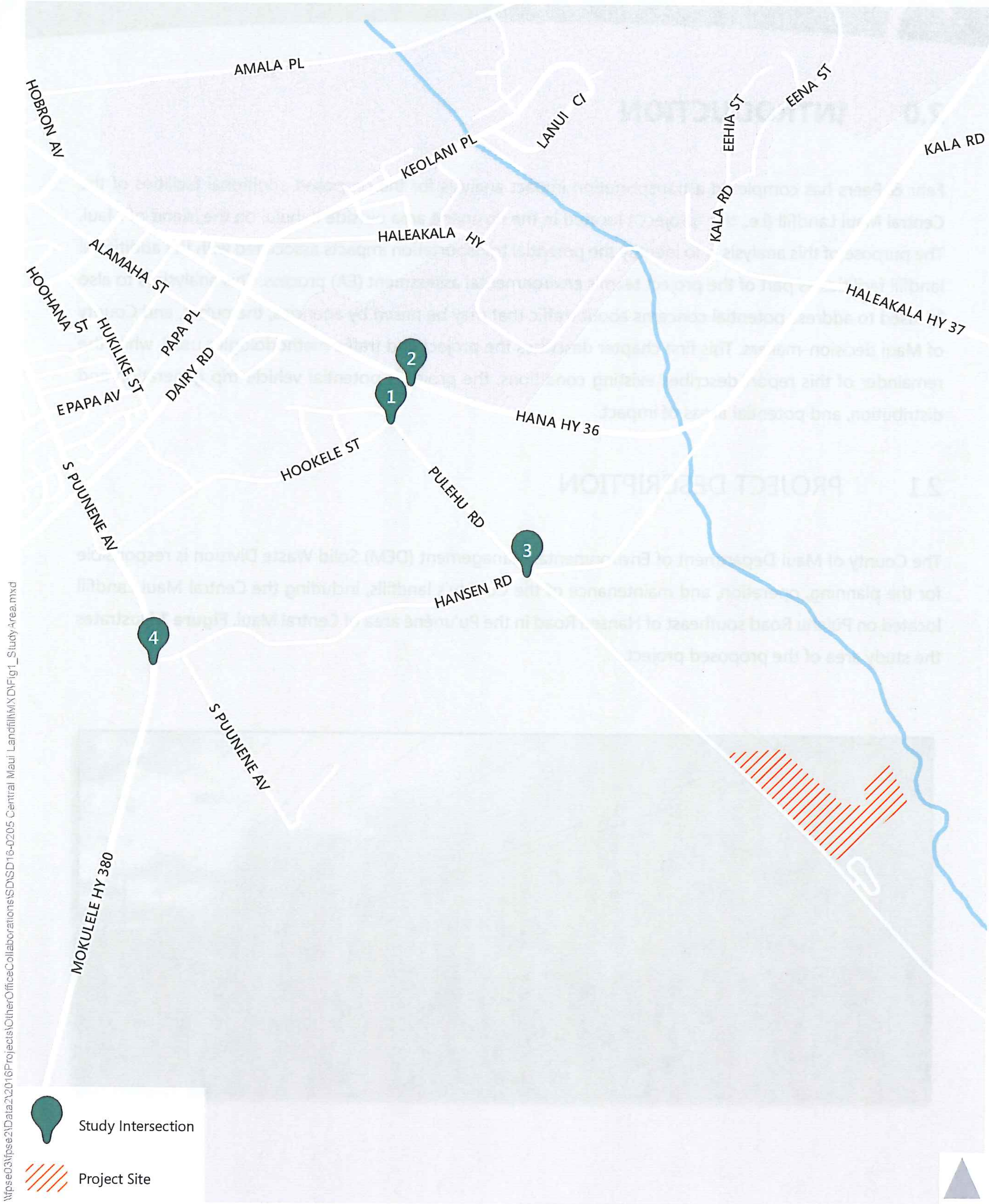


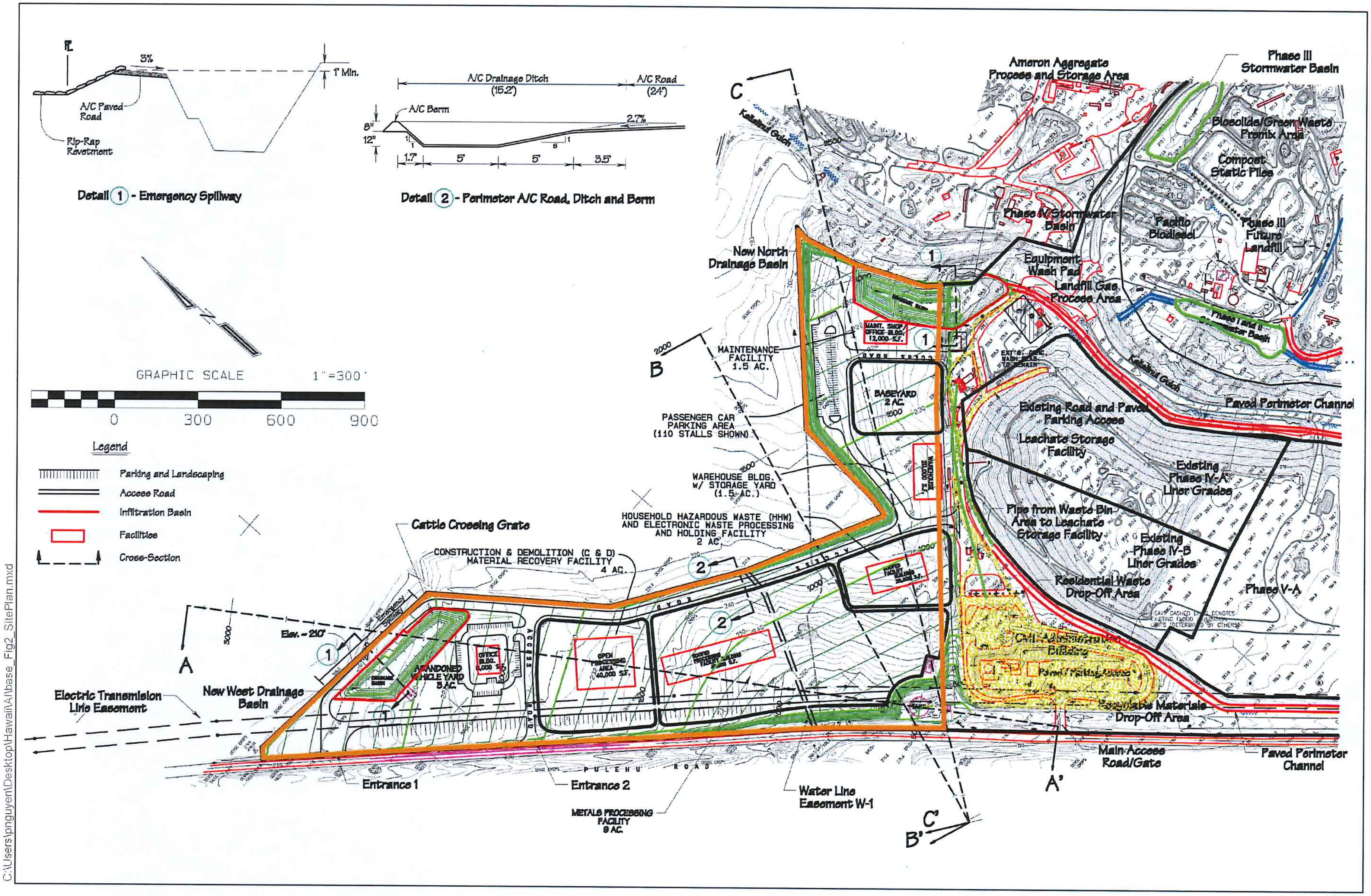
Figure 1

Study Area and Analyzed Intersections

The Central Maui Landfill currently accepts green waste and all other types of municipal waste, except for hazardous wastes. In addition to the landfill itself, existing supporting facilities include administrative offices, a recycling facility, and self-haul disposal area. The proposed project will develop approximately 40 acres adjacent to and west of the existing landfill and will provide ancillary uses to the site, which are illustrated on **Figure 2** and highlighted below.

- Relocation of the existing abandoned vehicle storage lot from the northeast quadrant of the intersection of Pūlehu Road and Hansen to the project site
- Relocation of the electronics collection facility on Lower Main Street in Wailuku to the project site
- Relocation and consolidation of the refuse operations from various base yards (i.e. Upcountry, Central/Wailuku, and West Side base yards) to the project site
- A new household hazardous waste disposal and service area
- A new construction and demolition materials recovery facility
- A new maintenance facility
- A new landfill facilities building
- A new administrative office
- A new metals processing facility

Access to the new and relocated uses will be provided via two driveways on Pūlehu Road. The southernmost driveway is the primary entrance/exit and provides full access, while the northernmost driveway is secondary and right in/right out only. The project is planned to be completed by 2020. The driveway to the existing landfill area east of the project site is shown below.



Source: A-Mehr, Inc.

Figure 2

Site Plan

2.2 PROJECT STUDY AREA

The assessment focused on evaluating the potential project-related traffic impacts at four (4) existing intersections in the vicinity of the Central Maui Landfill. These intersections were selected based on the amount of project traffic expected to be added to each location. The analyzed intersections are listed below and are shown on **Figure 1**:

1. Pūlehu Road/Ho'okele Street
2. Ho'okele Street/Hana Highway (Highway 36)
3. Pūlehu Road/Hansen Road
4. Mokulele Highway (Highway 311)/Hansen Road

2.3 INTERSECTION ANALYSIS SCENARIOS

The operations of the study intersections were evaluated during the weekday morning (AM) and evening (PM) peak hours for the following scenarios:

- **Existing (2016) Conditions** – The analysis of existing traffic conditions was based on 2016 counts collected for the analyzed peak hours. The existing conditions analysis also includes a description of key area roadways and an assessment of bicycle, pedestrian, and transit facilities and services in the study area.
- **Future (2020) No Project Conditions** – Future traffic volumes in the anticipated completion year of full project buildout were projected by increasing the existing volumes using an annual growth factor to account for ambient growth including entitled and pending developments in the area. This scenario does not include any project traffic.
- **Future (2020) plus Project Conditions** – Traffic projections from 2020 No Project Conditions *plus* traffic estimated from the completion and full occupancy of the expanded Central Maui Landfill facilities.

2.4 TRAFFIC ANALYSIS METHODS

The analysis of roadway operations performed for this study is based on procedures presented in the *Highway Capacity Manual* (HCM), published by the Transportation Research Board in 2010. The operations of roadway facilities are described with the term level of service (LOS). LOS is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Six levels are defined from LOS A, with the least congested operating conditions, to LOS F, with the most congested operating conditions. LOS E represents "at-capacity" operations. Operations are designated as LOS F when volumes exceed capacity, resulting in stop-and-go conditions. The methodologies for signalized and unsignalized intersections are described below.

2.4.1 SIGNALIZED INTERSECTIONS

The method described in Chapter 18 of the *Highway Capacity Manual 2010* was used to prepare the LOS calculations for the signalized study intersections. This LOS method analyzes a signalized intersection's operation based on average control delay per vehicle. Control delay alone is used to characterize LOS for the entire intersection or an approach. Control delay includes the initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The average control delay for signalized intersections is calculated using Synchro 9.0 analysis software and is correlated to a LOS designation as shown in **Table 2.**

TABLE 2: SIGNALIZED INTERSECTION LEVEL OF SERVICE CRITERIA

Level of Service	Description	Delay in Seconds
A	Progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	> 10.0 to 20.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	> 20.0 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 35.0 to 55.0
E	This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0
F	This level is considered unacceptable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	> 80.0

Source: *Highway Capacity Manual*, Transportation Research Board, 2010.

2.4.2 UNSIGNALIZED INTERSECTIONS

The operations of the unsignalized intersections were evaluated using the method contained in Chapter 19: Two-Way Stop-Controlled Intersections of the *HCM 2010*. LOS ratings for stop-sign-controlled intersections are based on the average control delay expressed in seconds per vehicle. At two-way or side-street-controlled (TWSC or SSSC) intersections, the average control delay is calculated for each minor-street stopped movement and the major-street left turns, not for the intersection as a whole. For approaches composed of a single lane, the control delay is computed as the average of all movements in that lane. For approaches with multiple lanes, the control delay is computed for each movement; the movement with the worst (i.e., longest) delay is presented for TWSC. As shown in the **Table 3**, LOS F is assigned to the movement if the volume-to-capacity (V/C) ratio for the movement exceed 1.0 regardless of control delay. The average control delay for unsignalized intersections is calculated using Synchro 9.0 analysis software and is correlated to a LOS designation as shown in **Table 3**.

TABLE 3: UNSIGNALIZED INTERSECTION LEVEL OF SERVICE DEFINITIONS

Level of Service (v/c ≤ 1.0)	Level of Service (v/c > 1.0)[1]	Description	Average Control Delay Per Vehicle (Seconds)
A	F	Little or no delay.	≤ 10.0
B	F	Short traffic delay.	> 10.0 to 15.0
C	F	Average traffic delays.	> 15.0 to 25.0
D	F	Long traffic delays.	> 25.0 to 35.0
E	F	Very long traffic delays.	> 35.0 to 50.0
F	F	Extreme traffic delays with intersection capacity exceeded.	> 50.0

Source: *Highway Capacity Manual*, Transportation Research Board, 2010.

Notes:

[1] For approach-based and intersection-wide assessments, such as that used for all-way stop controlled intersections, LOS is defined solely by control delay.

2.4.3 SIGNIFICANT IMPACT CRITERIA

The analysis of Future Conditions compares the future baseline or "No project" condition with the project assuming full build-out and occupancy, to determine whether or not the addition of project traffic is expected to result in a significant impact on the surrounding roadways. Based on previous studies conducted for the County of Maui, the minimum desired operating standard for a signalized intersection is LOS D for the overall intersection. Additionally, the Hawai'i Department of Transportation (HDOT) strives to universally maintain LOS D intersection operations and in their *Draft HDOT Best Practices for Traffic Impact Report* (June 2012) defines a significant impact when the operations of an intersection, turning movement, or roadway segment changes from LOS D or better to LOS E or F. Also when evaluating intersection approach LOS at any location, other factors should be considered in the analysis, such as traffic volumes, volume-to-capacity (V/C) ratios (should ideally be less than 1.00), and secondary impacts to pedestrian, bicycle, and transit travel.

Each of the identified significant impacts could be further categorized as either a cumulative impact or a project-specific impact. If the addition of project traffic is expected to degrade acceptable service levels (LOS D or better) to unacceptable service levels (LOS E or F) then the project is considered to have a project-specific impact. Whereas, if the LOS for any roadway element is expected to be LOS E or F without the project and the project adds traffic to this location, causing the delay to increase by 5% or more, then this would be characterized as a cumulative impact.

For unsignalized intersections, the project is determined to have a significant cumulative impact when it adds traffic to a study location that includes a controlled approach that operates at an unacceptable level (i.e., LOS E or F). If the addition of project traffic causes an unsignalized intersection to degrade from LOS D or better to LOS E or F, then the impact is considered to be project-specific.

3.0 EXISTING CONDITIONS

This chapter describes the study area's existing transportation network and includes a discussion of the roadway, bicycle, pedestrian, and transit facilities. Overall, the assessment of the existing conditions relevant to this study established an existing baseline condition against which the proposed project changes can be evaluated against.

3.1 ROADWAY SYSTEM

The key roadways providing access to the site are described below. **Figure 1** illustrates the proposed project location and the surrounding roadway system.

Hana Highway (Highway 36) is approximately a 64-mile long roadway comprised of Route 36 and Route 360 and connects Kahului with the town of Hana in east Maui. Hana Highway is a major tourist attraction for Maui as the arterial facility through Kahului transitions into a winding and narrow two-lane roadway makai and east of the project site. In the study area, the facility is a 45 miles per hour (mph) four-lane arterial (two lanes in each direction) that extends east-west and is divided by a landscaped median. Hana Highway is a State facility from Kahumanu Avenue to Kaupakalua Road (Route 36) and from Kaupakalua Road to Keawa Place before Hana Bay (Route 360).

Mokulele Highway (Highway 311) is approximately a seven-mile major arterial highway that connects Kahului and the Upcountry areas with Kihei. Leaving Kahului, Mokulele Highway begins as a continuation of Pu'unēnē Road and continues southward cutting through agricultural land (primarily sugarcane fields) and terminates at the junction with North Kihei Road and Pi'ilani Highway. It is a State-owned, four-lane roadway (two lanes in each direction) with a posted speed limit of 45 mph and divided by grass medians.

Hansen Road is a County-owned, two-lane rural roadway (one lane in each direction) with a 30 mph speed limit and advisory speeds of 20 mph when the facility curves just south of its intersection with Hana Highway. The roadway links Mokulele Highway and Hana Highway and is primarily used for local traffic between East Maui and Upcountry to South Maui.

Ho'okele Street is a county-owned, four-lane roadway (two lanes in each direction) divided by raised, landscaped medians. The roadway provides an alternative connection between Mokulele Highway and Hana Highway, as well as provides access to various existing and future commercial uses. The posted speed limit of the roadway is predominately 35 mph, but includes advisory speeds of 20 mph as it traverses through the more developed commercial frontages and approaches its intersection with Mokulele Highway.

Pūlehu Road is a County-owned, two-lane roadway (one lane in each direction) that serves the existing landfill and provides access to Upcountry. The speed limit along the roadway varies by segment. For example, from the cul-de-sac north of Ho'okele Street to approximately 600 feet south of Ho'okele Street the posted limit is 35 mph. As the roadway narrows between Ho'okele Street and Hansen Road the speed limit increases to 45 mph, and immediately south of Hansen Road the posted speed limit is 30 mph. However, roughly 1,800 feet it returns back to 45 mph as it fronts the future project site and the existing landfill.

3.2 TRANSIT FACILITIES

The Maui Bus service, operated by Roberts Hawaii, provides public transit service around the island with 13 bus routes. Each route operates seven days a week, including holidays. There is no transit route that directly provides service to the Central Maui Landfill nor the immediate study area. The Kihei Islander Route (#10) is the only Maui Bus that traverses on one of the study roadway facilities, Mokulele Highway. In the study area, this route operates along Mokulele Highway and provides hourly service between the Queen Ka'ahumanu in Kahului and Kihei. Overall, the limited transit service is reflective of the more rural and remote surroundings and lack of key higher-density, activity centers in the vicinity of the Central Maui Landfill. Service expansion is not anticipated in this area within the timeframe of the project.

3.3 PEDESTRIAN FACILITIES

Pedestrian facilities consist of sidewalks, crosswalks, and pedestrian signals at signalized intersections. Since the landfill is located in the Pu'unēnē area, which is more rural with its primary industry related to growing and processing agricultural products, the pedestrian facilities, such as sidewalks and marked crosswalks, are non-existent along Pūlehu Road and Hansen Road. Pedestrian facilities are only provided at intersections along Hana Highway and Mokulele Highway. Ho'okele Street fronts a variety of existing and future commercial uses and is therefore the only study facility that provides sidewalks with landscaped buffers along both sides of the roadway.

Despite the limited pedestrian facilities at the roadway segment level in the study area, there are pedestrian facilities provided at three of four study intersections and are described below.

1. Pūlehu Road/Ho'okele Street
    - Two-way stop controlled with high visibility crosswalks on all four legs
2. Ho'okele Street/Hana Highway (Highway 36)
    - Signalized with a high visibility crosswalk and pedestrian signals on the south leg

3. Pūlehu Road/Hansen Road
   - No pedestrian facilities provided
4. Mokulele Highway (Highway 311)/Hansen Road
   - Signalized with a high visibility crosswalk and pedestrian signals on the east leg

3.4 BICYCLE FACILITIES

Within the project study area, bicycle facilities are limited, and no bicycle facilities directly serve the project site. Along some segments of Hana Highway on the south side (eastbound side) there are dedicated bicycle lanes. The only *continuous* bicycle facility that exists along any of the study roadways is the Mokulele bike path located on the east side of Mokulele Highway between North Kihei Road and Ho'okele Street. As shown in the image to the right, the bike path provides a two-directional, completely separate right-of-way designated for the exclusive use of bicyclists with vehicle and pedestrian cross-flow minimized.

3.5 EXISTING INTERSECTION LEVEL OF SERVICE

The study intersections were evaluated during weekday morning (6:00 to 9:00 AM) and evening (3:00 to 6:00 PM) peak period conditions. Single-day traffic counts were collected during the weekday AM and PM peak periods at the study intersections in mid-May 2016, when local schools were in session. The study area's AM peak hour of traffic generally occurs between the hours of 7:00 AM and 8:00 AM, while the PM peak hour of traffic generally occurs 3:30 PM to 4:30 PM. Although the peak hours of traffic generally occur around the same time frame at each of the study intersections, the absolute peak hour of traffic at each of the study intersections slightly differ as shown in **Table 4**. It should also be noted that traffic volumes used in the intersection operations analysis were based on the individual intersection's peak hour.

Existing lane configurations and signal controls were obtained through field observations. **Figure 3** presents the existing AM and PM peak hour turning movement volumes, corresponding lane configurations, and traffic control devices. Traffic count data sheets are provided in **Appendix A.**

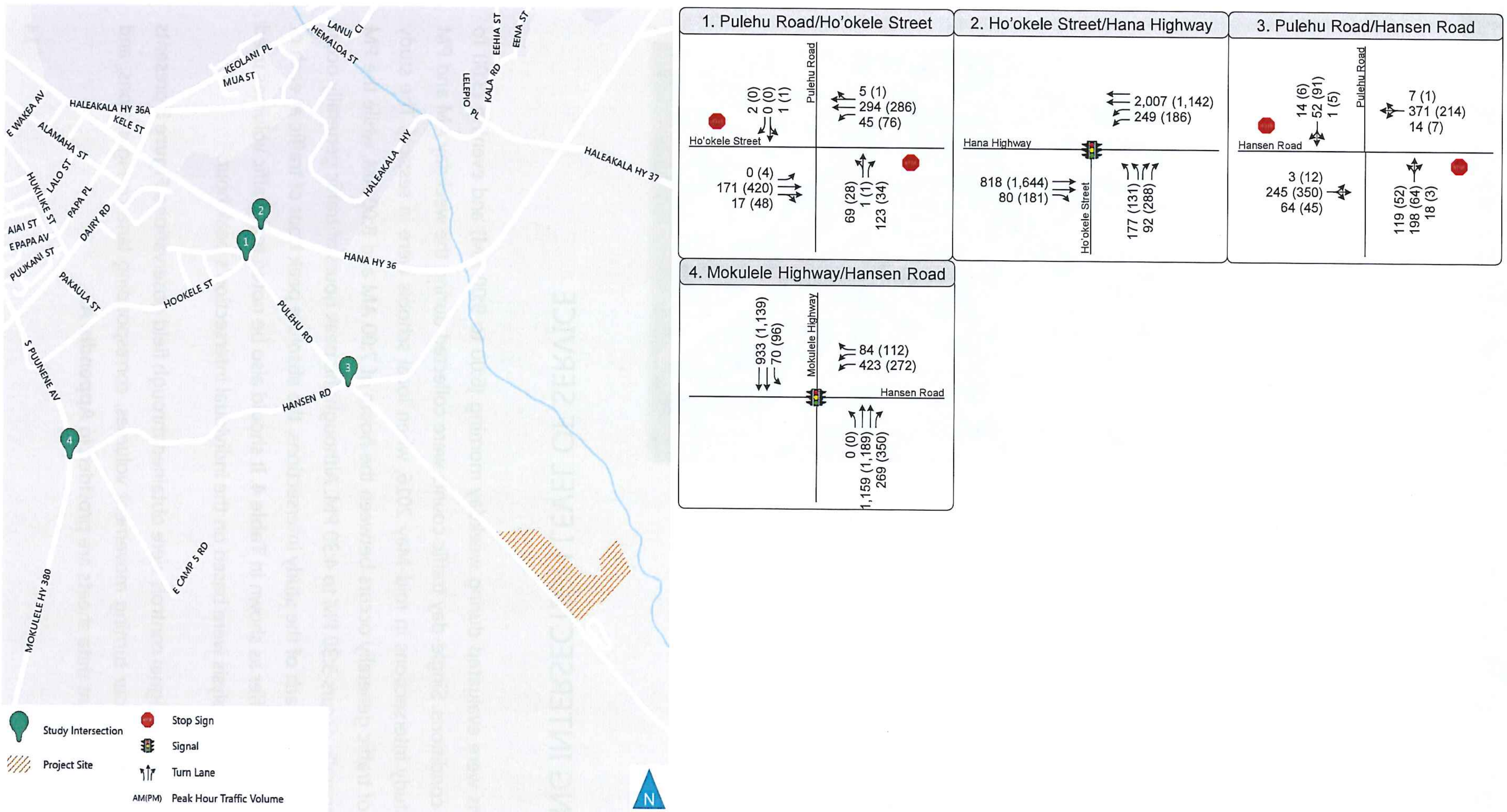


Figure 3
Peak Hour Traffic Volumes and Lane Configurations
Existing (2016) Conditions

TABLE 4: EXISTING INTERSECTION LEVEL OF SERVICE

Intersection	Traffic Control	Peak Hour[1]	Delay (sec/veh)[2]	LOS[3,4]
1. Pūlehu Road/Ho'okele Street	SSSC	7:30-8:30 AM	15.2	C
		4:15-5:15 PM	20.4	C
2. Ho'okele Street/Hana Highway	Signalized	7:15-8:15 AM	12.4	B
		3:45-4:45 PM	16.9	B
3. Pūlehu Road/Hansen Road	SSSC	7:00-8:00 AM	**172.8**	**F**
		3:30-4:30 PM	23.3	C
4. Mokulele Highway/Hansen Road	Signalized	7:00-8:00 AM	21.7	C
		3:30-4:30 PM	15.0	B

Source: Fehr & Peers, June 2016.

Notes:

SSSC = Side-street stop-controlled intersection

[1] Weekday AM and PM peak hour for each intersection. Traffic volumes used in the intersection operations analysis were based on the individual intersection's peak hour.

[2] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for side-street stop-controlled (SSSC) intersections.

[3] LOS calculations performed using the *2010 Highway Capacity Manual (HCM)* method.

[4] Unacceptable seconds of delay per vehicle and LOS highlighted in **bold.**

Existing peak-hour volumes and lane configurations were used to calculate levels of service for each of the study intersections. The results of the existing LOS analysis are presented above in **Table 4** and the corresponding LOS calculation sheets are included in **Appendix B**.

The results of the LOS calculations indicate that all of the existing study intersections operate at an overall desirable service level (LOS D or better) during the weekday AM and PM peak hours, with the exception of the following location:

- Intersection 3: Pūlehu Road/Hansen Road (LOS F – AM peak hour)
  - The side-street stop-controlled intersection's worst approach (i.e. the northbound approach) is composed of a shared left/through/right lane with a calculated average control delay of nearly three minutes in the morning peak hour. Poor operating conditions for this approach are due to the limited gap opportunities in Hansen Road traffic for vehicles to turn onto or travel through from northbound Pūlehu Road.

3.6 TRAFFIC CONTROL EVALUATION

As mentioned in the previous section, side-street stop controlled Intersection 3: Pūlehu Road/Hansen Road is operating at LOS F in the AM peak hour with an average vehicle delay of almost three minutes at the worst movement. Both an all-way stop evaluation and a traffic signal warrant analysis were conducted to see if installation of a different traffic control at the intersection is either currently justified and/or will help relieve vehicular delay.

3.6.1 ALL-WAY STOP APPLICATION

The decision to install multi-way stop control, such as an all-way stop control (AWSC), should be based on an engineering study. The *Manual of Uniform Traffic Control Devices* (MUTCD) *2009 Edition* provides guidelines and criterion about when installation of an AWSC at an intersection is satisfied. Using existing volume data at Intersection 3: Pūlehu Road/Hansen Road, we evaluated the MUTCD's following minimum volume criterion:

1. The vehicle volume entering the intersection from the major street approaches averages at least 300 vehicles per hour for any eight hours of an average day; and
2. The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches averages at least 200 units per hour for the same eight hours.

Based on the volume assessment, the intersection does not warrant the application of an AWSC at this location because the volumes along Pūlehu Road and Hansen Road are too low to meet any single criterion described above.

3.6.2 SIGNAL WARRANT ANALYSIS

Traffic signal warrants were developed by the Federal Highway Administration (FHWA) and are described in the MUTCD. The MUTCD calls for the analysis of up to nine (9) sets of warrant criteria that take into account a combination of traffic conditions, pedestrian characteristics, and physical characteristics to determine if the installation of a traffic control signal is justified for a proposed location.

Under this transportation assessment, a total of four (4) traffic signal warrants were tested for the intersection of Pūlehu Road/Hansen Road. These included Warrant 1: Eight Hour Volume, Warrant 2: Four Hour Volume, Warrant 3: Peak Hour Volume, and Warrant 8: Roadway Network. The remaining five (5) warrants were not tested due to data that was not available (e.g., Warrant 7: Crash Experience) and/or not applicable (e.g., Warrant 5: School Crossing). Satisfying one or more of the nine (9) warrants could justify the installation of a signal at an intersection. Also the hourly traffic volume for Warrants 1 and 2 were developed using AM and PM peak period counts collected at this intersection and existing 48-hour roadway segment counts at Pulehu Road south of Hansen provided in **Appendix A**.

Based on the analysis, all four of the warrants (Warrants 1, 2, 3, 8) are currently satisfied and so this location already justifies the need for signal at this location prior to the construction of the proposed project. The detailed information for the signal warrant analysis is included in **Appendix C.** It is important to note that the recommended traffic signal should not be solely based on the satisfaction of warrants, and that the responsible agency (County of Maui) will make the final determination on the need for a signal at this location.

3.7 FIELD OBSERVATIONS

Field observations conducted in May 2016 showed that traffic moves fairly well throughout the study area during the AM and PM peak hours at three of the four study intersections. The notable exception occurs at Intersection 3 during the AM peak hour, where queues of three (3) to seven (7) vehicles were seen on the northbound Pūlehu Road approach as cars were observed to wait for several minutes before turning onto Hansen Road or continuing through along Pūlehu Road. It was also observed that heavy vehicles did not make northbound right turns at this location due to the tight radius. However, for other parts of the day no substantial delays were observed at Intersection 3: Pūlehu Road/Hansen Road. Overall, the calculated existing peak hour intersection LOS at the study intersections shown in **Table 4** were representative of field conditions.

Negligible pedestrian activity was observed at the study intersections and roadways. Cycling activity was also minimal in the study area; however, a few bicyclists were observed riding along Ho'okele Street and the cycle track adjacent to Mokulele Highway during the AM peak period. The minimal active transportation activity in the study area is also reflected in the bicycle and pedestrian counts collected at the intersections.

4.0 PROJECT TRAFFIC ESTIMATES

Development of future traffic projections related to the amount of traffic added to the roadway system by the proposed landfill facilities is estimated using a three-step process: (1) trip generation, (2) trip distribution, and (3) trip assignment. The first step estimates the amount of project-generated traffic that will be added to the roadway network. The second step identifies the direction of travel to and from the project site and the proportion of traffic on each potential travel path. The new trips are assigned to specific street segments and intersection turning movements during the third step. This process is described in more detail in the following sections.

4.1 TRIP GENERATION

A variety of trip generation data sources were considered in estimating the number of new trips generated by the proposed project uses. Trip generation estimates were broken down by each ancillary use that will comprise the project and were primarily derived using information provided from County of Maui DEM staff. As part of the proposed landfill facilities, several existing uses, such as base yard refuse operations and abandoned vehicle storage, will be consolidated at the project site. For these relocated uses, traffic was estimated based on their existing data and operations including the number of employees and/or the number of truck trips. For example, AM and PM peak period driveway counts were collected over the course of one typical weekday in May 2016 at the existing abandoned vehicle storage facility, and the peak hour driveway counts were used for the project's abandoned vehicle yard trip generation. National data sources, such as the Institute of Transportation Engineers' (ITE) trip generation rates, were not applied since none of the land uses presented in ITE's *Trip Generation* were applicable nor reflective of the unique combination of ancillary uses and rural location of the project. Overall, details of the project's trip generation assumptions and data source are described in **Appendix D**.

As shown in **Table 5**, the proposed project is expected to generate a total of 356 net new daily vehicle trips, including 50 trips during the AM peak hour (30 inbound/20 outbound) and 47 trips during the PM peak hour (11 inbound/36 outbound).

For traffic analysis purposes, the project's truck trips were converted into passenger-car-equivalents (PCEs) since these heavy vehicles have a larger impact on traffic variables like speed, headway, and density compared to a private automobile. The *HCM 2010* provides PCE factors for trucks and buses as follows: Level Terrain – 1.5; Rolling Terrain – 2.5; and Mountainous Terrain – 4.5. The terrain within the study area is predominately level, but there are some grade changes along the Hansen Road and Pūlehu Road in the vicinity of the Central Maui Landfill. Therefore, for conservative purposes, a PCE factor of 2.0 was applied to the project's estimated peak hour truck trips. With the application of the PCE factor to truck trips, the proposed project is expected to generate a total of 520 net new daily PCE trips, including 73 PCE trips during the AM peak hour (40 inbound/33 outbound) and 71 PCE trips during the PM peak hour (21 inbound/50 outbound). These trip values were used for calculating intersection level of service.

TABLE 5: AM & PM PEAK HOUR TRIP GENERATION FOR THE CENTRAL MAUI LANDFILL FACILITIES PROJECT

New Traffic Generating Uses	Daily	AM Peak Hour									PM Peak Hour								
		Autos			Trucks			Auto & Trucks			Autos			Trucks			Auto & Trucks		
		In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
Abandoned Vehicle Yard																			
Customers	130	4	7	11	1	2	3	***5***	***9***	***14***	1	6	7	2	4	6	***3***	***10***	***13***
Employees	6	3	0	3	0	0	0	***3***	***0***	***3***	0	3	3	0	0	0	***0***	***3***	***3***
Consolidation of Base Yard Refuse Operations																			
Refuse Truck Drivers	90	0	0	0	0	0	0	***0***	***0***	***0***	0	0	0	0	0	0	***0***	***0***	***0***
New Refuse Truck Trips	48	0	0	0	0	0	0	***0***	***0***	***0***	0	0	0	0	0	0	***0***	***0***	***0***
Construction & Demolition Materials Recovery Facility																			
Customers	50	0	0	0	8	8	16	***8***	***8***	***16***	0	0	0	8	8	16	***8***	***8***	***16***
Employees	6	3	0	3	0	0	0	***3***	***0***	***3***	0	3	3	0	0	0	***0***	***3***	***3***
Metals Processing Facility[1]																			
Processed Metal Truck Drivers	4	0	0	0	0	2	2	***0***	***2***	***2***	0	0	0	0	2	2	***0***	***2***	***2***
White Goods Truck Drivers	2	0	0	0	1	1	2	***1***	***1***	***2***	0	0	0	0	0	0	***0***	***0***	***0***
Employees	6	3	0	3	0	0	0	***3***	***0***	***3***	0	3	3	0	0	0	***0***	***3***	***3***

TABLE 5: AM & PM PEAK HOUR TRIP GENERATION FOR THE CENTRAL MAUI LANDFILL FACILITIES PROJECT

New Traffic Generating Uses	Daily	AM Peak Hour									PM Peak Hour								
		Autos			Trucks			Auto & Trucks			Autos			Trucks			Auto & Trucks		
		In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
Other Ancillary Uses[2]																			
Administrative Office Staff	4	2	0	2	0	0	0	***2***	***0***	***2***	0	2	2	0	0	0	***0***	***2***	***2***
Refuse Office Staff	6	3	0	3	0	0	0	***3***	***0***	***3***	0	3	3	0	0	0	***0***	***3***	***3***
Maintenance Facility Mechanics	4	2	0	2	0	0	0	***2***	***0***	***2***	0	2	2	0	0	0	***0***	***2***	***2***
Total Net New Traffic	**356**	**20**	**7**	**27**	**10**	**13**	**23**	***30***	***20***	***50***	**1**	**22**	**23**	**10**	**14**	**24**	***11***	***36***	***47***

Source: Fehr & Peers, June 2016

Notes:

[1] Per discussion with County of Maui staff, truck traffic related to the metals processing facility does not occur daily; however, some truck traffic have been included in the trip generation estimate to provide a conservative analysis. For example, vehicles that are not sold at the abandoned vehicle yard's auction are sent to the metals process facility (an internal trip). Once the vehicles are processed they would leave the landfill on a truck, but similar to the auction, this processing and outbound trip would occur every two months. Depending on the volume of unsold cars this outgoing truck trip might be ongoing for a month or so, and so we have conservatively assumed in the project's trip generation that there would be a total of four (4) outgoing trucks leaving the metals processing facility a day and that half of these trucks would leave in the AM peak hour and the other half in the PM peak hour. Another conservative assumption included in the trip generation, is the inclusion of white goods refuse traffic in the AM peak hour despite it occurring only once a week.

[2] Traffic related to electronic waste and household hazardous waste activities do not occur every weekday day. Due to the infrequencies/irregular occurrence of these activities, they were excluded from the trip generation.

4.2 TRIP DISTRIBUTION & ASSIGNMENT

The geographic distribution of trips generated by the proposed project is dependent on characteristics of the street system serving the project site; the level of accessibility of routes to and from the project site; and residential areas from which local customers and employees would be drawn.

The project's trip distribution pattern was primarily developed by assessing Maui's population density data provided by the 2010 U.S. Census Bureau and presented in the *Maui County Data Book 2011*. This directional distribution was further refined and adjusted based on a review of the following information: distribution of the existing traffic counts, the residences of current refuse truck drivers, complementary land uses (i.e. the residences of Central Maui Landfill customers and employees), and access to local arterial streets and the regional transportation system.

The resulting overall trip distribution pattern estimates for the project-generated traffic are as follows:

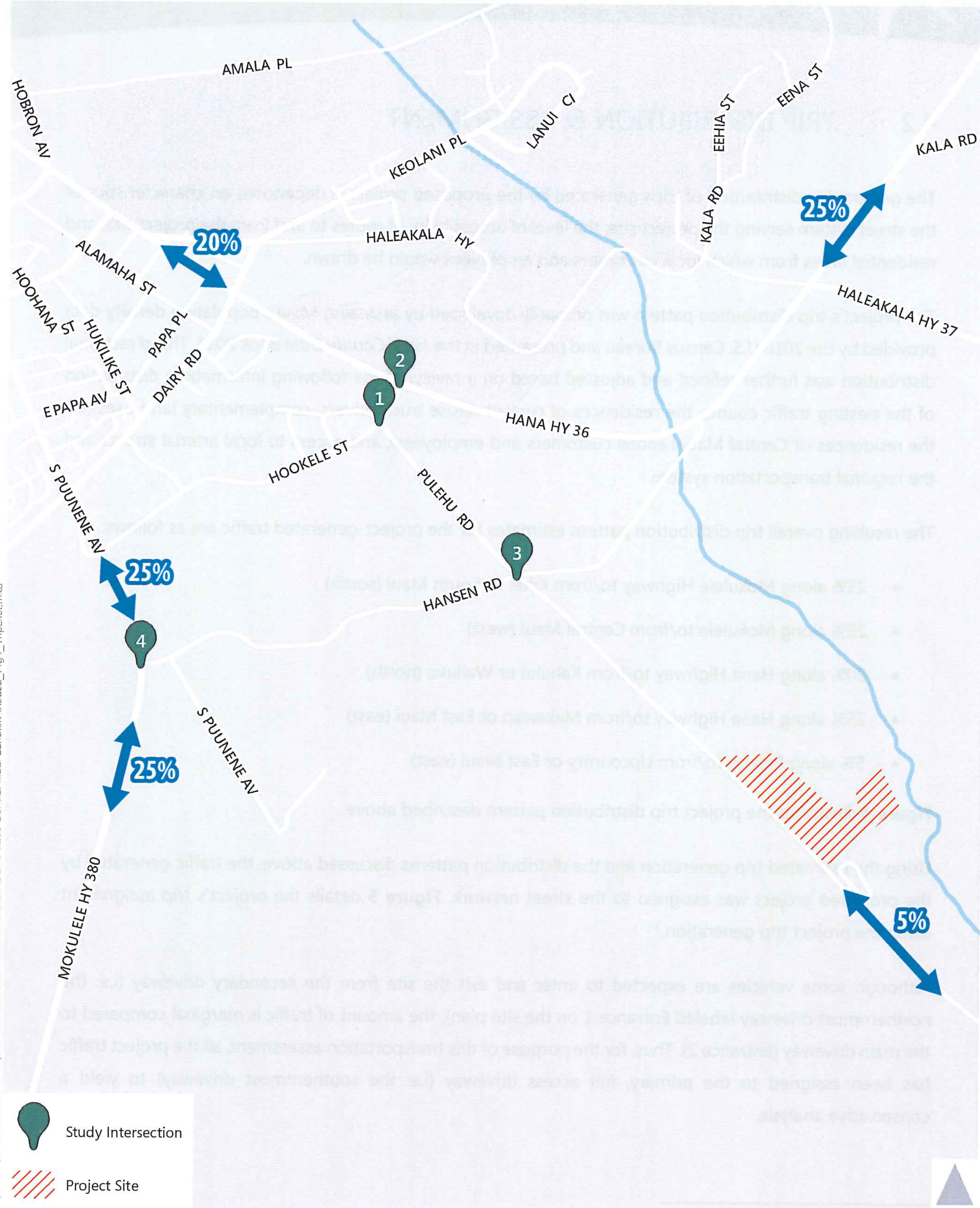
- 25% along Mokulele Highway to/from Kihei or South Maui (south)
- 25% along Mokulele to/from Central Maui (west)
- 20% along Hana Highway to/from Kahului or Wailuku (north)
- 25% along Hana Highway to/from Makawao or East Maui (east)
- 5% along Pulehu to/from Upcountry or East Maui (east)

Figure 4 illustrates the project trip distribution pattern described above.

Using the estimated trip generation and the distribution patterns discussed above, the traffic generated by the proposed project was assigned to the street network. **Figure 5** details the project's trip assignment using the project trip generation.[1]

Although some vehicles are expected to enter and exit the site from the secondary driveway (i.e. the northernmost driveway labeled Entrance 1 on the site plan), the amount of traffic is marginal compared to the main driveway (Entrance 2). Thus, for the purpose of this transportation assessment, all the project traffic has been assigned to the primary, full access driveway (i.e. the southernmost driveway) to yield a conservative analysis.

[1] It should be noted that the project trip assignment depicted in Figure 5 is based on the trip generation presented in Table 5 and does not account for PCE conversion of the truck trips.



\\fpse03\fpse2\Data2\2016Projects\OtherOfficeCollaborations\SD\SD16-0205 Central Maui Landfill\AI\base_Fig4_TripDist.mxd

Figure 4

Project Trip Distribution

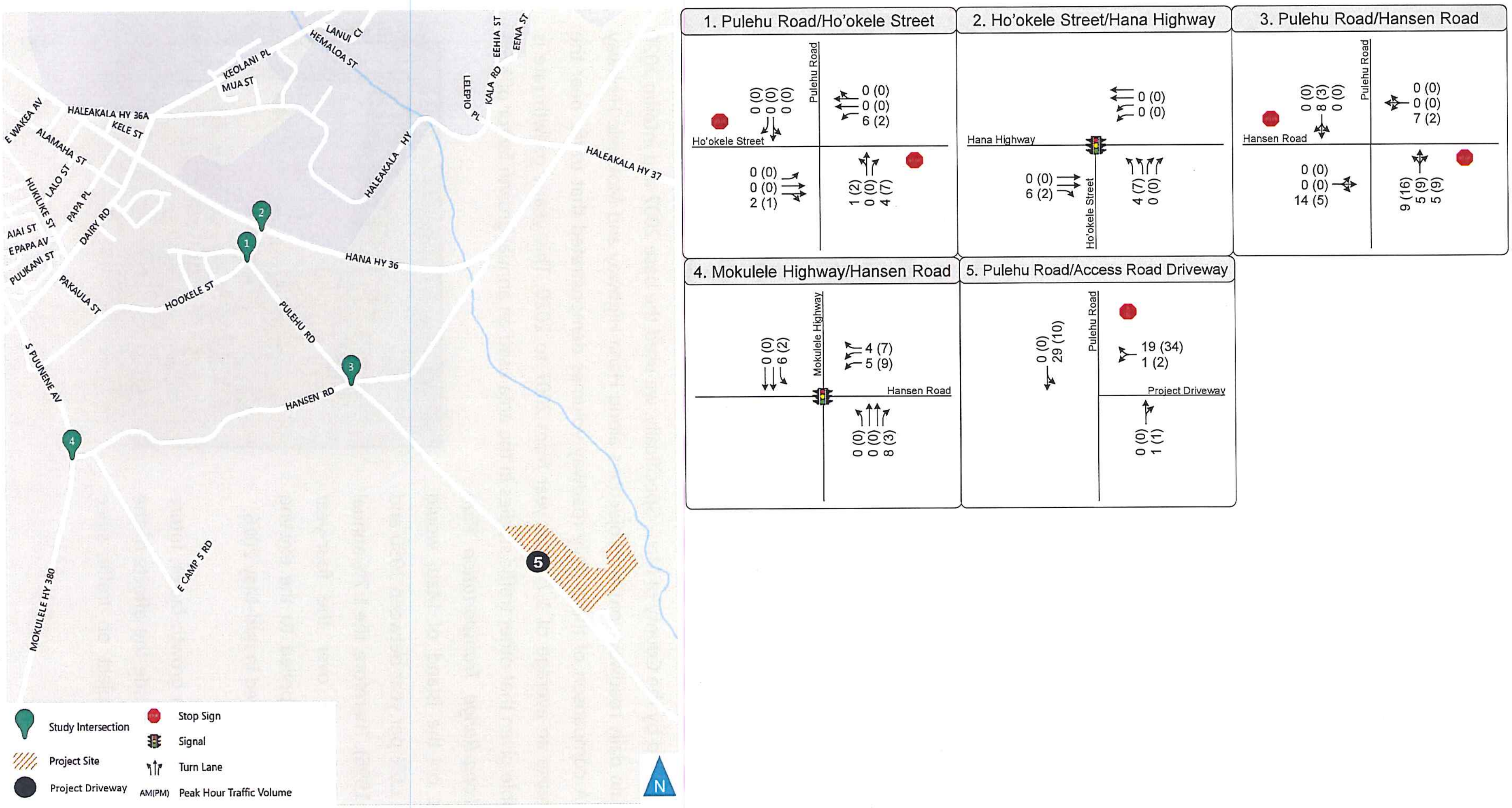


Figure 5
Project Trip Assignment

5.0 FUTURE CONDITIONS

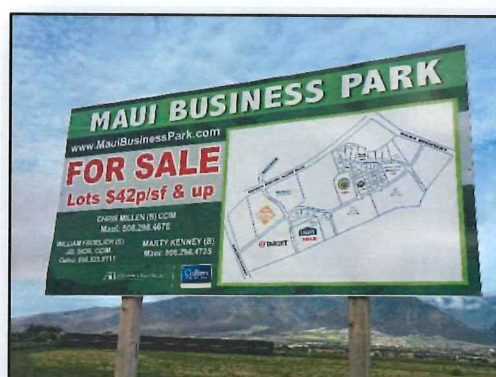
This chapter summarizes the methodology used to forecast the study area's traffic volumes under the project's 2020 opening year, as well as presents the results of the operations analysis under Future Conditions with and without the proposed project.

5.1 TRAFFIC PROJECTIONS

5.1.1 FUTURE (2020) NO PROJECT TRAFFIC VOLUMES

To evaluate the potential impact of traffic generated by the project on the surrounding street system, it was necessary to first develop estimates of future traffic conditions in the area without the project. Future traffic conditions without the project reflect traffic increases due to regional growth and development, as well as traffic increases generated by other specific developments near the project site. These conditions are referred to as the "no project" condition used as a baseline to identify impacts on the roadway system.

A growth factor was applied to the existing traffic to account for future growth along the major highways in the study area. This factor was derived using the Maui Travel Demand Forecasting Model (TDFM), which assigns traffic across the roadway network for the base and horizon years generated by land use and socioeconomic data provided by the County of Maui. Specifically, we used the base 2007 and interim 2020 No Build model to obtain daily roadway volume projections along Hana Highway and Mokulele Highway within the study area. A comparison of these daily roadway volumes demonstrated that traffic near the project site would increase an average of 1.7% per year from 2007 to 2020. This yearly growth rate is consistent and reasonable given that other traffic studies in the area used an annual growth factor of 1.6% based on the *Maui Long-Range Transportation Plan* concluding that traffic on the island of Maui would increase an average of 1.6% per year between 1990 and 2020 (Kaku Associates, 1996). Therefore, the 1.7% annual growth rate was compounded over the four-year timeframe (2016 to 2020) and applied to the existing intersection traffic volumes collected in mid-May 2016.



In addition to the application of a growth factor, future base traffic forecasts need to include the effects of the Maui Business Park Phase II project on traffic since portions or possibly all of this industrial park project is expected to be constructed within the Central Maui Landfill Facilities Project's four-year development timeframe and is expected to add traffic in the vicinity of the project site. Using the *Traffic Impact Assessment Report for the Maui Business Park Phase II and Hookele Street Extension* (Phillip Rowell and Associates, 2004) as a reference, trip assumptions for this cumulative project were made and then manually distributed and assigned to the network. Overall, the resulting volumes were also then rounded to the nearest ten (10). **Figure 6** illustrates the Future (2020) No Project AM and PM peak-hour turning movement volumes, corresponding lane configurations, and traffic control devices.

5.1.2 FUTURE (2020) PLUS PROJECT TRAFFIC VOLUMES

Per consultation with the County of Maui staff, refuse truck and public/visitor traffic to the existing Central Maui Landfill Refuse & Recycling Center is not expected to substantially change between now and 2020 and would most likely remain the same even with the project expansion in place. It should also be noted that no existing Central Maui Landfill employees are expected to relocate to the project's new ancillary uses. Therefore, net new trips generated from the proposed project **(Figure 5)** were added to the Future (2020) No Project traffic projections (**Figure 6**) to develop traffic volumes for Future (2020) plus Project Conditions. The resulting volumes are shown on **Figure 7**.[2]

5.2 STREET SYSTEM IMPROVEMENTS

County of Maui staff has confirmed that no roadway infrastructure improvements are planned or approved in the study area within the 2020 timeframe; therefore, the existing roadway network and intersection configuration and control at the study intersections were assumed for Future (2020) Conditions.

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[2] It should be noted that the intersection turning movement volumes depicted in Figure 7 do not match the Future (2020) plus Project analysis volumes presented in the Synchro outputs provided in Appendix B. The differences in volumes are due to the application of PCE factors to the truck trips for intersection analysis purposes.

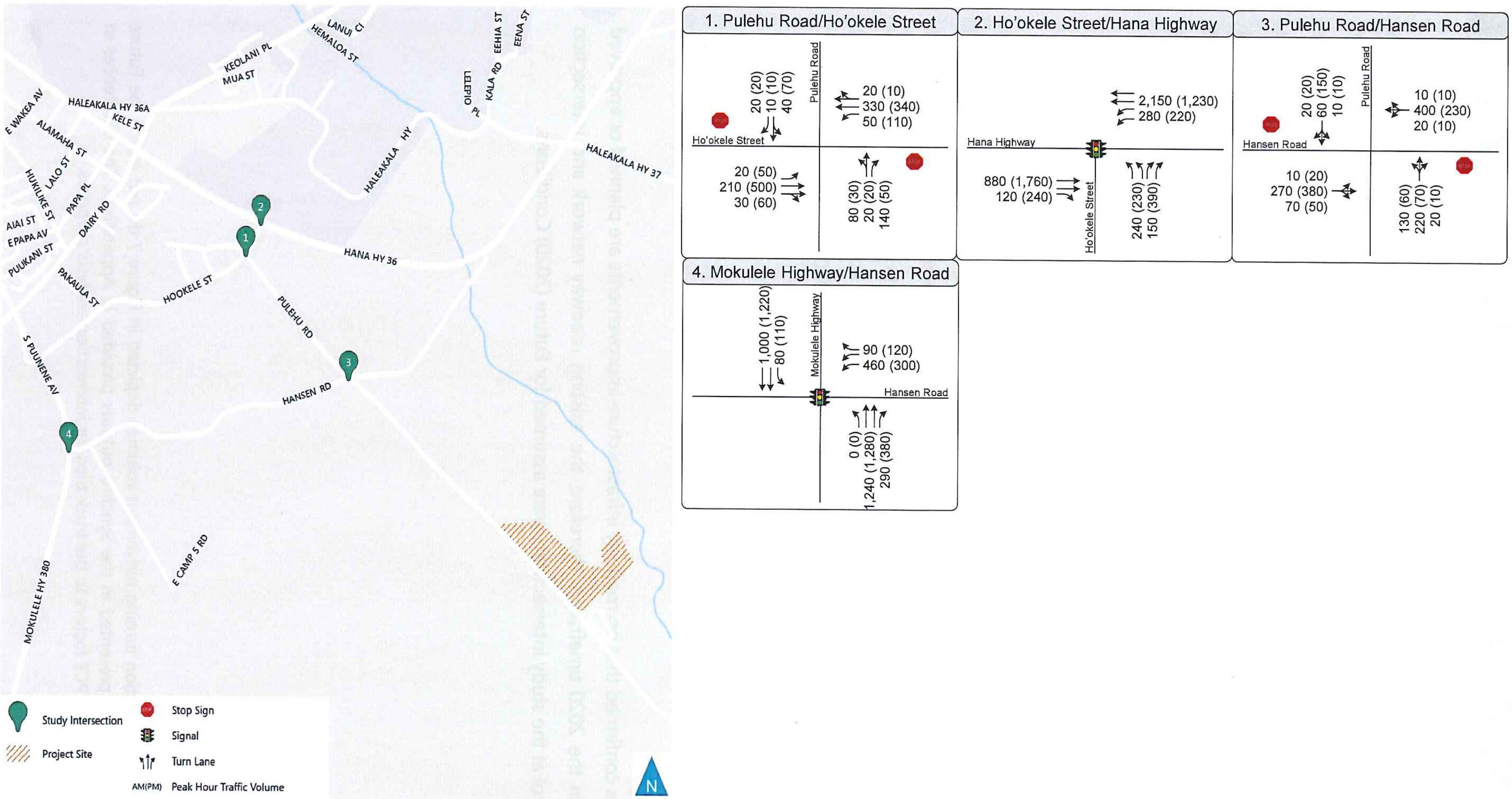

Figure 6
Peak Hour Traffic Volumes and Lane Configurations
Future (2020) No Project Conditions

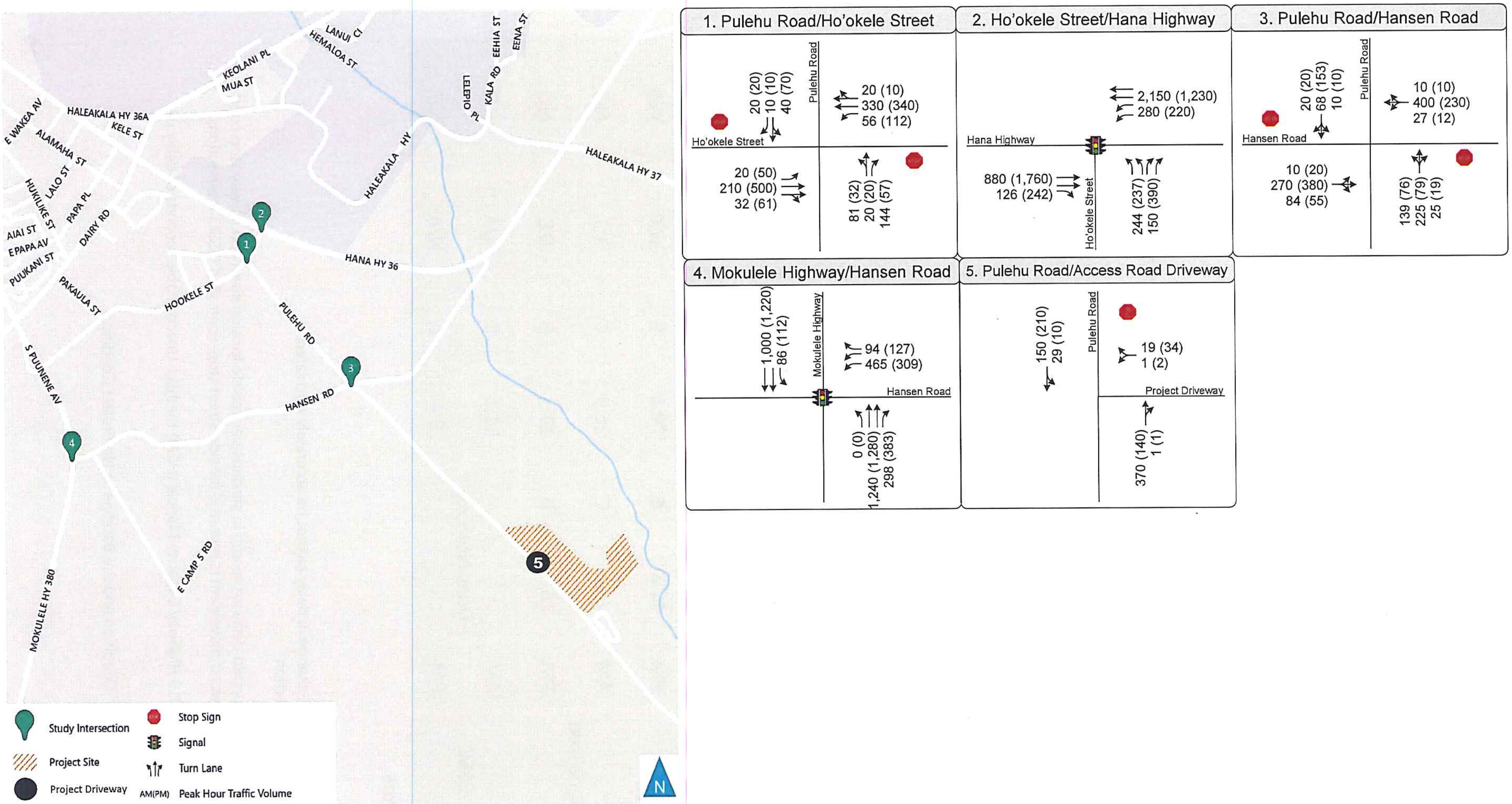

Figure 7
Peak Hour Traffic Volumes and Lane Configuration
Future (2020) plus Project Conditions

5.3 FUTURE INTERSECTION ANALYSIS

Table 6 presents the delay and level of service calculation results for the study intersections under Future (2020) No Project and Future (2020) plus Project Conditions. **Appendix B** contains the corresponding calculation sheets.

TABLE 6: FUTURE (2020) LEVEL OF SERVICE WITH AND WITHOUT THE PROJECT

Intersection	Traffic Control	Peak Hour	2020 No Project Conditions		2020 Plus Project Conditions		Delay Change[3]	Impacted Peak Hour?
			Del/Veh[1]	LOS[2]	Del/Veh[1]	LOS[2]		
1. Pūlehu Road/ Ho'okele Street	SSSC	AM	22.6	C	23.7	C	1.1	NO
		PM	**52.0**	**F**	**55.6**	**F**	3.6	**YES**
2. Ho'okele Street/ Hana Highway	Signalized	AM	15.3	B	15.6	B	0.3	NO
		PM	22.4	C	22.5	C	0.1	NO
3. Pūlehu Road/ Hansen Road	SSSC	AM	**>180**	**F**	**>180**	**F**	**	**YES**
		PM	**42.8**	**E**	**79.8**	**F**	37.0	**YES**
4. Mokulele Highway/ Hansen Road	Signalized	AM	25.6	C	26.9	C	1.3	NO
		PM	16.5	B	17.3	B	0.8	NO
5. Pūlehu Road/ Access Road (South Project Driveway)	SSSC	AM	Does Not Exist		11.1	B	N/A	NO
		PM			9.4	A	N/A	NO

Source: Fehr & Peers, June 2016

Notes:

** Indicates oversaturated conditions. The change in delay cannot be accurately calculated.
SSSC = Side-street stop controlled intersection

[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized and all-way stop control intersections. The vehicular delay for the worst movement is reported for side street stop-controlled (SSSC) intersections.

[2] LOS calculations performed using the 2010 Highway Capacity Manual (HCM) method. Unacceptable seconds of delay per vehicle and LOS highlighted in **bold.**

[3] Delay change between the "Plus Project" Condition and the Baseline or No Project Condition.

The results of the LOS calculations indicate that all the future study intersections operate at an overall desirable service level (LOS D or better) during the AM and PM peak hours under Future (2020) No Project and Future (2020) plus Project Conditions, with the exception of the following locations:

- Intersection 1: Pūlehu Road/Ho'okele Street (LOS F – PM peak hour)
- Intersection 3: Pūlehu Road/Hansen Road (LOS F – AM and PM peak hour)

The poor operating conditions projected to occur at the unsignalized study intersections, where the vehicular delay for the worst movement is reported. This delay is primarily due to the limited number of gaps for vehicles on the northbound Pūlehu Road stop-controlled approaches to make turns onto or cross the uncontrolled main roadways that they intersect (i.e. Ho'okele Street and Hansen Road). Also as shown in **Table 6**, the proposed project would contribute to cumulative impacts (exacerbating baseline LOS E or LOS F operations) at these two side-street stop-controlled intersections.

Although the remaining three study intersections are expected to continue operating at a desirable LOS (LOS D or better) at an overall intersection level during both peak hours in 2020 with and without the project in place, it should also be noted that it is possible that individual turning movements/approaches may operate below LOS D (the HDOT desired minimum operating level). The identified movement deficiencies at each location are summarized in **Table 7**.

TABLE 7: FUTURE (2020) SUMMARY OF TURNING MOVEMENTS OPERATING AT LOS E OR F

Intersection	Baseline Conditions		Plus Project	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
1. Pūlehu Road/ Ho'okele Street	Acceptable	NB L/T – LOS E SB L/T – LOS F	Acceptable	NB L/T – LOS E SB L/T – LOS F
2. Ho'okele Street/ Hana Highway	Acceptable	WBL – LOS E	Acceptable	WBL – LOS E
3. Pūlehu Road/ Hansen Road	NB LTR – LOS F SB LTR – LOS E	NB LTR – LOS E	NB LTR – LOS F SB LTR – LOS F	NB LTR – LOS F

TABLE 7: FUTURE (2020) SUMMARY OF TURNING MOVEMENTS OPERATING AT LOS E OR F

Intersection	Baseline Conditions		Plus Project	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
4. Mokulele Highway/ Hansen Road	WBL – LOS F SBL – LOS E	WBL – LOS E SBL – LOS E	WBL – LOS F SBL – LOS E	WBL – LOS E SBL – LOS E
5. Pūlehu Road/Access Road (South Project Driveway)	Does Not Exist		Acceptable	Acceptable

Source: Fehr & Peers, June 2016.

Notes:

Acceptable = Intersection and movements operate acceptably (LOS D or better).

NB = Northbound, EB = Eastbound, SB = Southbound, WB = Westbound

L = Left-Turn, R = Right-Turn, T = Through, LTR = Shared Left/Through/Right Lane, L/T = Shared Left/Through Lane

6.0 POTENTIAL TRAFFIC IMPROVEMENTS

Potential traffic improvements were developed to increase the capacity and/or efficiency of the roadway system at the locations where the addition of project-related traffic would cause or contribute to poor operating conditions. The emphasis was to identify physical and/or operational improvements that could be implemented within the existing or planned roadway rights-of-way.

The potential measures to address the identified traffic impacts are described later in this chapter. Each of the initially identified impacts would be reduced such that future operations would be at the minimum desired LOS (LOS D) for the overall intersection with the project in place. Although Maui County and HDOT strive to maintain LOS D or better conditions at the movement level, measures to improve turning movement operations are only proposed where feasible and appropriate from a traffic engineering perspective since adding lanes or signal control just to achieve the desired LOS for a particular movement can also has secondary negative impacts to the environment and to active transportation modes.

The scope of corresponding improvements for this type of mitigation process can be well beyond the project's actual impact, and could effectively eliminate existing or cumulative deficiencies, which should not be the project's responsibility consistent with State of Hawaii law. Therefore, measures that only return operations to pre-project levels have initially been identified followed by improvements that will result in LOS D or better overall operations. This is especially important where the addition of project traffic alone would not degrade operations below LOS D, but would contribute to projected poor levels of service caused by the addition of traffic from other cumulative developments (e.g., Maui Business Park II, other Pu'unēnē area uses, etc.). The potential improvements are listed in **Table 8**, which also summarizes the projected LOS in 2020 at the impacted locations with these proposed measures in place.

TABLE 8: FUTURE (2020) INTERSECTION LEVEL OF SERVICE RESULTS WITH MITIGATION

Scenario	Potential Improvement	AM Peak Hour Delay	AM Peak Hour LOS	PM Peak Hour Delay	PM Peak Hour LOS	Project Responsibility
1. Pūlehu Road/Ho'okele Street						
2020 No Project Conditions		22.6	C	**52.0**[5]	**F**	0%
Mitigated to Pre-Project or Better Conditions	Re-stripe NB and SB approaches w/ left-turn and shared through/right lane	23.3[1]	C[1]	**49.5**[5]	**E**	100%[3]
Mitigated to LOS D or Better Conditions	New traffic signal	16.4	B	11.0	B	1%[4] (Only when signal is warranted[2])
3. Pūlehu Road/Hansen Road						
2020 No Project Conditions		**>180**[6]	**F**	**42.8**[6]	**E**	0%
Mitigated to Pre-Project or Better Conditions	All-Way Stop Control	**60.4**	**F**	20.6	C	100%[3] (Only when MUTCD criteria is satisfied)
Mitigated to LOS D or Better Conditions	New traffic signal	10.1	B	7.1	A	4%[4] (Only when signal is warranted[2])

Source: Fehr & Peers, June 2016.

[1]Although the mitigation does not bring the delay of the worst movement back to pre-project conditions or better, it is was not identified as impacted in the AM peak hour under Future (2020) Conditions since it is projected to operate better than LOS D.

[2]It is recommended that the need for a traffic signal at these impacted locations be monitored as overall development and roadway extensions proceed in the greater study area and that signal installation be dependent on future traffic engineering studies and full warrant analysis.

[3] Since the costs for re-striping or installation of stop signs are relatively inexpensive we are assuming that the project can cover the costs of these improvements.

[4] Signal installation costs substantially more and so the project can make a fair share contribution to help fund the improvement's implementation based on the percentage of project vehicle trips that make up the total traffic at the intersection.

[5] Southbound shared left/through lane projected to operate with a delay of 52 seconds and movement LOS F during the PM peak hour under 2020 No Project Conditions. When pre-project mitigation is applied, this movement is projected to operate at a delay of 49.5 seconds and movement LOS E.

[6] Northbound shared left/through/right lane projected to operate with a delay of greater than 180 seconds and movement LOS F during the AM peak hour and a delay of 42.5 seconds and movement LOS E during the PM peak hour under 2020 No Project Conditions.

6.1 INTERSECTION 1: PŪLEHU ROAD/HO'OKELE STREET

At Intersection 1: Pūlehu Road/Ho'okele Street both the northbound and southbound through/left-turn movements are operating at LOS E or F in the PM peak hour under Future (2020) Conditions. The movement with the worst operations (i.e. the southbound through/left-turn) is reported in **Table 7** and **Table 8**.

The pre-project improvement would be to re-stripe the northbound and southbound approaches on Pūlehu Road from a shared left-turn/through lane and a separate right-turn lane, to a separate left-turn lane and a shared through/right-turn lane. Although these measures would mitigate the Future (2020) cumulative impact and reduce the vehicle delay to conditions better than the 2020 No Project Conditions, the southbound left-turn would still operate at LOS E. Installation of a traffic signal would be needed to improve PM peak hour operations of this movement to LOS D or better. As shown in **Table 8**, signal control at this intersection would improve peak hour operating conditions to a LOS B and should only be implemented when the warranted.

Overall, the project-generated traffic volume is estimated to represent only 1% of the total traffic at this location in 2020. Therefore, cumulative volumes generated by other developments along Ho'okele Street, such as the Maui Business Park, are projected to be the primary contributor to degrading intersection operations more so than the proposed Central Maui Landfill facilities. Other studies have assumed that this location will eventually be designed to State and/or County standards to provide an acceptable LOS based on the estimated traffic projections, which would include implementation of a signal. Per consultation with County staff, no plans are in place to construct a signal at this location; however, signalization at this location will most likely be a result of recurring signal warrant studies as parcels within the Maui Business Park are developed or as the County updates its own intersection studies.

6.2 INTERSECTION 3: PŪLEHU ROAD/HANSEN ROAD

Under Future (2020) plus Project conditions at Intersection 3: Pūlehu Road/Hansen Road, both the northbound and southbound single lane approaches are operating at LOS F in the AM peak hour, while in the PM peak hour only the northbound shared left/through/right lane is operating at a deficient LOS E. Per the *Traffic Impact Assessment Report for MEO Transportation Center* (Phillip Rowell and Associates, 2008), a separate northbound left turn lane was recommended as mitigation as part of the Pu'unēnē Baseyard project; however, the reconfiguration of the northbound approach on Pūlehu Road from a shared left/through/right lane to a left-turn lane and a shared through/right-turn lane would not bring the delay at this intersection back to pre-project conditions. Similarly, reconfiguration of both the northbound and southbound approach on Pūlehu Road from a shared left/through/right lane to a left-turn lane and a shared through/right-turn lane would only mitigate the AM peak hour delay to pre-project conditions. In order to bring the intersection operations back to pre-project conditions or better under both peak hours, the traffic control at this intersection would need to be converted into an AWSC. However, the change in traffic control only partially mitigates the impact since the AM peak hour would still operate at LOS F. It should be noted that due to the change in stop control, all approaches would experience an average delay of 60 seconds with the AWSC, whereas if the intersection were to remain a TWSC only the worst approach/movement would operate at LOS F with a vehicle delay of greater than 180 seconds. Still, the AWSC mitigation could be an interim measure that can be installed quickly to improve the average amount of time a vehicle is stopped during the peak hours, while arrangements are being made for implementation of the full mitigation at this location (i.e. traffic signal). Also installation of an AWSC should only occur if it is justified per MUTCD criteria for multi-way stop application and after an in-depth engineering study.

Installation of a traffic signal is needed in order to improve both the AM and PM operating conditions to LOS D or better conditions. As shown in **Table 8**, signal control at this intersection would improve peak hour operating conditions to a LOS B or better and should only be implemented when warranted.

Overall, the added volume from the project makes up only 4% of the total traffic at Intersection 2: Pūlehu Road/Hansen Road Street in 2020. Thus, cumulative volumes generated by other developments and regional growth are projected to have a larger contribution in degrading the operations of this intersection than the proposed Central Maui Landfill facilities. It is recommended that the need for a traffic signal at this location be monitored as overall development proceeds in the greater study area and that signal installation be dependent on future traffic engineering studies and full warrant analysis. The project's financial responsibility should be commensurate with its traffic contribution.

7.0 ASSESSMENT OF SITE ACCESS & ON-SITE CIRCULATION

This chapter describes the evaluation proposed site access and on-site circulation within the proposed project.

7.1 SITE ACCESS & DRIVEWAY ASSESSMENT

Two driveways on the north side of Pūlehu Road will provide access to the project and into a network of interior roadways providing access to the ancillary uses. The northernmost driveway (Entrance 1 on the site plan) will initially be configured as a right-in/right-out driveway, with the option to be converted into a full access driveway in the future if needed. It is recommended that in lieu of this driveway providing full access, proper advance signage and a raised median island be installed at the driveway to physically restrict left turns in and out of the site. The southernmost driveway (Entrance 2), which intersects with the site's Access Road, would provide full access and is expected to be signed and operated as the main site driveway.

For conservative analysis purposes, this transportation assessment assigned all the project traffic to the primary driveway on Pūlehu Road and Access Road to evaluate traffic operations. The intersection analysis results under Future (2020) conditions demonstrates that this full access driveway would operate at LOS B or better during both the AM and PM peak hours even with all the project traffic assigned to it. Therefore, the driveway may operate at better levels since some project generated traffic is expected to enter and exit the site via the secondary project driveway to the north.

It is recommended that any signage and/or landscaping should not obstruct a driver's view on on-coming traffic on Pūlehu Road. With a posted speed of 45 mph and an assumed design speed of 50 mph, the minimum stopping sight distance of 425 feet should be provided per AASHTO's sight distance guidelines at each of the driveways. Based on a preliminary field assessment and the current site plan, approximately 500 feet of stopping sight distance is provided at Entrance 1 and more than 500 feet of stopping sight distance is provided at Entrance 2. Prior to the installation of any signage or new or modified landscaping as part of site development, available sight distance should be verified to ensure that these minimum distances are maintained.

7.2 ON-SITE CIRCULATION

The network of interior roadways provide access to the project's various ancillary buildings (e.g. the office building, the base yard, and the metals processing facility). On the southern perimeter of the project site, two internal roadways provide access to the existing Central Maui Landfill. The interior roadway aisles accommodate for two-way traffic and provide 90-degree parking spaces. All of the on-site roadways should include traveled ways of 24 feet in width to accommodate two-way traffic and larger vehicles. It should be noted that the expanded Central Maui Landfill is expected to periodically but infrequently host larger events on-site (e.g.. the household hazardous waste collection event held quarterly and car auctions at the abandoned vehicle yard held every two months). Accordingly the proposed parking supply would help accommodate the influx of patrons related to these events. Overall, the on-site vehicular circulation is generally considered to be acceptable, and no modifications are recommended.