

UPPER GREEN RIVER OZONE INVESTIGATION
(O3i)

LUMAN AND PARADISE ROAD TRAFFIC COUNT STUDY

03/05/2009 AND 06/09/2009

Study Summary

Prepared for

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1.0 INTRODUCTION

The University of Wyoming's (UW) Upper Green River Ozone Investigation (O3i) study was initiated October 2009. This vehicle counting exercise was conducted through a contract with the Wyoming Department of Environmental Quality, Air Quality Division (WDEQ-AQD). This report describes vehicle counts conducted at the Luman Road and Paradise Road vehicle count sites during March and July 2009, respectively.

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1.1 Background

The WDEQ-AQD contracted with the UW Atmospheric Science Department (ATSC) to conduct a pilot-scale vehicle count at several locations in Sublette County, Wyoming. Vehicle counts were conducted at two sites; Luman Road and Paradise Road. At Luman Road counting was performed on March 5th, 2009 using a motion activated remote camera to capture traffic activity. This site is a primary access to the Jonah Field oil and gas development. At Paradise Road counting was performed on June 9th, 2009 using manual methods aided by a digital camera to capture traffic activity. This site is a primary access to the Pinedale Anticline oil and gas development.

1.2 Location and Vicinity Maps

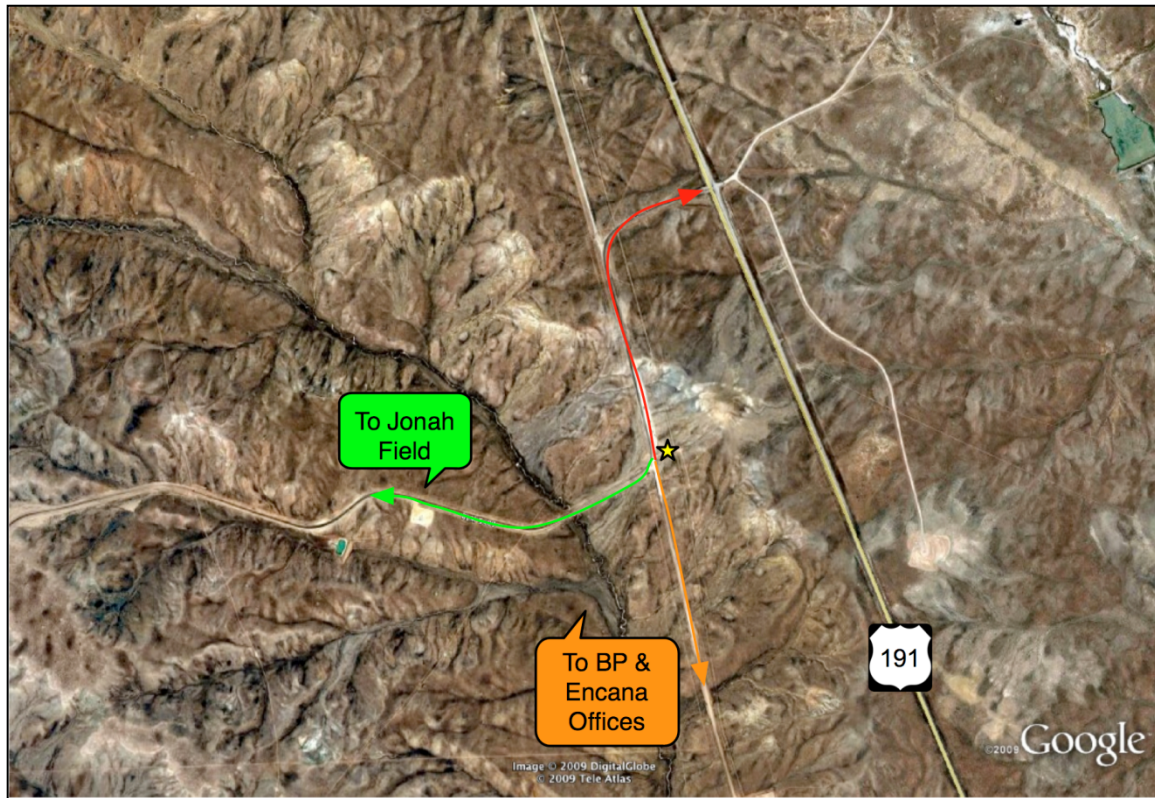
The following figures represent the geographic location of vehicle count sites. Figure 1-1 provides an overview of the entire study area. Figures 1-2 and 1-3 provide a closer look at the observation sites as well as notations regarding potential traffic destinations.

Figure 1-1. Map showing overview of the study area.



Vehicle monitoring at Paradise road was performed in conjunction with mobile air quality measurements that were performed at O3i monitoring site Olson Ranch. Vehicle monitoring at Luman road was performed in conjunction with mobile air quality measurements that were performed at O3i monitoring site Luman Road. Both sites were selected as while close to US highways the traffic flow in both cases is related almost entirely to oil and gas development operations. Both roads are predominately unpaved with short lengths of tarmac close to the junction with the connecting US highways.

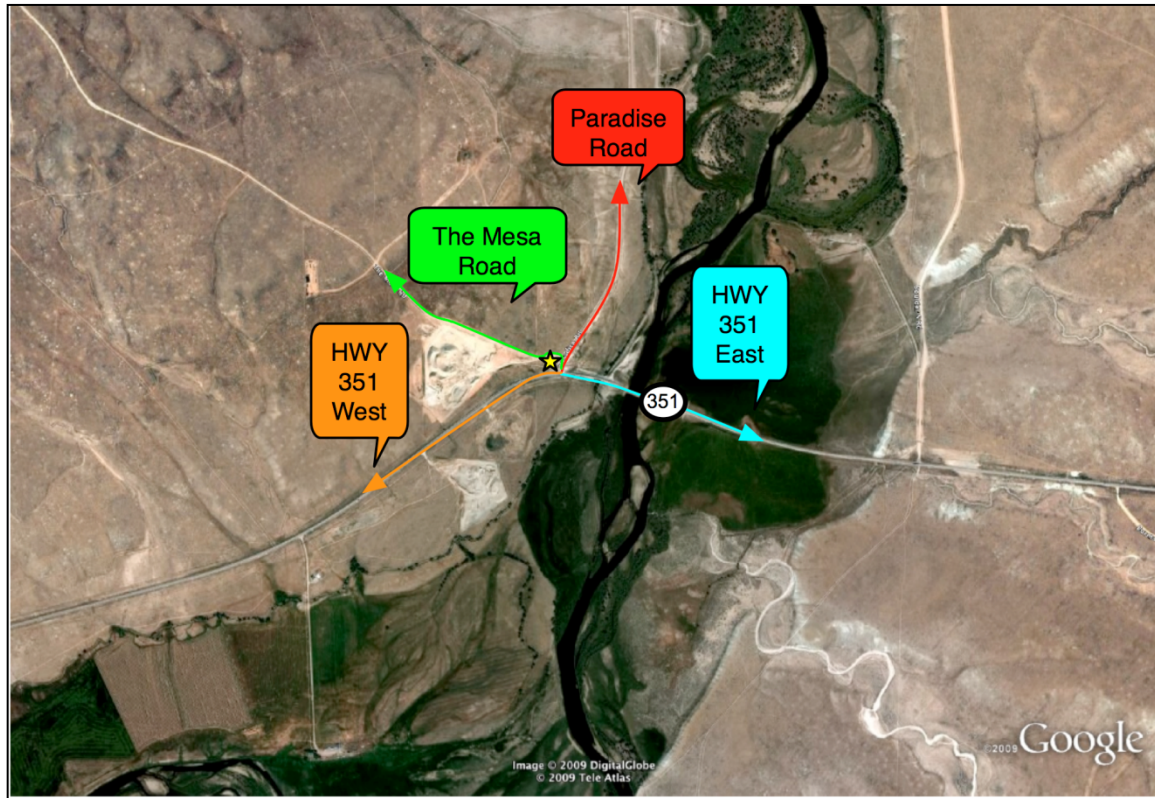
Figure 1-2. Map showing location and traffic flows at the Luman Road observation site.



The Luman Road site is located adjacent to Highway 191 South of Pinedale. As seen in the map in Figure 1-2, Luman Road is a main access route for vehicles visiting Jonah Field operations. This is also the main point of access to BP and EnCana field offices for their Jonah Field operations.

Vehicle monitoring at Luman Road was performed at the location indicated by a star. While some traffic was associated with vehicles travelling to and from BP and EnCana offices most traffic at this location is associated with transits into and from the Jonah Field.

Figure 1-3. Map showing location and traffic flows at the Paradise Road observation site.



The Paradise Road site is located adjacent to Highway 351 East of Big Piney. As seen in the map in Figure 1-3, Paradise Road is a main access route for vehicles visiting Pinedale Anticline operations. This is also the main point of access to the Gobbler's Knob compression facility and the newly installed liquids gathering facility.

Vehicle monitoring at Paradise Road was performed at the location indicated by a star. Traffic was associated with vehicles travelling to and from locations served by both Mesa Road and Paradise Road. Most traffic at this location is associated with transits into and from the PAPA.

2.0 METHODOLOGY

Continuous remote monitoring at Luman Road was conducted with a motion-activated webcam. This method provided images for the duration of the operational period (27 February to 01 April 2009). Monitoring at Paradise Road was conducted for one hour on 09 June 2009 with a manually operated digital camera.

Traffic counts are provided for eight hours of activity at the Luman Road site, and one hour of activity at the Paradise Road site. The resulting data provides a snapshot of traffic activity at the two monitoring sites.

2.1 Vehicle classifications

Vehicles were categorized by type based on number of axles, trailers, and type. Table 2-1 presents class descriptions used for this study. The vehicle classes given below are those defined by the US Department of Transportation.

Table 2-1. Vehicle class descriptions.

University of Wyoming Vehicle Count Study Class Descriptions	
Vehicle Class	Description
Class 1	Class 1 is for Motorcycles.
Class 2	Class 2 is for Passenger Cars.
Class 3	Class 3 is for Other Two-Axle, Four-Tire, Single-Unit Vehicles.
Class 4	Class 4 is for Buses.
Class 5	Class 5 is for Two-Axle, Six-Tire, Single-Unit Trucks.
Class 6	Class 6 is for Three-Axle, Single-Unit Trucks.
Class 7	Class 7 is for Four-or-More Axle, Single-Unit Trucks.
Class 8	Class 8 is for Four-or-Less Axle, Single-Trailer Trucks.
Class 9	Class 9 is for Five-Axle, Single-Trailer Trucks.
Class 10	Class 10 is for Six-or-More Axle, Single-Trailer Trucks.
Class 11	Class 11 is for Five-or-Less Axle, Multi-Trailer Trucks.
Class 12	Class 12 is for Six-Axle, Multi-Trailer Trucks.
Class 13	Class 13 is for Seven-or-More Axle, Multi-Trailer Trucks.
Class 14	Class 14 is for Heavy Equipment.

3.0 RESULTS

Table 3-1 presents vehicle counts sorted by vehicle class according to the date and hour during which they were counted. The data reported for the 9th June 2009 is for Paradise Road and the data reported for the 5th March 2009 is for Luman Road.

Table 3-1. Number of vehicles counted, by date and hour, at Paradise Road and Luman Road observation sites.

University of Wyoming Vehicle Count Study Hourly Vehicle Count by Class Value															
DATE	HOUR	Vehicle Class													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
6/9/09	10:00	-	0	38	-	-	6	0	5	22	7	-	0	5	1
3/5/09	8:00	-	1	93	-	-	7	0	1	10	17	-	1	1	5
3/5/09	9:00	-	0	50	-	-	9	1	4	12	2	-	2	0	0
3/5/09	10:00	-	2	65	-	-	5	0	2	20	3	-	1	3	0
3/5/09	11:00	-	3	78	-	-	2	0	1	22	3	-	0	2	0
3/5/09	12:00	-	0	59	-	-	6	0	1	14	4	-	1	1	0
3/5/09	13:00	-	0	51	-	-	7	0	0	19	2	-	1	4	0
3/5/09	14:00	-	1	49	-	-	3	0	2	14	4	-	0	3	0
3/5/09	15:00	-	2	96	-	-	3	0	3	8	5	-	0	3	0
3/5/09	16:00	-	1	97	-	-	2	0	2	12	2	-	0	1	0

Vehicles are sorted by percent of total in Table 3-2. While data are given for each class, descriptors are included to highlight those that contribute 5% or more to the total. While multi axle vehicles account for approximately 30%, nearly 70% is accounted for by single axle trucks. Passenger cars accounted for a negligible proportion of traffic flow.

Table 3-2. Percentage of vehicles by type counted at Luman Road observation sites.

Vehicle Count Percentage by Class Value		
Vehicle Class	Count	Percentage
Class 1	0	0.0%
Class 2	10	1.1%
Class 3 (Other Single Two-Axle)	638	70.0%
Class 4	0	0.0%
Class 5	0	0.0%
Class 6 (Single Three-Axle)	44	4.8%
Class 7	1	0.1%
Class 8	16	1.8%
Class 9 (Single Five-Axle)	131	14.4%
Class 10 (Single Six-or-More Axle)	42	4.6%
Class 11	0	0.0%
Class 12	6	0.7%
Class 13	18	2.0%
Class 14	5	0.5%

Total Vehicles	911	100%
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Figure 3-1 illustrates the data given in Table 3-2. It should be noted that engine size can be related to axle size. However vehicle weight and engine load is more difficult to determine. Vehicle emissions may vary depending on a number of factors including age, size, fuel type, speed and load.

Figure 3-1. Pie chart showing percentage at Luman Road

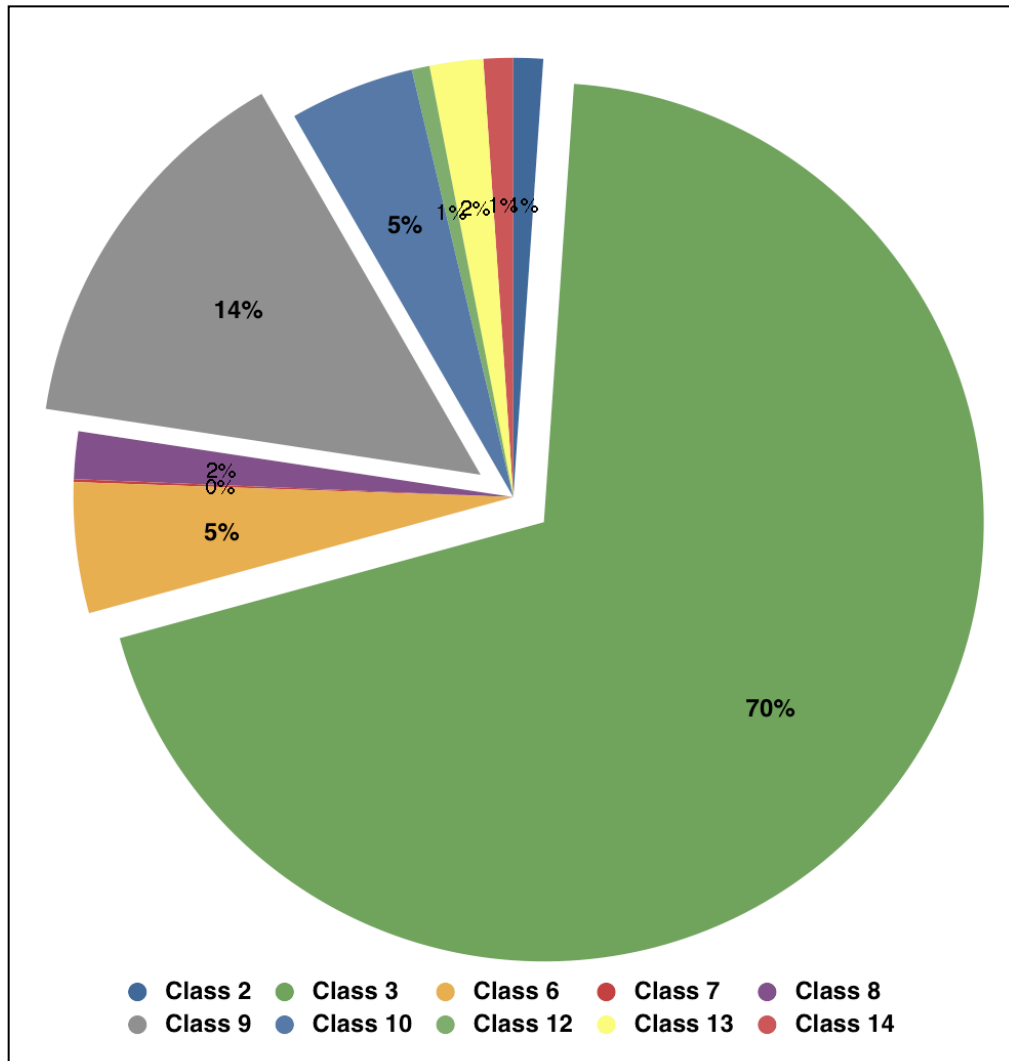
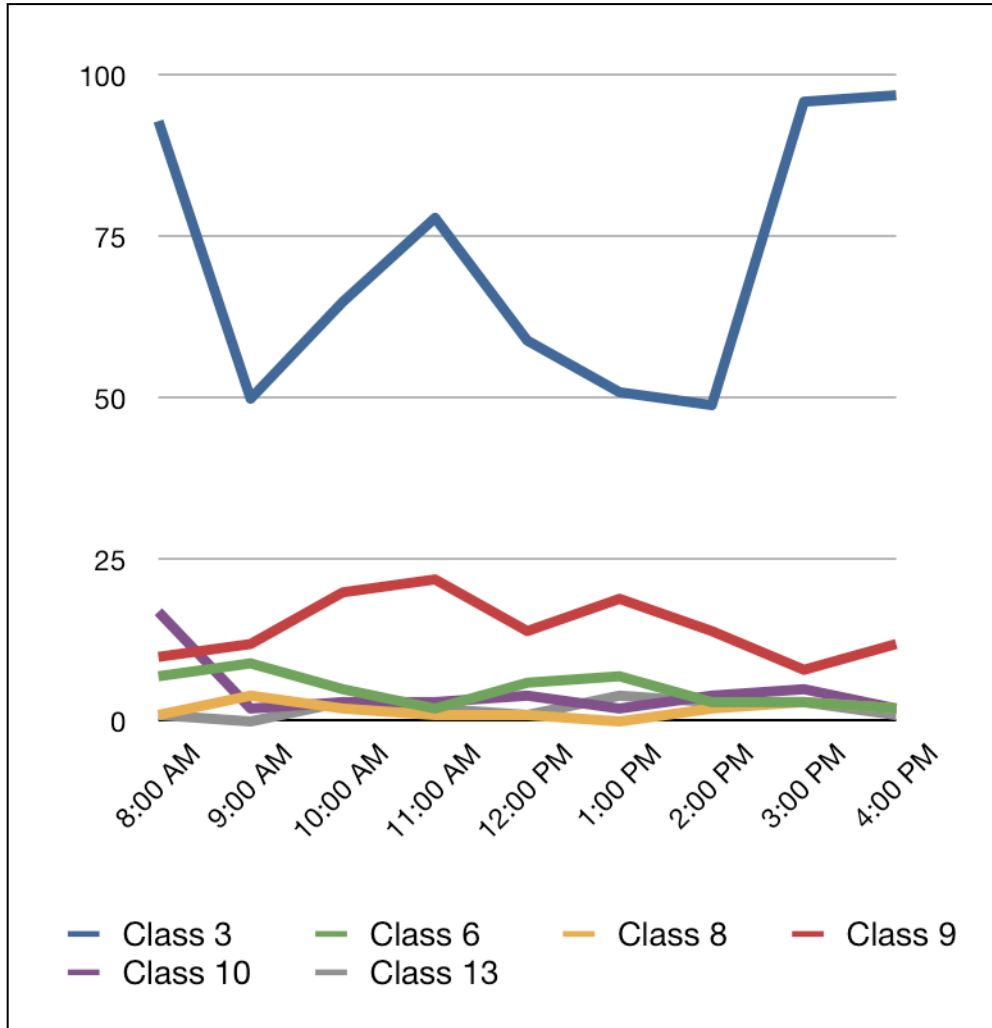


Figure 3-2 illustrates the variation shown at Luman Road on an hourly basis. While there is insufficient data to determine diurnal variation it indicates that the contribution exhibits variation during the monitoring period.

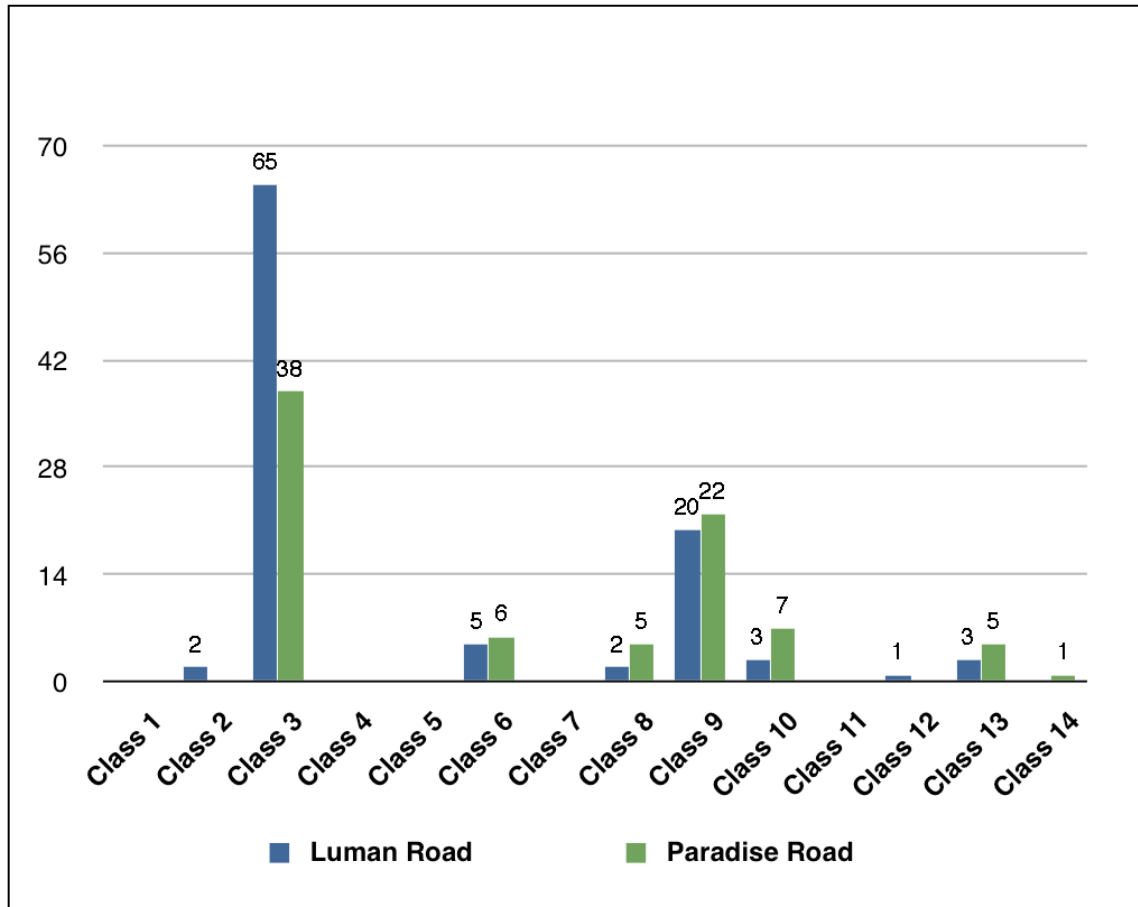
Figure 3-2. Luman Road traffic observation by hour.



Note: Class 3 is Other Single Two-Axle Trucks; Class 6 is Single Three-Axle Trucks; Class 8 is Single Trailer Trucks with Four-or-Less Axle, Class 9 is Single Trailer Trucks with Five-Axle, Class 10 is Single Trailer Trucks with Six-or-More Axle, Class 13 is Multi-Trailer-Truck with Seven-or-More Axle

Figure 3-3 compares the same hour of day, on different days, for Luman and Paradise Road. Diurnal patterns of traffic flow are often evident related to human behavior patterns in cities. Whether such patterns are also evident for oil and gas development is unclear. Some operations are operated 24/7 whereas other require daylight with associated normal working hour behavior.

Figure 3-3. Chart showing comparison of vehicle count at Luman Road and Paradise Road.



4.0 DISCUSSION

At both sites the dominant vehicle class is single axle trucks (class 3) with approximately a 70% share of the total traffic flow. The same hour of day comparison, while a snapshot viewpoint, shows a good deal of consistency between the vehicle distribution associated with PAPA and Jonah developments. Pick-up trucks are the dominant vehicle class. Their function varies from worker transport through a variety of utility, service and construction functions. The remainder of the traffic flow (30%) is dominated by multi-axle trucks and trailers. With the greatest contribution (14%) from single unit five axle trailer trucks (class 9) with important 5% contributions from both single six or more axle trucks (class 10) and single unit three axle trucks (class 6). Class 9 and Class 10 vehicles tend to be primarily related to water and condensate transport. Class 6 vehicles are multi purpose vehicles that have utility, service and construction functions.

This screening pilot study was not designed to consider other characteristics of the vehicle fleet. The level of pollutant emissions from traffic is an important consideration

of emission inventories for defined geographical areas. Clearly the vehicle distribution reported here is unique to oil and gas development and as such is divergent from that of urban areas. A consideration of engine size, vehicle loading, emission control technology and fuel type are important factors for the definition of pollutant emissions from this vehicle fleet.

5.0 CONCLUSIONS

- The vehicle distribution at the two sites Luman Road and Paradise Road was similar.
- Larger engine vehicles dominate the vehicle fleet.
- Single two axle trucks are the dominant vehicle type (Class 3) accounting for 70% of the vehicle fleet. This class is associated with servicing activities.
- Class 9 (single five axle) and class 10 (single six or more axle) trucks together account for 20% of the vehicle fleet. These classes are often associated with the transport of condensate, water and other fluids.