



**WorleyParsons**

resources & energy

EcoNomics

**WATERFALL MANAGEMENT COMPANY**



## **Services Report for the Development known as Comet Extension 8**

279220-000 – GZ1

2013-03-06

**COMPILED FOR:**

**Waterfall Management Company**  
PO Box 2506, Saxonwold, 2132  
Ad Outpost Building  
Woodmead North Office Park 54  
Maxwell Drive  
Jukskei View  
Sandton  
2191  
Telephone: +27 (0)11 253 9222  
Facsimile: +27 (0)11 253 9228

**COMPILED BY:**

**WorleyParsons RSA (Pty) Ltd**  
ABN 61 001 279 812  
Contact person: Gerhard Zandberg  
Cnr Aramist Avenue and Corobay Avenue, Waterkloof  
Glen, Pretoria  
PO Box 22, Menlyn, 0063  
South Africa  
Telephone: +27 (0)12 745 2000  
Facsimile: +27 (0)12 745 2001  
email: [gerhard.zandberg@worleyparsons.com](mailto:gerhard.zandberg@worleyparsons.com)  
[www.worleyparsons.com](http://www.worleyparsons.com)

© Copyright 2013 WorleyParsons RSA (Pty) Ltd



### WATERFALL MANAGEMENT COMPANY SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 8

---

## SYNOPSIS

This report consists of the bulk engineering services required to develop the applicable land. The budget costs are also provided to enable the developer to make an informed decision to proceed with the development based on the expected return on investment.

### Disclaimer

*This report has been prepared on behalf of and for the exclusive use of Waterfall Management Company, and is subject to and issued in accordance with the agreement between Waterfall Management Company and WorleyParsons RSA (Pty) Ltd. WorleyParsons RSA (Pty) Ltd accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this report by any third party.*

*Copying this report without the permission of Waterfall Management Company and WorleyParsons RSA (Pty) Ltd is not permitted.*

---

#### PROJECT 279220-000 - SERVICES REPORT

---

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for Internal review	G Zandberg	A Reviewer	N/A	2013-06-13	N/A	



**WorleyParsons**

resources & energy

EcoNomics

**WATERFALL MANAGEMENT COMPANY**

**COMPILED BY:**

Service Provider : WorleyParsons RSA (Pty) Ltd  
Contact : Mr JG Zandberg Pr Eng  
Postal Address : PO Box 22, Menlyn, 0063  
Physical Address : Cnr Aramist Avenue and Corobay Avenue. Waterkloof  
Glen, Pretoria  
Telephone : 012 745 2000  
Facsimile : 012 745 2001  
Cell Phone : 083 453 1099  
E-mail : [gerhard.zandberg@worleyparsons.com](mailto:gerhard.zandberg@worleyparsons.com)  
Project Number : 279220-000



## CONTENTS

1.	DEVELOPMENT INFORMATION .....	1
1.1	INTRODUCTION AND TERMS OF REFERENCE .....	1
1.2	DEVELOPER .....	1
1.3	DESCRIPTION OF THE PROPERTY .....	1
1.4	PROPOSED ZONING .....	2
1.5	SITE CHARACTERISTICS .....	2
1.6	EXISTING SERVITUDES .....	3
1.6.1	R.O.W.....	3
1.6.2	ERPM PIPE.....	3
2.	ROADS .....	4
2.1	ACCESSES TO THE DEVELOPMENT .....	4
2.1.1	SECTIONAL TITLE STANDS (RESIDENTIAL 4).....	4
2.1.2	FULL TITLE STANDS (RESIDENTIAL 1).....	4
2.2	TRAFFIC IMPACT STUDY .....	4
2.2.1	INTERSECTION: MAIN REEF ROAD / PRETORIA ROAD .....	4
2.2.2	INTERSECTION: RONDEBULT ROAD / MIDDEL ROAD.....	5
2.2.3	INTERSECTION: RONDEBULT ROAD / MAIN REEF ROAD .....	5
2.2.4	INTERSECTION: RONDEBULT ROAD / COMET ROAD .....	5
2.2.5	ADDITIONAL ROUNDABOUT .....	5
2.3	STANDARDS AND SPECIFICATIONS .....	5
2.4	PAVEMENT DESIGN .....	6
2.4.1	ROAD CATEGORY UC (ES0.3: RESIDENTIAL ACCESS LOOP).....	6
2.4.2	ROAD CATEGORY UD (ES0.1: ACCESS CUL-DE-SAC).....	6
2.5	COST ESTIMATE: ROADS.....	7
3.	STORMWATER.....	8
3.1	STORMWATER DRAINAGE .....	8
3.2	FLOOD LINES .....	8



**WATERFALL MANAGEMENT COMPANY  
SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION D**

---

3.3	STANDARDS AND SPECIFICATIONS .....	8
3.4	DESIGN CRITERIA .....	8
3.5	BULK CONTRIBUTIONS .....	9
3.6	COST ESTIMATE: STORM WATER.....	9
4.	WATER RETICULATION .....	10
4.1	GENERAL DESIGN CRITERIA .....	10
4.2	BULK SUPPLY.....	10
4.2.1	STANDARDS AND SPECIFICATIONS .....	12
4.2.2	DESIGN CRITERIA.....	12
4.2.3	LEVELS OF SERVICE .....	13
4.3	BULK CONTRIBUTIONS .....	13
4.4	COST ESTIMATE: WATER.....	13
5.	SEWER RETICULATION .....	14
5.1	BULK SERVICES.....	14
5.2	STANDARDS AND SPECIFICATIONS .....	15
5.3	DESIGN CRITERIA.....	15
5.4	LEVELS OF SERVICE .....	15
5.5	BULK CONTRIBUTIONS .....	16
5.6	COST ESTIMATE .....	16
6.	ELECTRICAL RETICULATION.....	17
7.	COST SUMMARY.....	18

APPENDIX 1 – LOCALITY PLAN

APPENDIX 2 – GENERAL LAYOUT

APPENDIX 3 – PROPOSED ROAD UPGRADES

APPENDIX 4 – ROADS AND STORMWATER DRAINAGE PLAN

APPENDIX 5 – EKURHULENI RESPONSE: WATER & SEWER

APPENDIX 6 – PROPOSED WATER LAYOUT

APPENDIX 7 – PROPOSED SEWER NETWORK

APPENDIX 8 – PROPOSED ELECTRICAL SERVICES



**WATERFALL MANAGEMENT COMPANY  
SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 8**

---

## **1. DEVELOPMENT INFORMATION**

### **1.1 INTRODUCTION AND TERMS OF REFERENCE**

WorleyParsons RSA (Pty) Ltd has been appointed by the developer's Town Planner (Urban Dynamics) to provide an overview of the engineering services available for the development of the proposed township. The report is required as supplementary documentation for township application. The report will cover the engineering aspects of the availability, position and capacity of bulk services necessary to produce a successful development.

### **1.2 DEVELOPER**

The developer of the property is Waterfall Management Company

Physical Address : Ad Outpost Building, Woodmead North Office Park 54,  
Maxwell Drive, Jukskei View, Sandton, 2191

Tel no. : 011 253 9222

Fax no. : 011 253 9229

Postal Address : PO Box 2506  
Saxonwold  
2132

### **1.3 DESCRIPTION OF THE PROPERTY**

The property involved is Portion 406 of the farm Driefontain 85 IR.

The property is situated in the Ekurhuleni Metropolitan Municipality. The southern boundary is Soksburg Township called Plantation and the western boundary is Rondebult Road (K90). On the northern side of the property lies an existing undeveloped stand and the property is bounded by an existing mine dump of the ERPM mine to the east. A locality plan is attached as **Annexure 1**.

The property is currently undeveloped.



## WATERFALL MANAGEMENT COMPANY SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 2

---

### 1.4 PROPOSED ZONING

A previous services report was compiled during August 2007 with an application for land use rights. Due to a commercial decision the application was never concluded. A new application is now being formalised and form the basis of this services report. This services report is based on the application as stated in table 1 below.

**Table 1: Proposed land use rights**

Zoning	Land Use	Erf Numbers	No. of Stands	Area of Stands & Streets	% of Area
Residential 1	Detached houses 240 m <sup>2</sup> erven	3-40, 42-126	123	3,39	32,31%
Residential 4	Residential dwelling units @ 60u/ha	1-2	2 (122 units)	2,04	19,44%
Special	Conservation	41	1	1,25	11,91%
P.O.S	Park	127	1	2,98	28,4%
Streets				0,83	7,94%
<b>Total</b>		<b>128</b>	<b>127</b>	<b>10,48</b>	<b>100%</b>

The drawing showing the respective stands and general layout of the proposed development is attached as **Annexure 2** – Drawing number Comet8Lay C13/2012.11.19 revision 13.

### 1.5 SITE CHARACTERISTICS

The site was previously occupied by a mine dump. The mine dump was rehabilitated and the site is now very flat. The site slopes in a south western direction with gradients between 1% and 2%.

An earth dam structure exists on the northern side of the Public Open Space stand. This dam is dry most of the time and has no purpose.

An unlined channel is situated along the southern boundary of the Public Open Space stand. This channel varies in width and the purpose of this channel is also unknown.



## WATERFALL MANAGEMENT COMPANY SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION B

---

The site is condensed into the following three geotechnical zones:

**Zone 1: 2 / H1-H2 / S1 / P (contaminated soils)** comprising the central and northern portions of the site in which potentially *moderately to highly expansive* clay horizons underlie, a horizon of moist, compressible mine tailings and / or transported soils.

**Zone 2: 2 / C-C1 / R (hardpan ferricrete sub-outcrop) / P (contaminated soils)** comprising the southern and eastern fringe of the site around the perimeter of Zone 1, in which very competent ferricrete underlies the site, intermittently buried beneath shallow *potentially collapsible* and/or compressible transported soils.

**Zone 3: 2 / C2 / P (contaminated soils)** which comprises the south-western extremity of the site in which thick, potentially *highly collapsible* transported soils overlie hardpan ferricrete at depth.

These geotechnical zones can be seen on the general layout attached as **Annexure 2**.

### 1.6 EXISTING SERVITUDES

The following information regarding servitudes can be reported on the property:

#### 1.6.1 R.O.W

A 30m wide right of way servitude, running from north to south has been applied for on the western side of the Public Open Space stand.

#### 1.6.2 ERPM Pipe

An ERPM pipeline, which transport mine silt, runs on the northern boundary of the Public Open Space stand. This pipeline is situated in a 12m wide servitude (servitude not registered).





## 2. ROADS

### 2.1 ACCESSES TO THE DEVELOPMENT

Access is proposed to the development from Rondebult Road and is discussed in much detail in the document produced by the traffic consultant ITS.

#### 2.1.1 Sectional Title Stands (Residential 4)

Stand 1 will be accessed from the south by Elm Street. Stand 2 will be accessed from the east by the newly constructed ring road (Road 2). No road upgrades are foreseen on Elm Street, other than the access onto the site.

#### 2.1.2 Full Title Stands (Residential 1)

The residential stands can be directly accessed from the following existing minor access roads:

- Rondebult Road (K90) at the turning circle
- Pine Street
- Ash Street
- Beech Street

Beech Street will serve as the collector to and from these roads mentioned above. No improvements are foreseen on these roads. Beech Street will thus be used for access to the residential stands.

### 2.2 TRAFFIC IMPACT STUDY

A Traffic Impact Study was performed by ITS Engineers, dated April 2013.

Some road upgrades are necessary to accommodate the development. Refer to **Annexure 3** for the proposed road upgrades.

#### 2.2.1 Intersection: Main Reef Road / Pretoria Road

Although this intersection is situated quite a distance from the development, the development will have an effect on the capacity of the intersection. It is recommended to provide an exclusive left turn



**WATERFALL MANAGEMENT COMPANY  
SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 8**

---

lane on the southern approach, a through left turn lane on the northern approach and a through right turn lane on the eastern and western approaches, - not for the developer's cost.

### **2.2.2 Intersection: Rondebult Road / Middel Road**

The existing exclusive left turn lane on the eastern approach must make provision for an additional through lane. Only this improvement is necessary at this intersection to accommodate the development - not for the developer's cost.

### **2.2.3 Intersection: Rondebult Road / Main Reef Road**

The development will also have an influence on this intersection and provision of an additional through lane on southern and northern approaches is required - not for the developer's cost.

### **2.2.4 Intersection: Rondebult Road / Comet Road**

The developer of Comet extension 8 will only be responsible for the upgrades at the intersection of Rondebult Road and Comet Road and the traffic circle at Comet Street and Palm Street due to the low distribution on the other mentioned intersections above.

This intersection will be the access for the residential and sectional title stands of the development. Provision of an additional through lane on northern approach and conversion of a through lane to a through right turn lane on the eastern approach will be required.

### **2.2.5 Additional Roundabout**

A roundabout is required in Comet Road south at the Intersection with Palm Street.

## **2.3 STANDARDS AND SPECIFICATIONS**

All internal roads will be designed in accordance with the Guidelines for Human Settlement Planning and Design (Red Book).



## 2.4 PAVEMENT DESIGN

The proposed pavement design is based on anticipated traffic volumes. It may have to be amended to suit in-situ geotechnical conditions.

Anticipated vehicles per day : 75-220

Anticipated bearing capacity :  $0.1-0.3 \times 10^6$  EBCs

The following pavement design is proposed:

### 2.4.1 Road Category UC (ES0.3: Residential Access Loop)

Refer to **Annexure 4** for the roads layout plan for the proposed development.

Carriage Way	:	5.50 meter
Surfacing	:	30 mm continuously medium graded asphalt. (Surface treatment)
Base	:	125 mm natural gravel G4 compacted to 98% of mod AASHTO)
Sub base	:	150 mm stabilized gravel (cemented natural gravel) (C4) compacted to 96% of mod AASHTO density
Selected layer	:	150 mm natural gravel - soil (G7) compacted to 93% of mod. AASHTO density
Roadbed	:	150 mm rip and re-compact to 93% of mod. AASHTO density.
Kerbs (if required)	:	mountable (Fig 8c) with 150 mm wide channel on one side and edge beams on the other.

### 2.4.2 Road Category UD (ES0.1: Access Cul-de-sac)

Carriage Way	:	3.50 meter
Surfacing	:	60 mm interlocking paving
Sub base	:	150 mm stabilized gravel (cemented natural gravel) (C4) compacted to 96% of mod AASHTO density



## WATERFALL MANAGEMENT COMPANY SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 3

- Selected layer : 150 mm natural gravel - soil (G7) compacted to 93% of mod. AASHTO density
- Roadbed : 150 mm rip and re-compact to 93% of mod. AASHTO density.
- Kerbs (if required) : Edge beams (Fig 8c).

### 2.5 COST ESTIMATE: ROADS

The cost estimate does not make provision for the relocation of major services or the expropriation of land. The cost estimate for the road network is provided in table 1.

**Table 1: Cost Estimate: Roads**

Description	QTY	Unit	Rate	Amount
Rondebult Road and Comet upgrades	1 546	m <sup>2</sup>	R 1 000	R 1 546 000.00
Internal roads (6,5m)	5 280	m <sup>2</sup>	R 550	R 2 904 000.00
Internal roads (3,5m)	1 785	m <sup>2</sup>	R 350	R 624 750.00
Round-about (traffic circle)	993	m <sup>2</sup>	R 1 000	R 993 000.00
Sub-Total				R 6 067 750.00
Contingency			10%	R 606 775.00
<b>TOTAL</b>				<b>R 6 674 525.00</b>



### 3. STORMWATER

#### 3.1 STORMWATER DRAINAGE

Refer to **Annexure 4** for the storm water drainage plan for the proposed development.

It is proposed that an embankment will be created following the ERPM servitude that will serve as buffer for a 1:50 flood that might emanates from the catchment area of the dry pan. The cut material from the road excavation will be used for the embankment. Landscaping behind the embankment will be carried out that will make the Public Open Space more usable for the residential areas.

The storm water of the sectional title stand 2 (Residential 4) will be linked to the drainage pipe, running from the attenuation pond to the connection point to the existing network. Storm water from the sectional title stand 1 (Residential 4) will be linked to the existing drainage pipe situated in Elm Street.

#### 3.2 FLOOD LINES

The development is not affected by any flood lines.

#### 3.3 STANDARDS AND SPECIFICATIONS

Minimum Pipe size : 450 mm

Pipe Material : Concrete 50D

Minimum Gradient : 1:150

Catch-pits, junction boxes, man-holes and other civil structures: in accordance with the Ekurhuleni Metropolitan Municipality Standard details.

#### 3.4 DESIGN CRITERIA

Flood Return Period: 1:5 years for pipe systems in residential areas

1:20 years for the combined pipe and road systems

Design Method: Rational method for smaller catchment areas.



**WATERFALL MANAGEMENT COMPANY  
SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 8**

---

### 3.5 BULK CONTRIBUTIONS

No storm water and roads bulk contributions are applicable to the proposed development. The developer is thus relieved from all bulk contributions regarding storm water and roads. The developer will however be responsible for the upgrading of the roads and storm water that is necessary to accommodate the development.

### 3.6 COST ESTIMATE: STORM WATER

The cost estimate for the storm water layout is provided in table 2.

**Table 2: Cost Estimate: Storm Water**

Description	QTY		Rate	Amount
Pond Buffer	4410	m <sup>3</sup>	R 100	R 441 000.00
450 Concrete (50D)	450	m	R 800	R 360 000.00
Manholes	17	no.	R 7 500	R 127 500.00
Kerb Inlet (900 x 450)	8	no.	R 4 500	R 36 000.00
Sub-Total				R 964 500.00
Contingency			10%	R 96 450.00
<b>TOTAL</b>				<b>R 1 060 950.00</b>



## 4. WATER RETICULATION

### 4.1 GENERAL DESIGN CRITERIA

The estimated water demands and sewage outflows for the proposed development as indicated on the attached layout drawing were calculated and the following design standards were used:

- The Guidelines for Human Settlement Planning and Design (Red Book).
- SABS 1200 series.

The material design standards of the Ekurhuleni Metropolitan Municipality (EMM) as provided by Mr John Mclean, as well as the typical drawings for house connections, sewer erf connections, etc. will prevail in the compilation of the design.

### 4.2 BULK SUPPLY

A 600 mm diameter bulk water main was identified on the western side of Rondebult Road (K90) as illustrated in figure 1.

According to a letter from Mr John Mclean from EMM (attached as Annexure 5), all indications were that there should be sufficient spare capacity in this water main for water provision for the proposed development at an approximate static pressure of 40 m. EMM however does require GLS Consulting (GLS) to conduct a capacity assessment for the development at the Developers expense. Provision for this has been made in the disbursements in table 5.

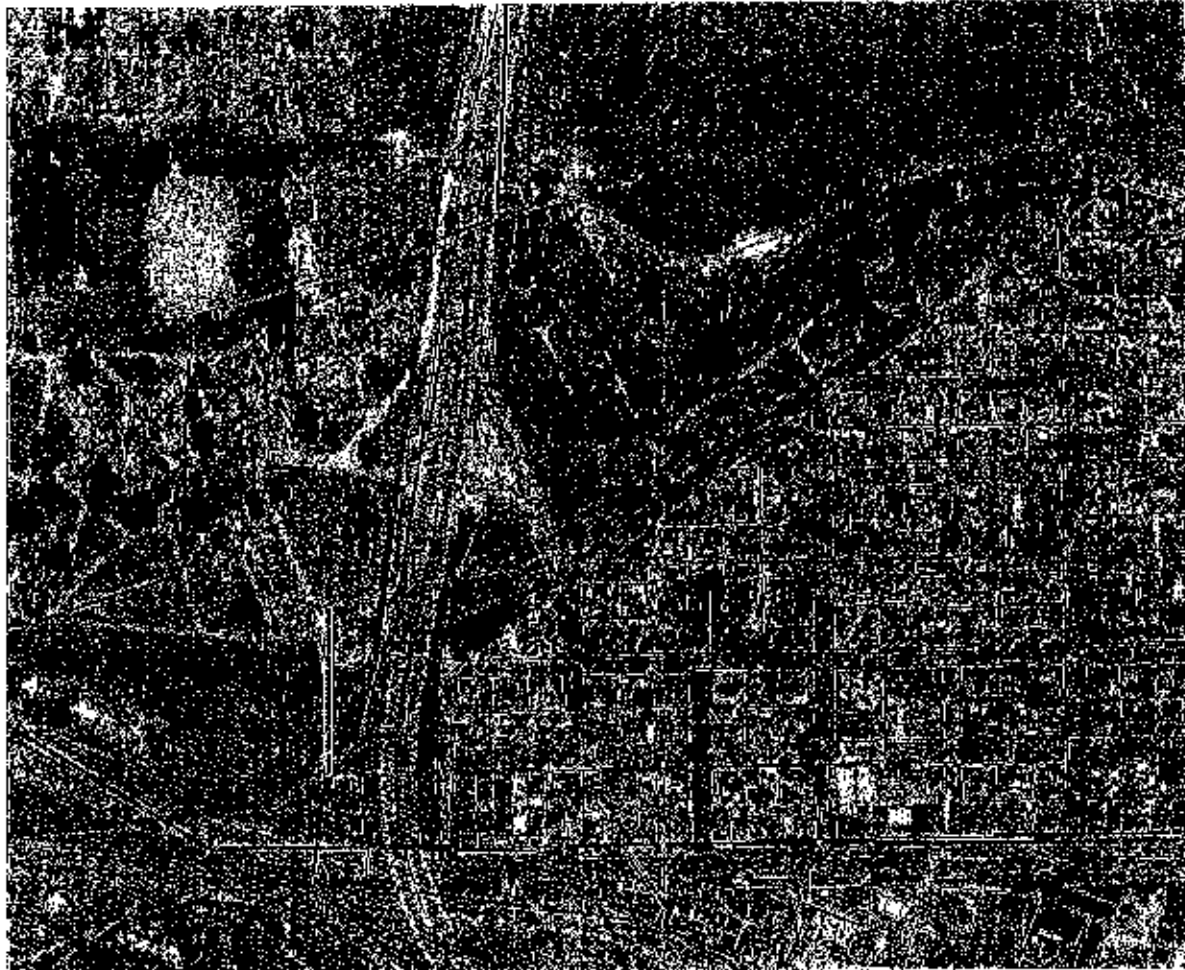
Two possible option exists, which will be clarified by the GLS assessment, the first being a road crossing to the proposed development and directional drilling. A chamber will also need to be constructed where the connection will be made to the existing 600 mm diameter bulk water main.

The proposed water network layout is depicted in Figure 1 attached as Annexure 6. EMM has indicated that the connection to the existing 600 mm bulk water main can be made as indicated on the drawing.

The second option is to tie-in at the existing connection 150mm diameter pipe in Ceder Avenue. This will eliminate any road crossings across Rondebult Road and tie-in on the 600mm diameter steel pipe.



Figure 1: Existing Sewer Networks and Water main



Note: Cyan = Sewer, Dark blue = water





## WATERFALL MANAGEMENT COMPANY

### SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 8

#### 4.2.1 Standards and Specifications

The water reticulation system will be designed with design software and constructed in accordance with the material design standards of the EMM to facilitate the take-over of this service after completion of the installation thereof.

#### 4.2.2 Design Criteria

The estimated water demands for the proposed development are summarized in Table 4.

**Table 4: Estimated Water Demands**

Erf No.	Description	Average Annual Demand		Fire-Fighting Red Book Table 9.20		
		Total AADD k/day	Total Demand l/s	Fire-Risk Category	Minimum Hydrant Flow Rate (l/s)	Minimum Residual Head (m) (Refer to Note (a))
3-40, 42-126	Residential 1 (123 full title stands)	86,1	1,00	Low risk	8,3	6
1-2	Residential 4, 60 u/ha. (2,04 ha)	85,4	0,99	Moderate risk	25	15
41	Special (Conservation) (1,25 ha)	-	-	Low risk		
127	Public Open Space (2,98ha)	37,3	0,43	Low risk		
TOTAL		208,8	2,42			

**Notes:**

- (a) The minimum residual head should be obtained with the hydrant discharging at the minimum hydrant flow rate, assuming the reticulation is operating under a condition of instantaneous peak domestic demand at the time.



## WATERFALL MANAGEMENT COMPANY

### SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 8

#### 4.2.3 Levels of Service

The levels of service planned for this development will be:

- A metered connection to every stand.
- For a peak factor of 4 and a maximum flow speed of 2m /s a feeder line of 160mm is recommended to the residential and sectional title stand.
- The distribution from the residential stands will be a diameter 110mm.
- House connections for road crossings will range from 63mm to 32mm

#### 4.3 BULK CONTRIBUTIONS

EMM indicated in the letter attached as **Annexure 5** that no bulk services contributions in respect of water are required

#### 4.4 COST ESTIMATE: WATER

The cost estimate for the water layout is provided in table 5.

**Table 5: Cost estimate: Water**

Description	QTY		Rate	Amount
160 uPVC Class 12	220	m	R 830	R 182 600.00
110 uPVC Class 12	900	m	R 470	R 423 000.00
63 HDPE Class 12	520	m	R 220	R 114 400.00
40 HDPE Class 12	40	m	R 140	R 5 600.00
32 HDPE Class 12	200	m	R 50	R 10 000.00
150 Valve	1	no.	R 2 000	R 2 000.00
100 Vale	4	no.	R 1 700	R 6 800.00
63 Vale	1	no.	R 600	R 600.00
Below Ground Hydrant (Bayonet)	8	no.	R 2 500	R 20 000.00
Connection to Municipal	1	no.	R 25 000	R 25 000.00
House connections (double)	48	no.	R 300	R 14 400.00
House connections (single)	31	no.	R 150	R 4 650.00
Sub-Total				R 809 050.00
Contingency			10%	R 80 905.00
<b>TOTAL</b>				<b>R 889 955.00</b>



## WATERFALL MANAGEMENT COMPANY

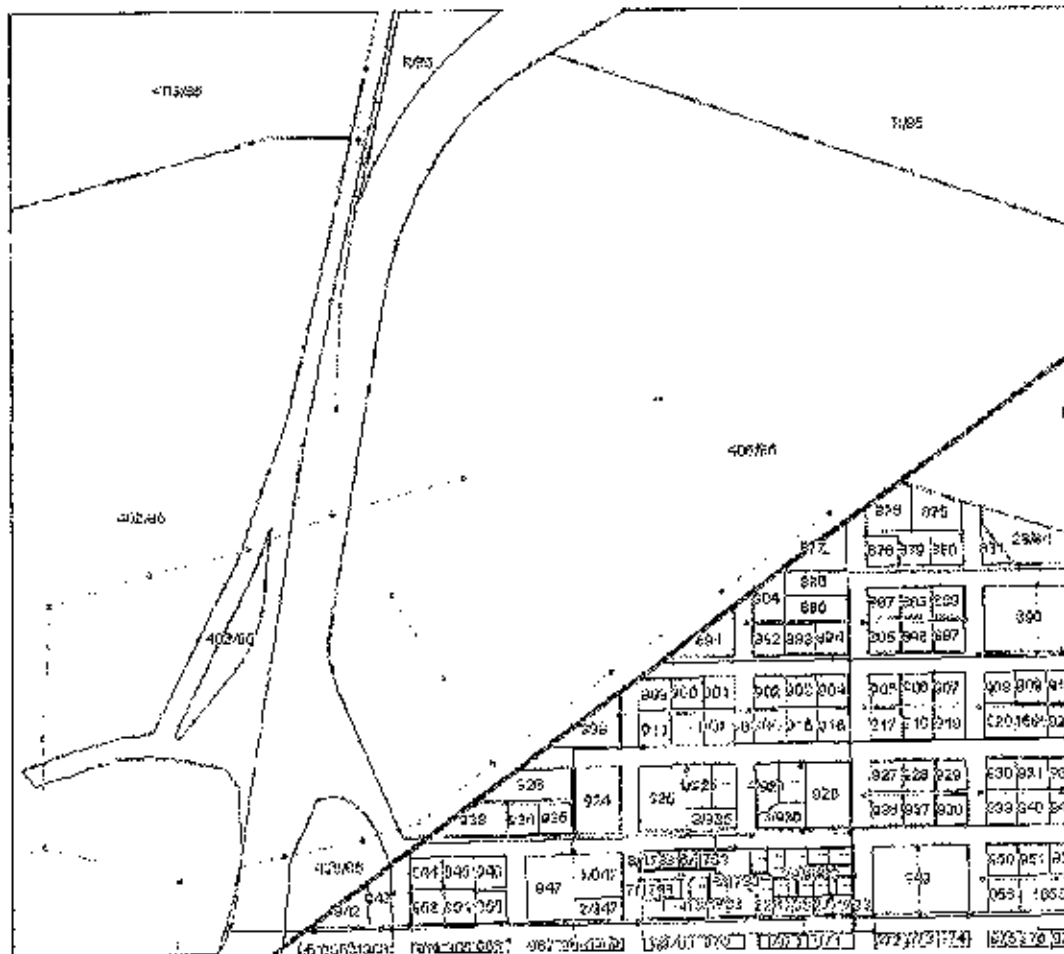
### SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION B

## 5. SEWER RETICULATION

### 5.1 BULK SERVICES

The existing main 300 mm diameter sewer outfall line traverses along Rondebult Road (K90). EMM require GLS Consulting (GLS) to conduct a capacity assessment for the development at the Developers expense. Provision for this has been made in the disbursements in table 7. This information is required to determine whether sufficient capacity exists in the existing infrastructure to accommodate the proposed development. Mr Mclean however indicated that their department will in principal support the application for the development based on the previous master plan information, which indicated that capacity was still available. They will also support the utilisation of the existing sewer connections as depicted in Figure 2.

Figure 2: Existing Sewer Networks





## WATERFALL MANAGEMENT COMPANY SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION B

For the purpose of this report it was assumed that the existing sewer main outfall line has sufficient capacity and that the sewer line located on the southern side of the development can also be utilised.

The existing sewer network layout is depicted in Figure 2 with the proposed attached as **Annexure 7**. The connection to the existing sewer line is proposed at position B on the drawing.

### 5.2 STANDARDS AND SPECIFICATIONS

The sewer reticulation system will be designed with design software and constructed in accordance with the material design standards of the EMM to facilitate the take-over of this service after completion of the installation thereof.

### 5.3 DESIGN CRITERIA

The estimated sewage outflows for the proposed development are summarized in Table 6.

**Table 6: Estimated Sewage Outflows**

Erf Number	Description	Design flow rate	Average Daily Flow Rate (l/s)
3-40, 42-126	Residential 1 (123 full title stands)	0,6/unit	0,85
1-2	Residential 4, 60 u/ha. (2,09 ha)	0,6/unit	0,85
41	Special (Conservation) (1,25 ha)		-
127	Public Open Space (2,98ha)		0,53
	<b>TOTAL</b>		<b>2,23</b>

Note:

Peak factor of 2.5 and 15% infiltration will be used.

### 5.4 LEVELS OF SERVICE

The levels of service planned for this development will be:

- A water borne sewerage reticulation system serving each stand
- Manhole spacing will be at 100 meter intervals or directional changes.
- uPVC pipes with a minimum diameter of 160mm except for house connections from the municipal connection to the house which will be 110mm diameter.



## WATERFALL MANAGEMENT COMPANY

### SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION B

---

#### 5.5 BULK CONTRIBUTIONS

EMM indicated in the letter attached as **Annexure B** that no bulk services contribution in respect of sewer is required.

#### 5.6 COST ESTIMATE

The cost estimate for the sewer layout is provided in table 7.

**Table 7: Cost estimate: Sewer**

Description	QTY		Rate	Amount
160 uPVC	1 800	m	R 750	R 1 425 000.00
House connections	125	no.	R 300	R 37 500.00
Manholes	42	no.	R 7 500	R 315 000.00
<b>Sub-Total</b>				<b>R 1 777 500.00</b>
Contingency			10%	R 177 750.00
<b>TOTAL</b>				<b>R 1 955 250.00</b>



WATERFALL MANAGEMENT COMPANY

SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMPT EXTENSION B

---

## 6. ELECTRICAL RETICULATION

WorleyParsons RSA appointed Motla Consulting Engineers to do an independent study on the existing and required electrical networks. The report presents two options for the electrical network.

The electrical report is attached hereto as **Appendix B**.



## 7. COST SUMMARY

The cost summary of all the engineering services listed in section 2 to 6 is provided in table 11.

**Table 11: Engineering Services Cost Summary (Including Electrical Option 1)**

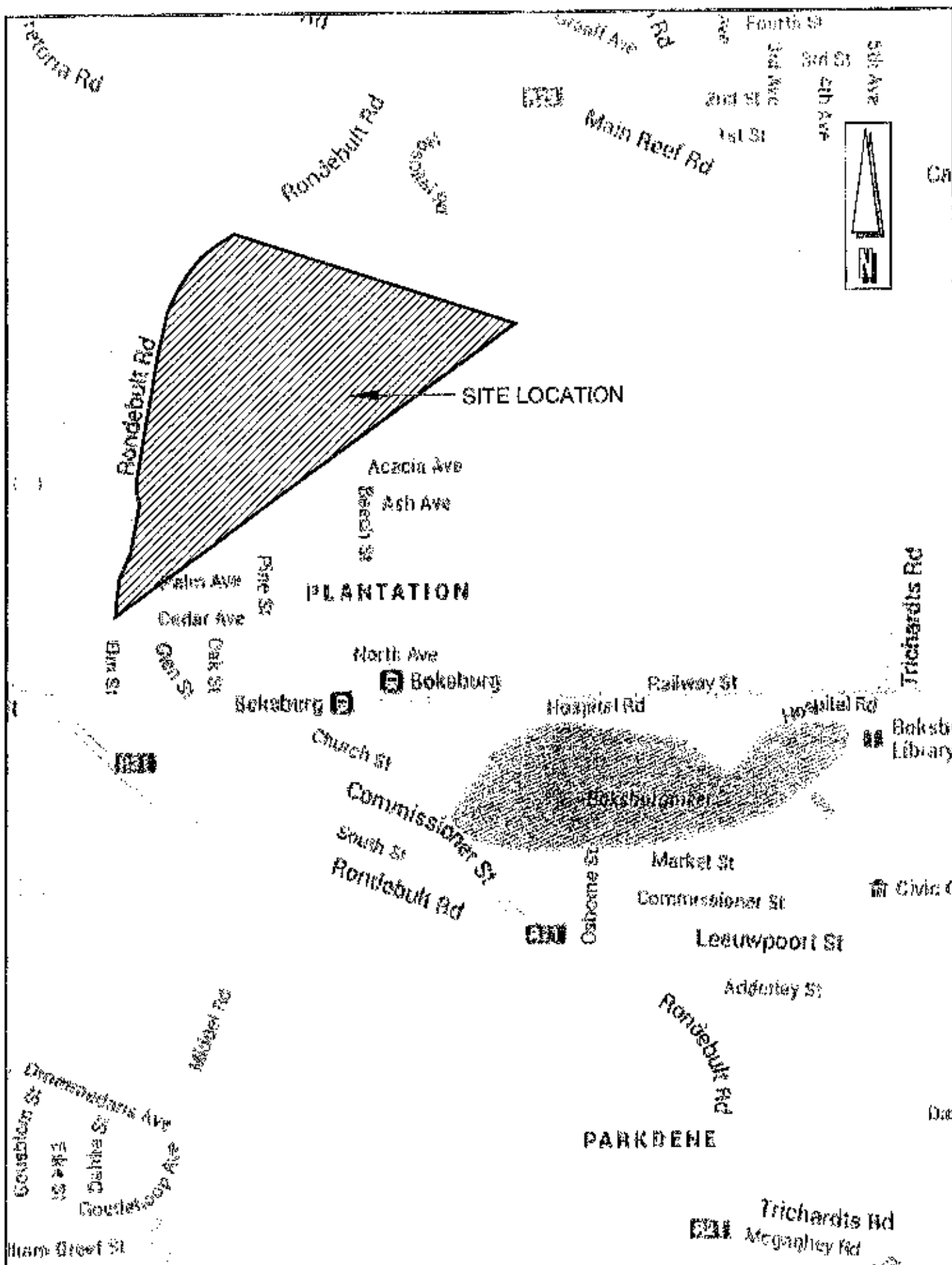
Discipline	Cost
Roads	R 6 674 525.00
Storm Water	R 1 060 950.00
Water	R 889 955.00
Sewer	R 1 955 250.00
Electricity	R 11 430 637.59
<b>Sub-total</b>	<b>R 22 011 317.59</b>
Professional Fees	R 3 548 422.36
Construction Monitoring	R 628 612.75
Disbursements	R 316 301.81
<b>Sub-Total</b>	<b>R 26 504 654.52</b>
VAT	R 3 710 651.63
<b>TOTAL</b>	<b>R 30 215 306.15</b>

The cost of servicing the stands (including the 122 sectional title units) amounts to R 123 327.78 per stand for option 1.

**Table 12: Engineering Services Cost Summary (Including Electrical Option 2)**

Discipline	Cost
Roads	R 6 674 525.00
Storm Water	R 1 060 950.00
Water	R 889 955.00
Sewer	R 1 955 250.00
Electricity	R 9 651 906.90
<b>Sub-total</b>	<b>R 20 232 586.90</b>
Professional Fees	R 3 402 889.85
Construction Monitoring	R 612 341.97
Disbursements	R 308 166.43
<b>Sub-Total</b>	<b>R 24 555 985.15</b>
VAT	R 3 437 837.92
<b>TOTAL</b>	<b>R 27 993 823.07</b>

The cost of servicing the stands (including the 122 sectional title units) amounts to R 114 260.60 per stand for option 2.



**WorleyParsons**

resources & energy

P.O. BOX 22 TEL: +27 (0) 11 746 2003  
 MENLYN 0005 FAX: +27 (0) 11 745 2021  
 www.worlpar.com

COMET EXT. 8  
 LOCALITY PLAN

Scale	N.T.S.
Date	OCTOBER 2008
Drawing number	210270/C1





**WorleyParsons**

resources & energy

EcoNomics

WATERFALL MANAGEMENT COMPANY

SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 8

---

## Appendix 1 – Locality Plan



**WorleyParsons**

resources & energy

EcoNomics

WATERFALL MANAGEMENT COMPANY

SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION B

---

## **Appendix 2 – General Layout**

PROPOSED TOWNSHIP  
**COMET EXTENSION 8**  
 DIVISION 04 PART OF SUBDIVISION 405 OF THE  
 OF THE TOWN OF DRIEFONTEIN 85-IR  
 LOCAL AUTHORITY : DISTRICT MUNICIPALITY  
 DISTRICT : 22  
 GEOTECHNICAL ZONING : M2-2P



NO.	DESCRIPTION	AREA (m²)	PERCENTAGE
1	ROADS	1200	1.2
2	PLANTATION	1500	1.5
3	OPEN SPACE	1000	1.0
4	UTILITIES	500	0.5
5	OTHER	1000	1.0
<b>TOTAL</b>		<b>5200</b>	<b>52.0</b>

DATE: 15/05/2012  
 DRAWING NO: C/13/2012.11.18  
 SCALE: 1:2500  
 SHEET: 1 OF 2

PROJECT: COMET EXTENSION 8  
 CLIENT: EAST RAND PROPRIETARY MINES  
 ENGINEER: [Signature]  
 CHECKED: [Signature]  
 DATE: 15/05/2012

GEOTECHNICAL ZONATION

ZONE	SOIL TYPE	DESCRIPTION
ZONE 1	2H1-H2S1P	(Contaminated Soils)
ZONE 2	7H1-7H2P	(Handicap, for toxic substances)
ZONE 3	2C2-2P	(Contaminated Soils)

DATE: 15/05/2012  
 DRAWING NO: C/13/2012.11.18  
 SCALE: 1:2500  
 SHEET: 1 OF 2



DRIEFONTEIN 85-IR

PORTION 405  
 OF THE FARM DRIEFONTEIN 85-IR  
**ZONE 1**  
 2H1-H2S1P

VOGELFONTEIN 84-IR

BOKSBOURG-TOWNSHIP  
 PLANTATION

GEOTECHNICAL ZONATION  
 ZONE 1 2H1-H2S1P (Contaminated Soils)  
 ZONE 2 7H1-7H2P (Handicap, for toxic substances)  
 ZONE 3 2C2-2P (Contaminated Soils)

PROPOSED ACCESS  
 FROM PROVINCIAL  
 ROUTE

**EAST RAND  
 PROPRIETARY  
 MINES**

1/25  
 DRIEFONTEIN 85-IR

X - 1:25 1000

Y - 1:25 1000

DATE: 15/05/2012  
 DRAWING NO: C/13/2012.11.18  
 SCALE: 1:2500  
 SHEET: 1 OF 2





**WorleyParsons**

resources & energy

EcoNomics

WATERFALL MANAGEMENT COMPANY

SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 8

---

## **Appendix 3 – Proposed Road Upgrades**



***Waterfall Investment Company***

## **Traffic Impact Study**

### **Comet Extension 8**

**(Portion 406 of the farm Driefontein 85 IR)**

***May 2013***

29 De Havilland Crescent  
Pro Park  
Building 1  
Perseus Park 0020

Tel: (012) 349 1664  
Fax: (012) 349 1665  
e-mail: [mail@ltse.co.za](mailto:mail@ltse.co.za)

---

**Title:** Traffic Impact Study – Proposed Comet Extension 8

**Client:** Waterfall Investment Company

**Project Team:** Clement Maphanga (Pr Tech Eng)

Jaco Stoip (Pr Tech Eng)

Henri Vorster

**Reviewed by:** Dr Pieter Pretorius (Pr Eng)

**Project nr:** ITS 2278.2

**Date:** May 2013

**Report Status:** Draft Report

---

# **TRAFFIC IMPACT STUDY**

## **COMET EXTENSION 8**

### **TABLE OF CONTENTS**

1. Traffic Impact Study
2. Appendix A – Tables
3. Appendix B – Figures
4. Appendix C – Proposed Township Layout
5. Appendix D – Previous Comments

**Traffic Impact Study  
Comet Extension 8  
(Portion 406 of the farm Driefontein 85 IR)**

	Description	Refer to Appendix
<b>1. Introduction</b>	<p>A new development, which consist of residential land uses is proposed on Portion 406 of the Farm Driefontein 85 -IR, located in Boksburg.</p> <p>The previous application for industrial, commercial and business 2 to be developed on erven 100, 101 and 102 will no longer be pursued and it is proposed to rezone the above erven to residential only.</p> <p>The residential development will generate less peak hour trips than the previous application and it is therefore necessary to re-analyse the intersections to determine the extent of road network upgrading required for this development.</p>	
<b>2. Locality</b>	<p>The development is situated on Portion 406 of the Farm Driefontein 85 -IR, which is located east of the K90 (Rondebult Road between K106 (Main Reef Road) and Commissioner Road. Refer to <b>Figure 1</b>.</p>	Appendix B, Figure 1
<b>3. Proposed Development</b>	<p>The development will consist of the following:</p> <ul style="list-style-type: none"> <li>⇒ 123 units Residential 1 (stands)</li> <li>⇒ 122 units Residential 4 (60u/ha)</li> </ul>	
<b>4. Latent Rights</b>	<p>The following development was included as latent rights in this study (based on the information received from Council and previous studies):</p> <ul style="list-style-type: none"> <li>⇒ Comet X14 situated on Portion 403 of the Farm Driefontein 85. Holding 7, land use rights consist of Industrial.</li> </ul> <p>Comet X14 is 70% operational, therefore it is assumed that this development traffic is included in the traffic volumes counted on the 5<sup>th</sup> March 2013. An additional 30% of the Comet X14 development traffic will be added as latent development traffic to the network.</p> <p>The expected 30% (119vph) of Comet X14 as latent rights is shown in <b>Table 2</b> and the trip assignment is shown in <b>Figure 3a</b></p>	Appendix A, Table 2, Appendix B, Figure 3a
<b>5. Trip Generation</b>	<p>The proposed development will generate 270 trips during both the weekday AM and PM peak hours. Refer</p>	Appendix A, Table



**Traffic Impact Study  
Comet Extension 8  
(Portion 406 of the farm Driefontein 85 IR)**

	Description	Refer to Appendix
	to Table 1 for the trip generation.	1
<b>6. Expected Trip Distribution</b>	<p>The additional development traffic is expected to be distributed as follows:</p> <ul style="list-style-type: none"> <li>±20% to the East on K106 (Main Reef Rd)</li> <li>±10% to the West on K106 (Main Reef Rd)</li> <li>±15% to the North on K90 (Rondebult Rd)</li> <li>±25% to the South on Commissioner Rd</li> <li>±15% to the West on K106 (Main Reef Rd)</li> <li>±5% to the North on Pretoria Rd</li> <li>±10% to the South on Middel Rd</li> </ul>	Appendix B, Figure 4a
<b>7. Trip Assignment</b>	The expected trip assignment is shown in <b>Figures 4b and 4c</b> , Appendix B.	Appendix B, Figure 4b & 4c
<b>8. Access to the Development</b>	The proposed residential development will have three access points. The main access will be from a proposed traffic circle at the corner of Comet and Palm Street. Two additional access points will be provided via Ash/Pine Streets and Beech Street.	Appendix B, Figure 8
<b>9. Study Area &amp; existing intersection layouts</b>	<p>The following intersections were included in the study area of this study:</p> <ol style="list-style-type: none"> <li>1. K106 (Main Reef Rd) / Pretoria Rd;</li> <li>2. K106 (Main Reef Rd) / K90 (Rondebult Rd);</li> <li>3. K90 (Rondebult Rd) / Pretoria Rd / Comet St;</li> <li>4. K90 (Rondebult Rd) / Comet Rd</li> <li>5. K90 (Rondebult Rd) / Middel Rd</li> <li>6. Palm St / Comet St</li> </ol>	

**Traffic Impact Study  
Comet Extension 8  
(Portion 406 of the farm Driefontein 85 IR)**

	Description	Refer to Appendix
<p><b>10. Adjacent Road Network</b></p>	<p>The local road network south of the development can be considered as Class 4 and Class 5a Municipal Roads and include:</p> <ul style="list-style-type: none"> <li>➤ Comet St</li> <li>➤ Palm St</li> <li>➤ Pine St</li> <li>➤ Ash St</li> <li>➤ Beech St</li> <li>➤ Acacia St</li> </ul> <p>It is also envisaged that development traffic will be distributed to the major road network which includes the following:</p> <ul style="list-style-type: none"> <li>➤ <b>K90 (Rondebult Rd) part of R21 (Class 2):</b> is a Provincial road located on the western side of the development that links the Boksburg area with the N12 and N17. It is a four-lane dual carriageway.</li> <li>➤ <b>K106 Main Reef Rd (R29) (Class 2):</b> is a four-lane dual carriageway, with a east/west direction. Situated north of the proposed development.</li> <li>➤ <b>Pretoria Road</b> is a Class 3 road, running in an north/south direction. It intersects with Main Reef Road (R29) and Rondebult Road (R21).</li> </ul>	
<p><b>11. Background Volumes</b></p>	<p>Traffic surveys were conducted by ITS Engineers during the AM and PM peak on Tuesday on the 5<sup>th</sup> of March 2013. A growth rate of 3% per annum was used to estimate the year 2018 traffic demand.</p>	<p>Appendix B, Figure 2a &amp; 6a</p>
<p><b>12. Analysis Scenarios</b></p>	<p><b>Scenario 0:</b> 2013 Traffic volumes (Existing Geometry)</p>	<p>Appendix B, Figure 2a</p>

**Traffic Impact Study  
Comet Extension 8  
(Portion 406 of the farm Driefontein 85 IR)**

	Description	Refer to Appendix
	<p><b>Scenario 1:</b> 2013 Traffic volumes with Latent Rights (Existing Geometry)</p> <p><b>Scenario 2:</b> 2013 Traffic volumes plus Latent Rights and Development traffic (Existing Geometry)</p> <p><b>Scenario 2u:</b> 2013 Traffic volumes plus Latent Rights and Development traffic (Proposed Geometry)</p> <p><b>Scenario 3:</b> 2018 Future traffic volumes with Latent Rights (Existing Geometry)</p> <p><b>Scenario 3u:</b> 2018 Future traffic volumes with Latent Rights (Proposed Geometry)</p> <p><b>Scenario 4:</b> 2018 Future traffic volumes with Latent Rights and Development traffic (Proposed Geometry)</p>	<p>Appendix B, Figure 3b</p> <p>Appendix B, Figure 5a</p> <p>Appendix B, Figure 5b</p> <p>Appendix B, Figure 6a</p> <p>Appendix B, Figure 6b</p> <p>Appendix B, Figure 7</p>
<p><b>13. Capacity analyses</b></p>	<p>The capacity analyses for this study were conducted using the Highway Capacity Manual 2000 intersection analysis methodologies for signalised and unsignalised intersections.</p> <p>The results of the capacity analyses are discussed below:</p> <p>In <b>Scenario 0, 1 &amp; 4</b> all the existing intersections operate at an acceptable level of service (LOS).</p> <p><b>Scenario 2:</b> 2013 Traffic volumes plus Latent Rights and Development traffic</p> <p>The following intersections operate at an unacceptable level of service during the AM and PM peak hour.</p> <ul style="list-style-type: none"> <li>➤ <b>Intersection 1</b> Pretoria Rd and Main Reef Rd</li> <li>➤ <b>Intersection 6</b> Comet St and Palm St</li> </ul> <p><b>Scenario 3:</b> 2018 Future traffic volumes with Latent Rights</p> <p>The following intersections operate at an unacceptable level of service during the AM and PM peak hour.</p>	<p>Appendix A, Table 5 and Appendix D, Drawing 2278.2-GL-01</p> <p>Appendix B, Figure 2a, 3b, 5a, 5b, 6a, 6b and 7.</p>

**Traffic Impact Study  
Comet Extension 8  
(Portion 406 of the farm Driefontein 85 IR)**

	Description	Refer to Appendix
	<ul style="list-style-type: none"> <li>➤ Intersection 2 Rondebult Rd and Main Reef Rd</li> <li>➤ Intersection 4 Rondebult Rd and Comet Rd</li> <li>➤ Intersection 5 Rondebult Rd and Middel Rd</li> </ul> <p>With the proposed upgrades in place (Scenario 2u and 3u), all the Intersections are expected to operate at an acceptable levels of service.</p>	
14. Expected road upgrades	<p>With reference to Table 4 the following upgrades were proposed:</p> <p><b>Latent Development Rights:</b></p> <ul style="list-style-type: none"> <li>➤ Pretoria Rd and Main Reef Rd: Provide an exclusive left turn lane on the southern approach, a through left turn lane on the northern approach and a through right turn lane on the eastern and western approaches.</li> </ul> <p><b>Latent Development Rights and Background:</b></p> <ul style="list-style-type: none"> <li>➤ Rondebult Rd and Middel Rd: Provision of an additional through lane on eastern approach.</li> <li>➤ Rondebult Rd and Main Reef Rd: Provision of an additional through lane on southern and northern approaches.</li> </ul> <p><b>Developer of Comet x8:</b></p> <ul style="list-style-type: none"> <li>➤ Rondebult Rd and Comet Rd: Provision of an additional through lane on northern approach and conversion of a through lane to a through right turn lane on the eastern approach.</li> <li>➤ Comet Rd and Palm St: Should be upgraded to a traffic circle.</li> </ul>	Appendix A, Table 4 and Appendix B, Figure 8
16. Parking	According to Ekurhuleni Metropolitan Municipality Development Planning guidelines.	
16. Public Transport	The proposed development will result in an increase in the number of public transport users on K90. Provision should be made to accommodate public transport vehicles safely. The construction of public transport lay-	

**Traffic Impact Study  
Comet Extension 8  
(Portion 406 of the farm Driefontein 85 IR)**

	Description	Refer to Appendix
	by at Rondebult Road / Comet Road intersection is therefore recommended.	
<b>17. Cost Estimate</b>	Estimated cost of road upgrades R 2 539 000 (excluding VAT).	Appendix A, Table 4
<b>18. Conclusions</b>	<p>Given the findings of this report, the following are concluded:</p> <ul style="list-style-type: none"> <li>➤ The proposed development will consist of residential land uses.</li> <li>➤ It is expected that the development will generate an additional 270 development trips during the AM and PM peak hour.</li> <li>➤ The 30% of Comet X14 development traffic is considered as Latent development traffic. The additional 119 Latent development trips were added to the road network.</li> <li>➤ The existing road network is currently operating close to capacity with limited spare capacity.</li> <li>➤ Given the road upgrading proposed in this document, the proposed development trips can be accommodated at an acceptable level of service during the 2018 horizon year.</li> <li>➤ The estimated cost to upgrade the external road network to accommodate the 2018 traffic demand of Comet X8 is R2,539 000; excluding VAT, engineering design fees, contingencies, the relocation of major services or the expropriation of land. In addition, a traffic circle is to be implemented at the Intersection of Comet Road/ Palm Avenue.</li> <li>➤ The road network will have sufficient capacity to accommodate the trips generated by the proposed development if the road upgrading proposed in this document is implemented.</li> <li>➤ The road upgrading should be designed by a registered professional engineer with sufficient roads design experience.</li> <li>➤ The cost of the road upgrading proposed in this document should be shared amongst the Comet X14 and X8 development. The distribution of cost should be negotiated amongst the relevant</li> </ul>	

**Traffic Impact Study  
Comet Extension 8  
(Portion 406 of the farm Driefontein 85 IR)**

	Description	Refer to Appendix
	developers.	
<b>19. Recommendations</b>	The proposed development is supported from a traffic engineering point of view provided that the road upgrading recommended in this document are implemented.	

## APPENDIX A

### TABLES AND ADDITIONAL INFORMATION

- Table 1: Expected trip generation of the proposed development
- Table 2: Trip generation for the latent rights
- Table 3: Required road network upgrades
- Table 4: External road upgrades cost estimate for the proposed development

## COMET EXTENTION 8

### APPENDIX A

**Table 1** Expected trip generation of the proposed development

Development	Area (m <sup>2</sup> )	Area of stands & streets (m <sup>2</sup> )	Land Use	Br. No	Number Units	Trip Rate	Dist % In	Dist % Out	Total Trips In	Total Trips Out	Total Trips
<b>Weekday AM Peak Hour</b>											
Comet X8	54 300	33 900	Residential 1	3 - 40 & 42 - 126	123	1.1	25%	75%	34	101	135
		20 400	Residential 4 (60u/ha)	1 & 2	122	1.1	25%	75%	34	101	135
<b>Total</b>									<b>68</b>	<b>202</b>	<b>270</b>
<b>Weekday PM Peak Hour</b>											
Comet X8	54 300	33 900	Residential 1	3 - 40 & 42 - 126	123	1.1	76%	25%	101	34	135
		20 400	Residential 4 (60u/ha)	1 & 2	122	1.1	76%	25%	101	34	135
<b>Total</b>									<b>202</b>	<b>68</b>	<b>270</b>

**Table 2:** Trip generation for latent rights

No.	Development	Land Use	Extent	Trip Rate	Rate	Trip Generation (vph) (100% Trips)			Trip Generation (vph) (80% TNps)		
						In	Out	Total	In	Out	Total
<b>Weekday AM Peak</b>											
1	Comet X14	Industrial	10 704 m <sup>2</sup>	0.6	vph/100m <sup>2</sup>	318	80	396	85	24	119
<b>Weekday PM Peak</b>											
1	Comet X14	Industrial	10 704 m <sup>2</sup>	0.6	vph/100m <sup>2</sup>	80	316	396	24	95	119



**Table 3: Required road network upgrades**

Intersection	Intersection	Types of control	Approach	Upgrades	Responsibility
1	Pretoria Road and Main Reef Road	Signalised	Eastern	Construct an additional through right turn lane	Latent Rights (Council X14)
			Western	Construct an additional through right turn lane	
			Northern	Convert the left turn lane to a through left turn lane.	
			Southern	Construct an exclusive left lane	
2	Rondebult Road and Main Reef Road	Signalised	Southern & Northern	Construct one additional through lane per approach	Latent Rights and Roadside U
4	Rondebult Road and Comet Road	Signalised	Eastern	Convert the through lane to a through right turn lane.	Municipal (Council X4)
			Northern	Construct an additional through lane	
5	Rondebult Road and Middel Road	Signalised	Eastern	Construct one additional through lane	Latent Rights and Roadside U
6	Comet Street and Palm Street	Traffic Circle	Provide a traffic circle		Developer (Council X3)

*Note: The developer of Comet X8 will only upgrade Intersection 4 and 6 because of the low distribution on Intersections 2, 3 and 5.*

**Table 4: External road upgrades cost estimate for the proposed development**

Intersection	Intersection name	Extent	Area (sqm)	Total (R)
4	Rondebult Road and Comet Road	Road widening on north approach	1546	R 1 546 000
6	Comet Street and Palm Street	Construct a traffic circle	993	R 993 000
<b>Total (excluding VAT)</b>				<b>R 2 539 000</b>

*Please note that the above cost estimate was based on a unit rate approach, which exclude professional fees, contingencies, the relocation of major services and VAT. The estimate was also based a conceptual layout, which was done without detailed services information being available at the time of the study. The cost estimate does not include the acquisition of land required to construct access roads.*

- R1000,00 per sqm of a road.

**COMET EXTENTION 8  
(PORTION 406 OF THE FARM DRIEFONTEIN 85 IR)**

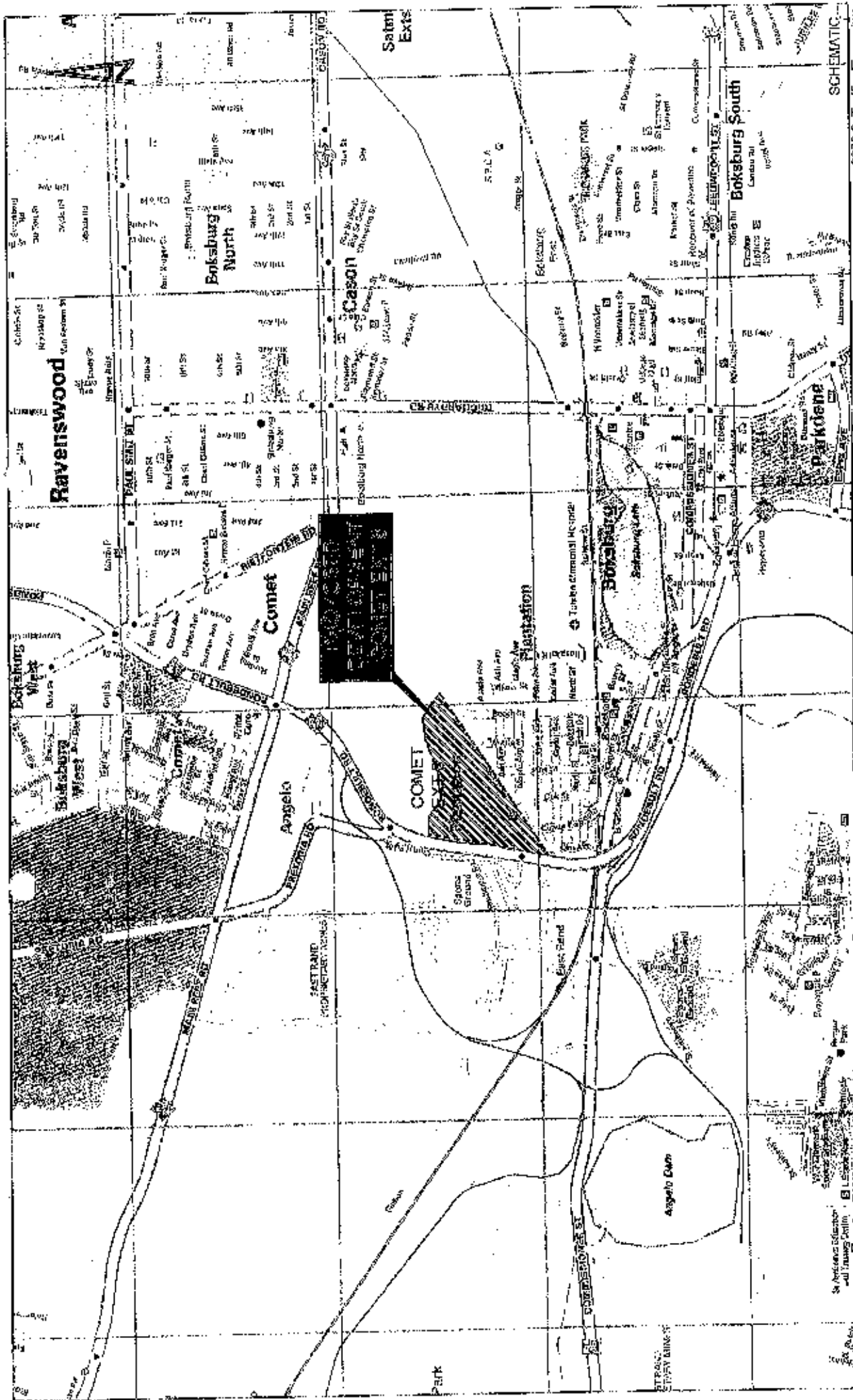
**APPENDIX B**

**FIGURES**

## APPENDIX B

### LIST OF FIGURES

- Figure 1:** Locality Plan
- Figure 2a:** Scenario 0 - Base year volumes (2013) AM & PM Peak Hour & analysis results
- Figure 2b:** Scenario 0 - Intersection geometry
- Figure 3a:** AM & PM Latent rights
- Figure 3b:** Scenario 1 - AM & PM Peak Hour Base year volumes (2013) plus Latent Rights traffic and analysis results
- Figure 4a:** Expected Trip Distribution
- Figure 4b:** AM Peak Hour Trip assignment
- Figure 4c:** PM Peak Hour Trip assignment
- Figure 5a:** Scenario 2 - AM & PM Peak Hour Base year volumes (2013) plus Latent Rights traffic, Development traffic and analysis results
- Figure 5b:** Scenario 2u - AM & PM Peak Hour Base year volumes (2013) plus Latent Rights traffic, Development traffic with upgrades and analysis results
- Figure 5c:** Scenario 2 - Intersection geometry
- Figure 6a:** Scenario 3 - Horizon 2018 traffic volumes AM and PM Peak Hour with Latent Rights traffic & analysis results
- Figure 6b:** Scenario 3u - Horizon 2018 traffic volumes AM and PM Peak Hour plus Latent Rights traffic with upgrades & analysis results
- Figure 6c:** Scenario 3 - Intersection geometry
- Figure 7:** Scenario 4 - Horizon 2018 traffic volumes AM and PM Peak Hour, Latent Rights traffic plus development traffic & analysis results
- Figure 8:** General layout and proposed road upgrades



2278-2 Traffic Figures DWG

FIGURE NUMBER

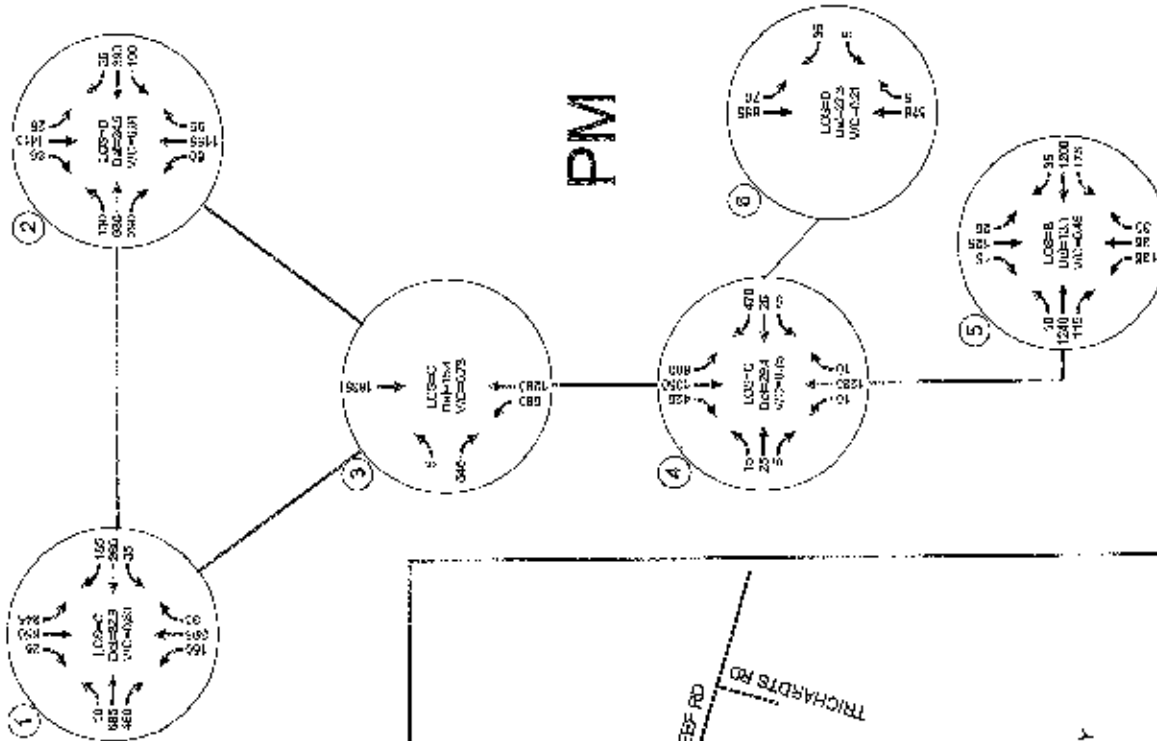
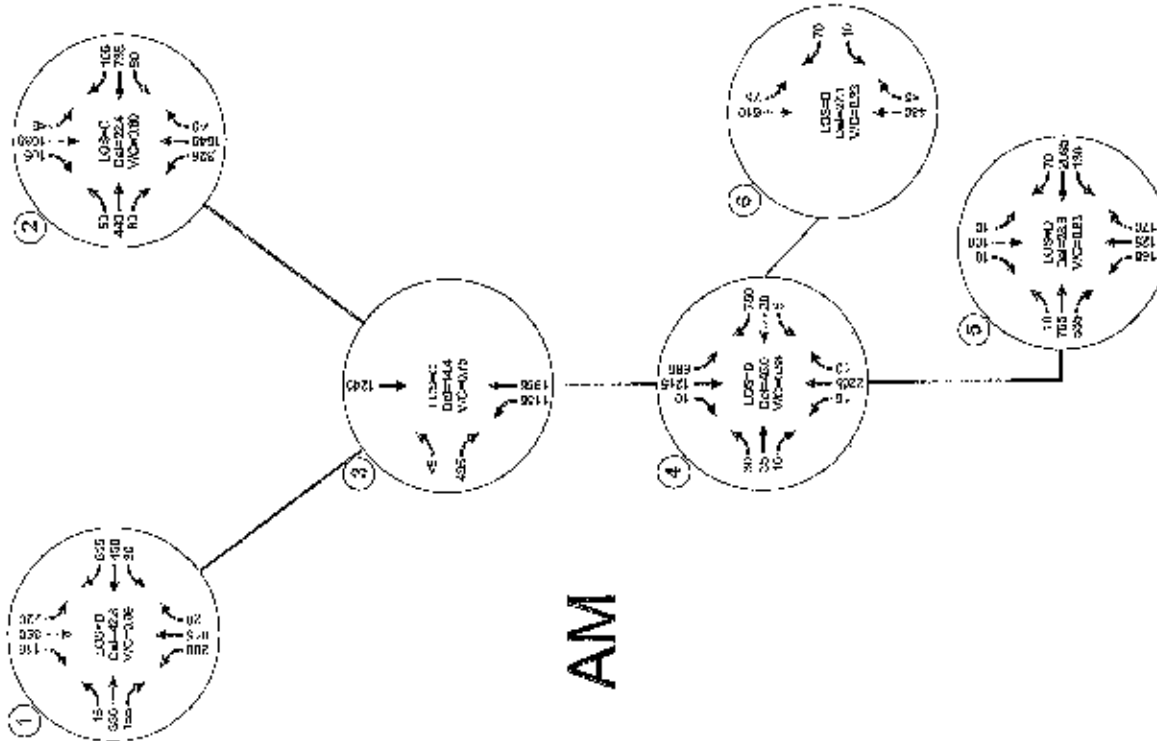
1

LOCALITY PLAN

COMET EXTENSION & TIS

SCALE

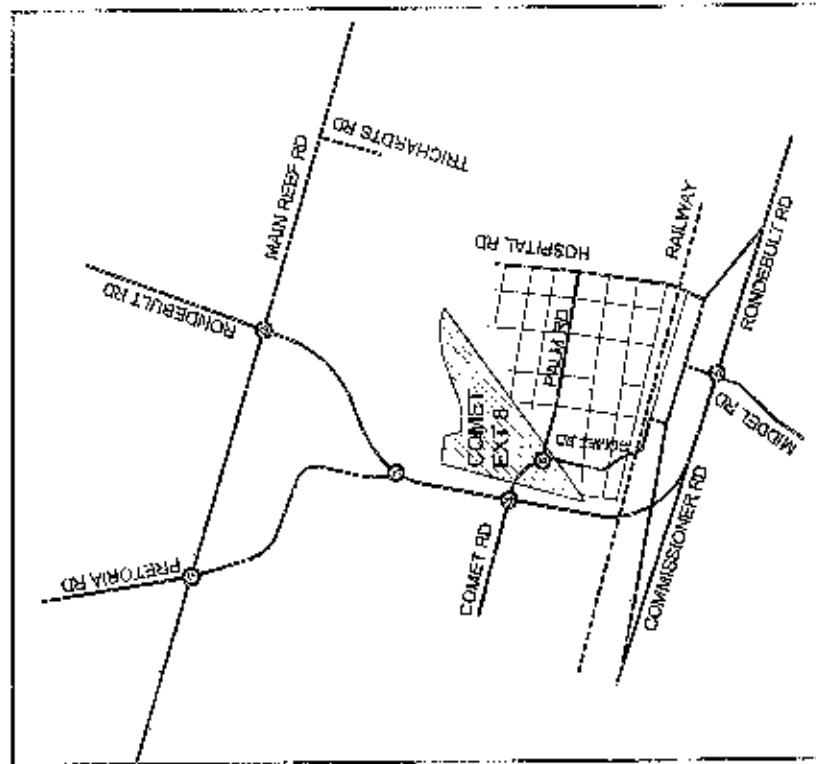


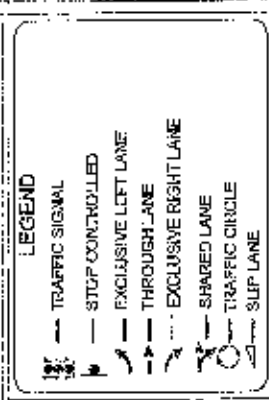
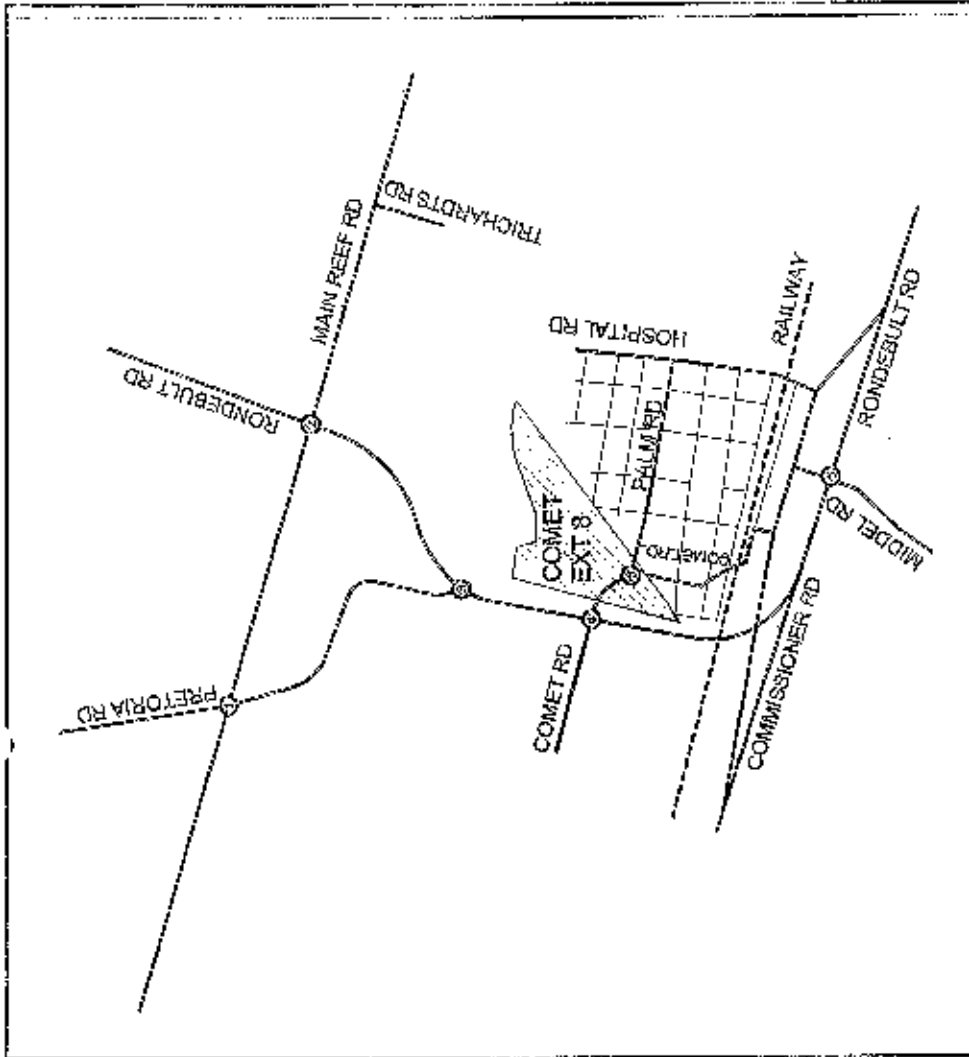
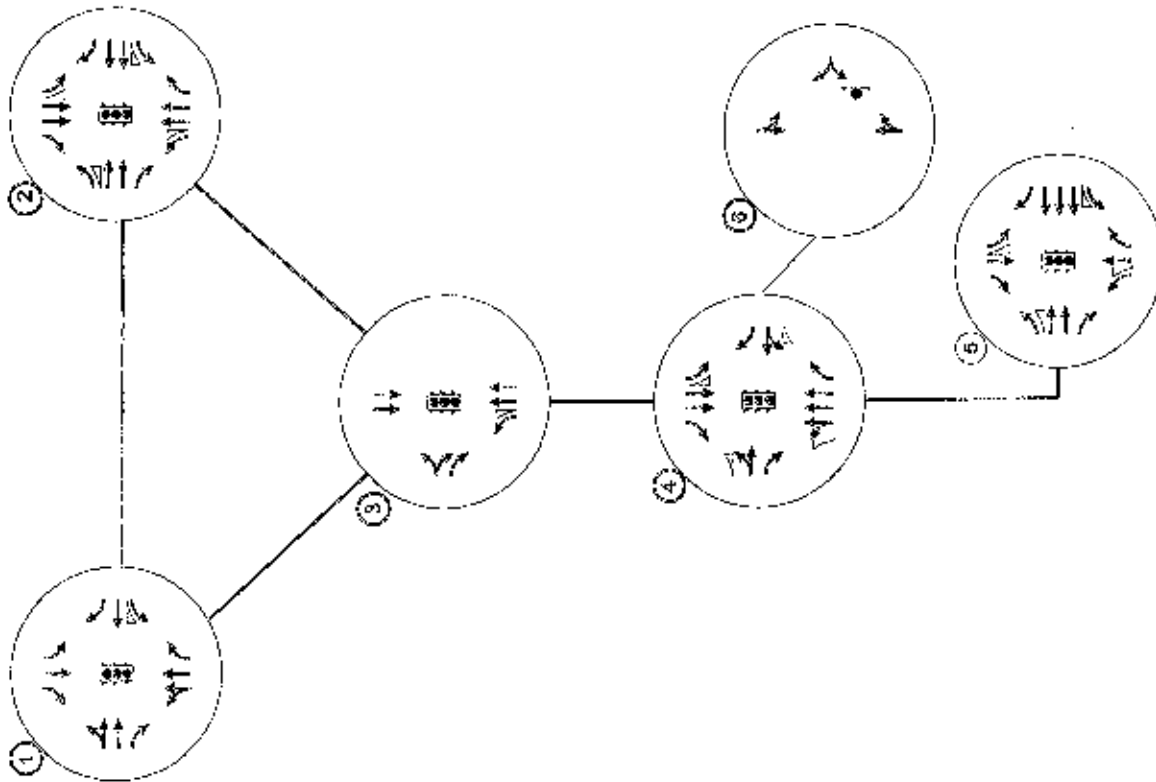


**LEGEND**

TURNING VOLUMES

LOS -- LEVEL OF SERVICE  
 D/S -- DELAY SECOND / VEHICLE  
 V/C -- VOLUME / CAPACITY RATIO





SCHENATIC

2278.2 Traffic Figures.dwg

NUMBER

Scenario 0: 2013 Existing Intersection  
Geometry

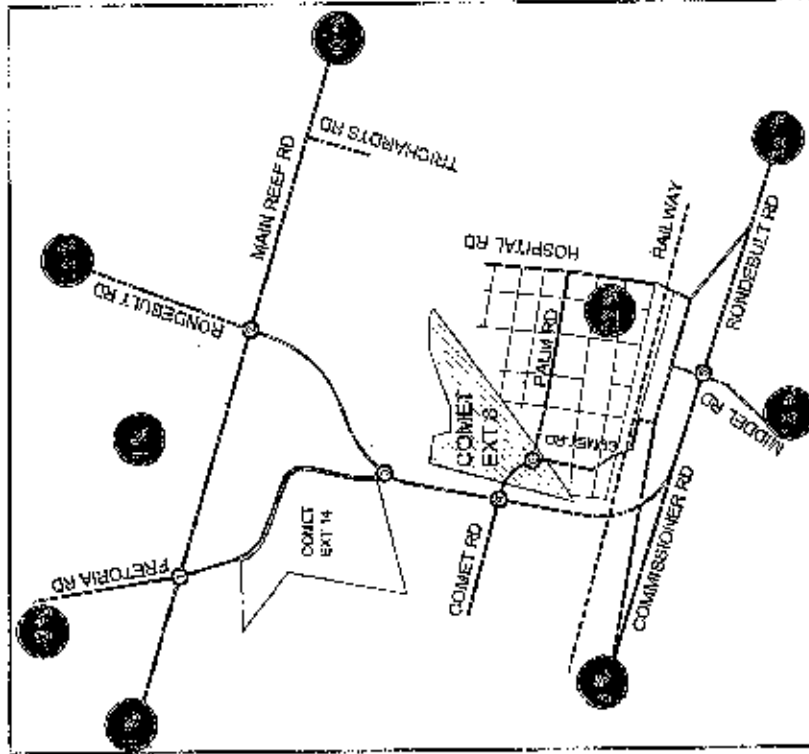
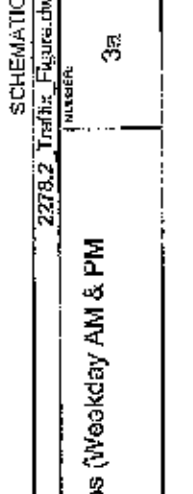
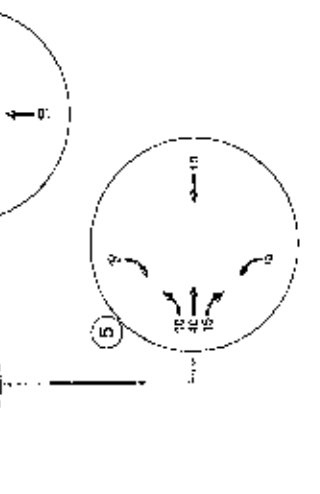
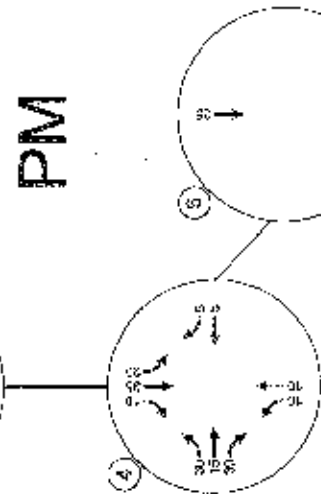
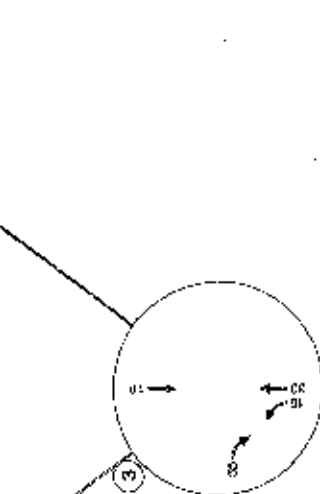
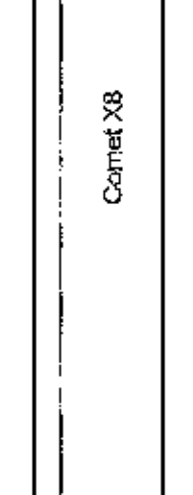
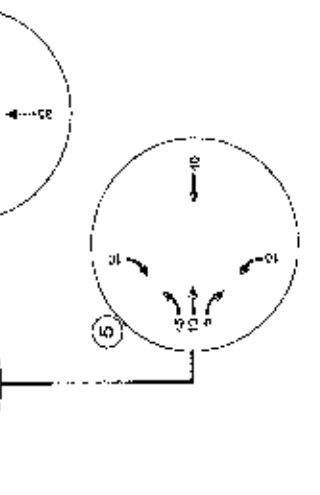
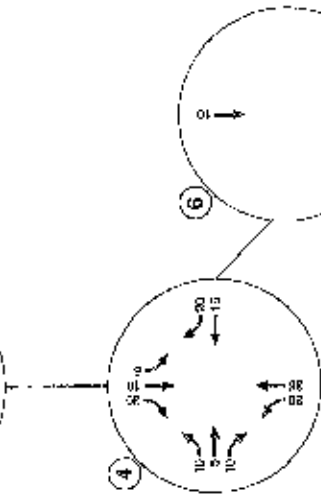
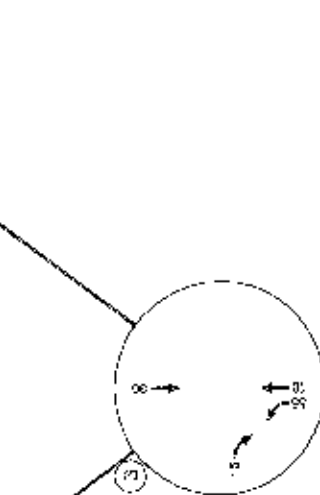
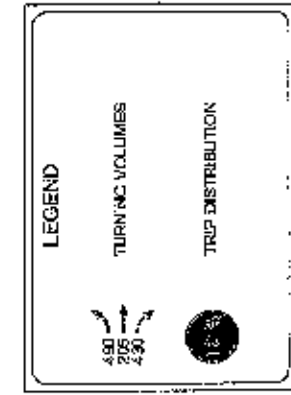
2b

TWO/16

Comet Xa

PROJEN





AM

PM

SCHMATIC  
2278.2 Traffic Figures.dwg

FIGURE

NUMBER

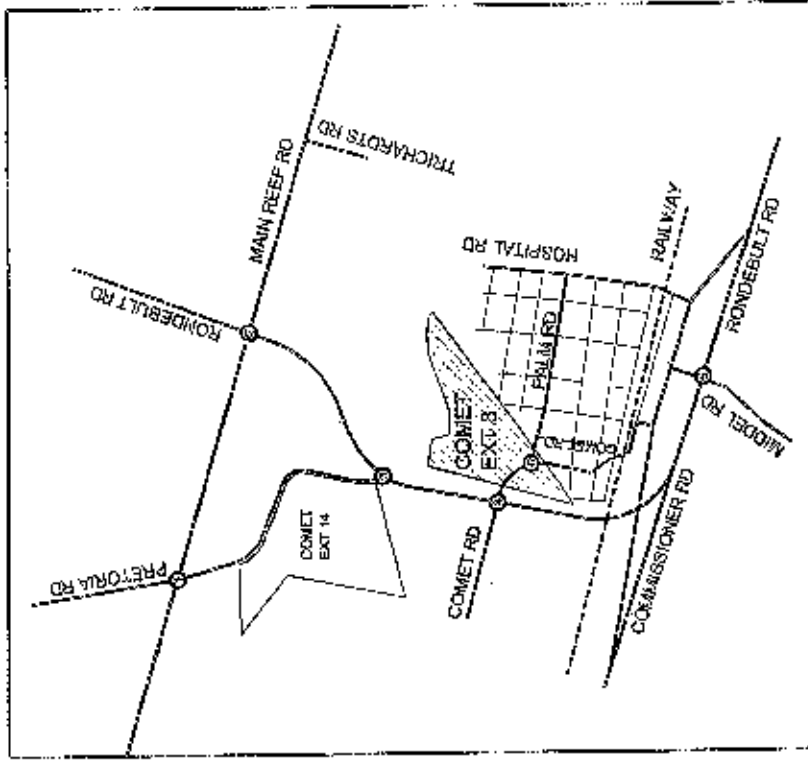
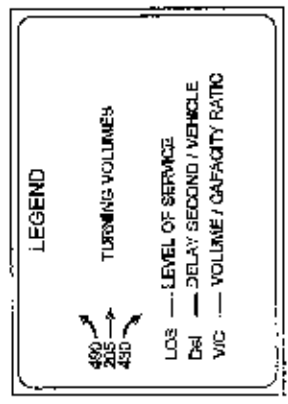
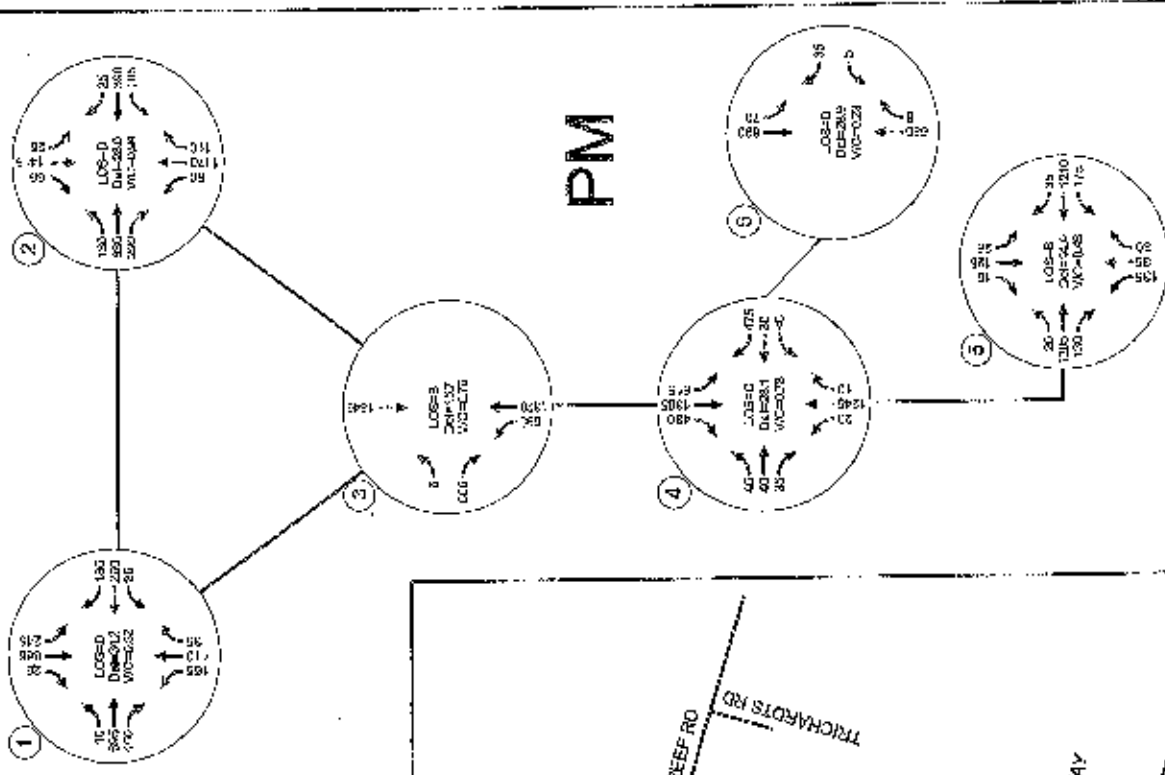
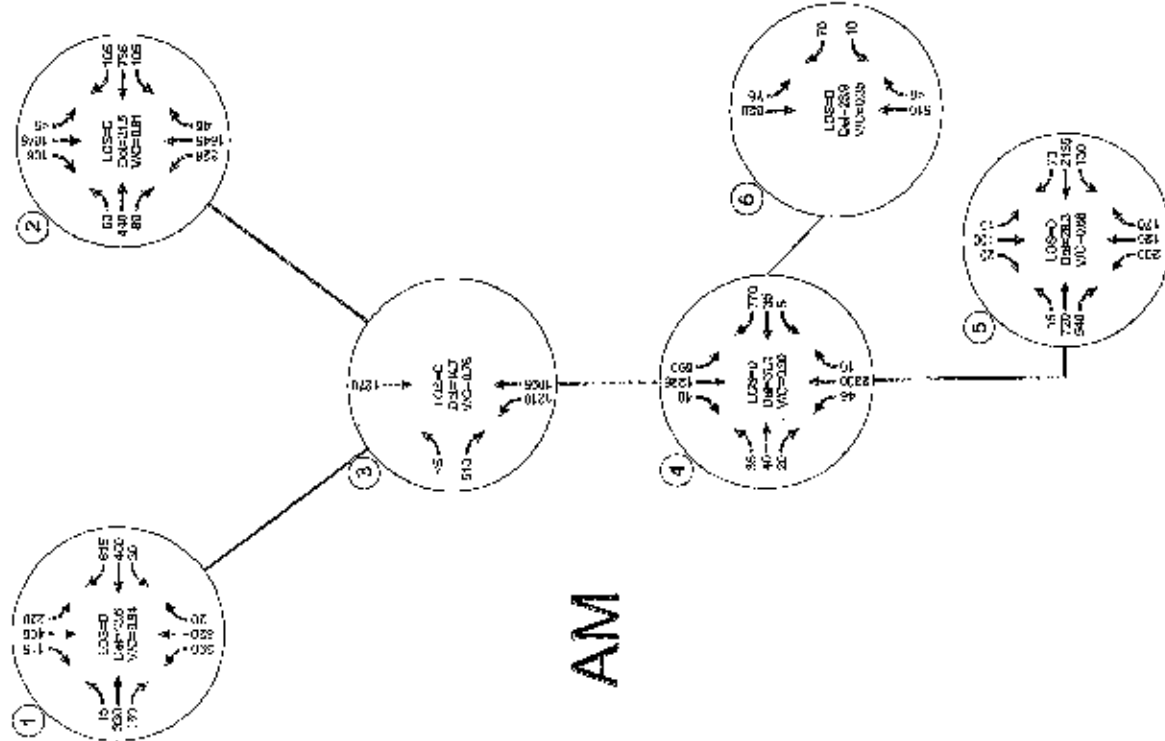
Latent Development Traffic Volumes (Weekday AM & PM Peak Hour)

Comet X8

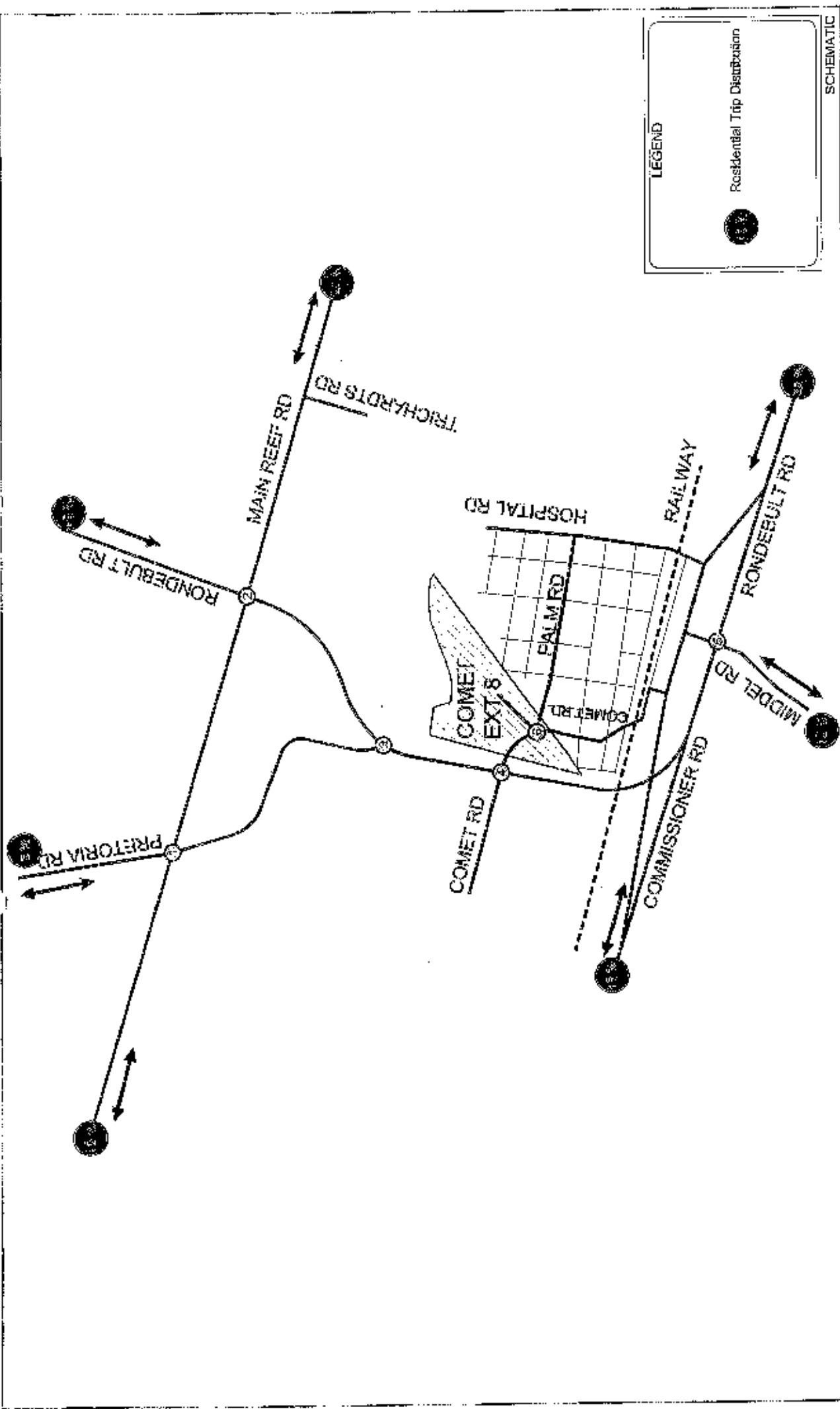
PROJECT



3a







**LEGEND**

● Residential Trip Distribution

SCHMATIC  
2278\_Traffic\_Figures.dwg

FIGURES

PROJECTIONS



Comet X3

Expected Trip Distribution

NUMBER

4a



PROJECT

DATE

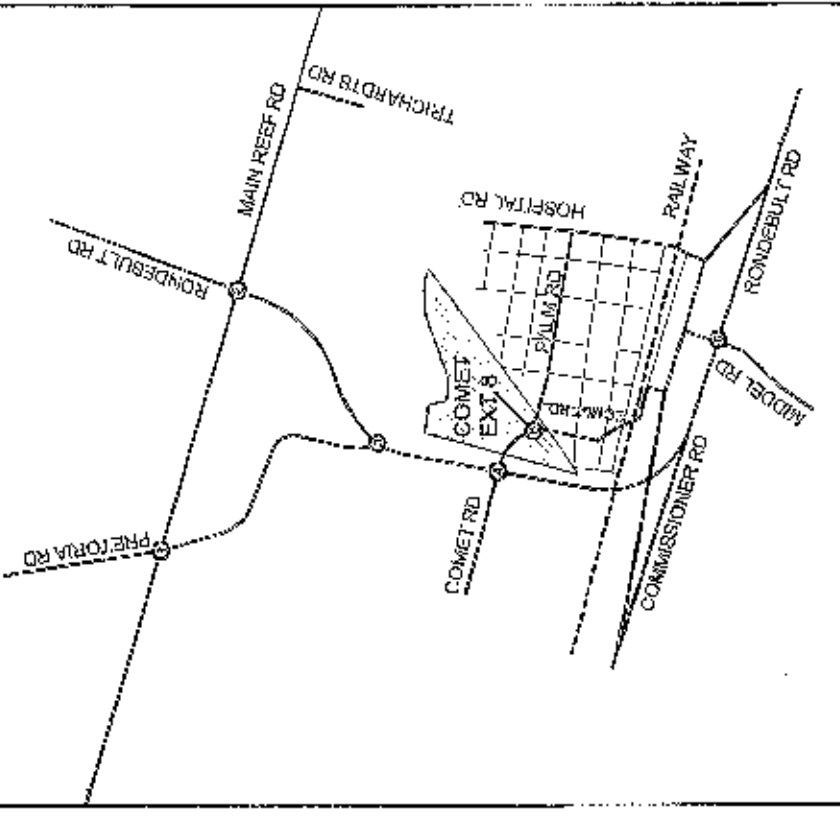
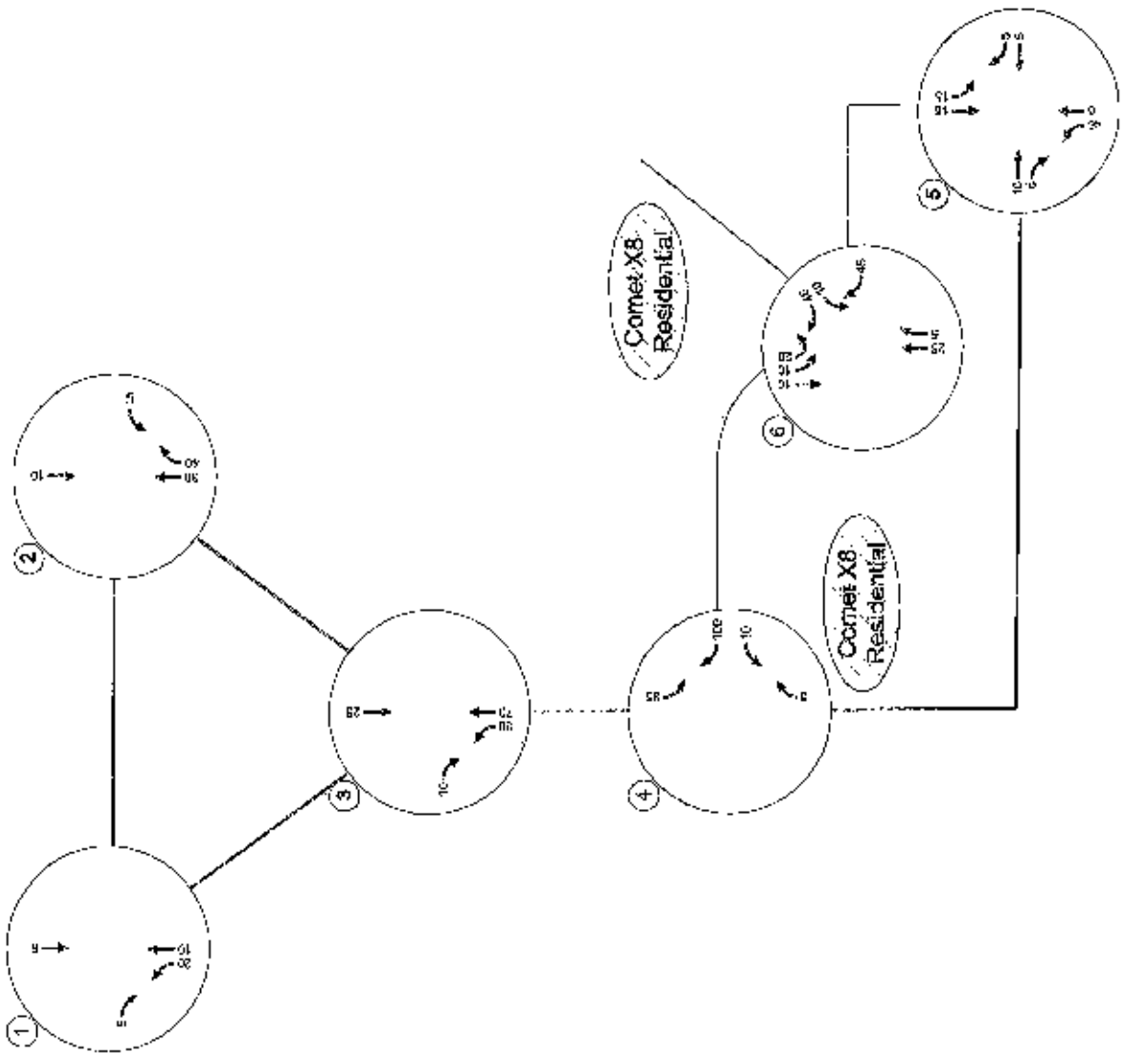
Comet X8

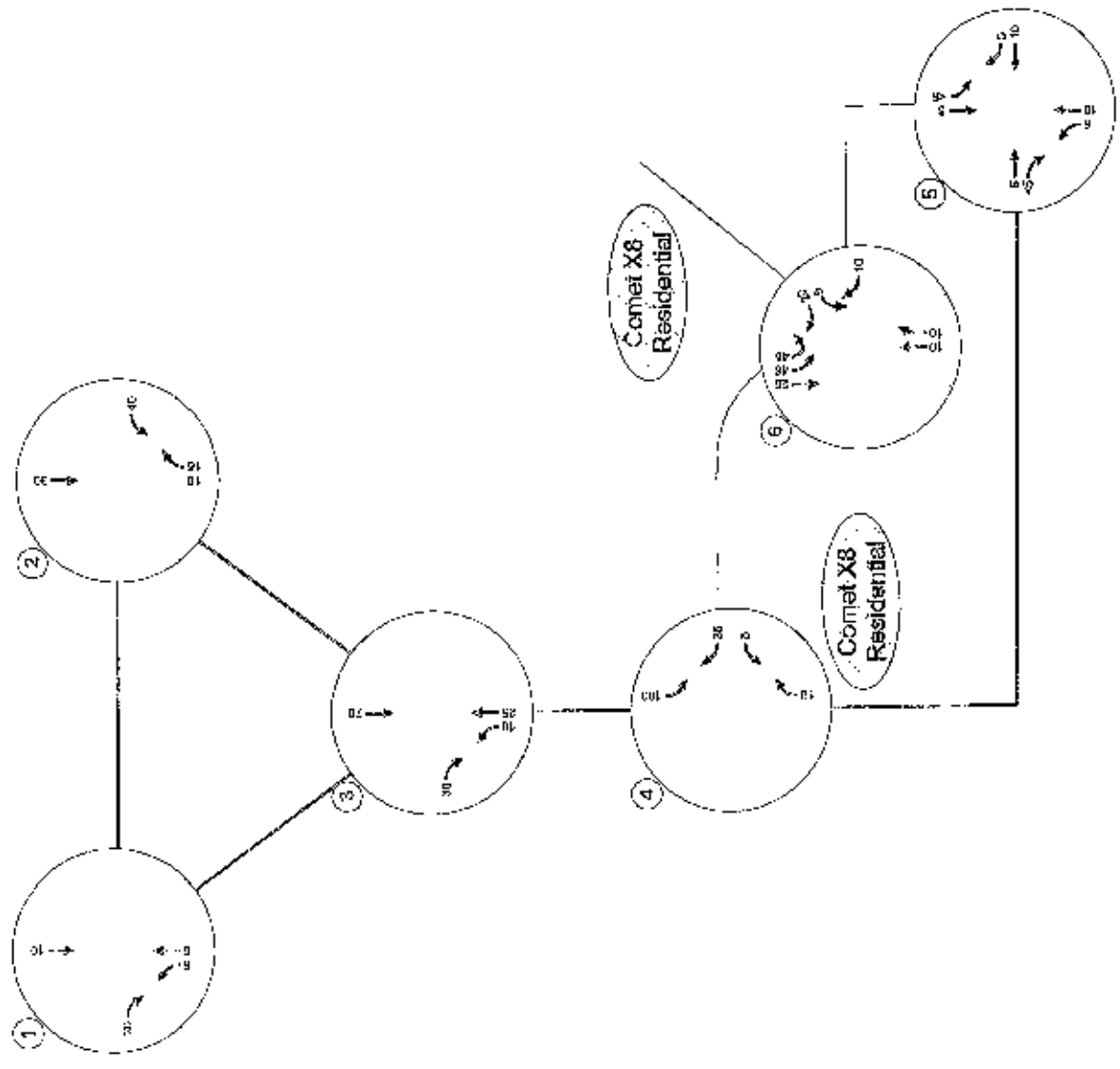
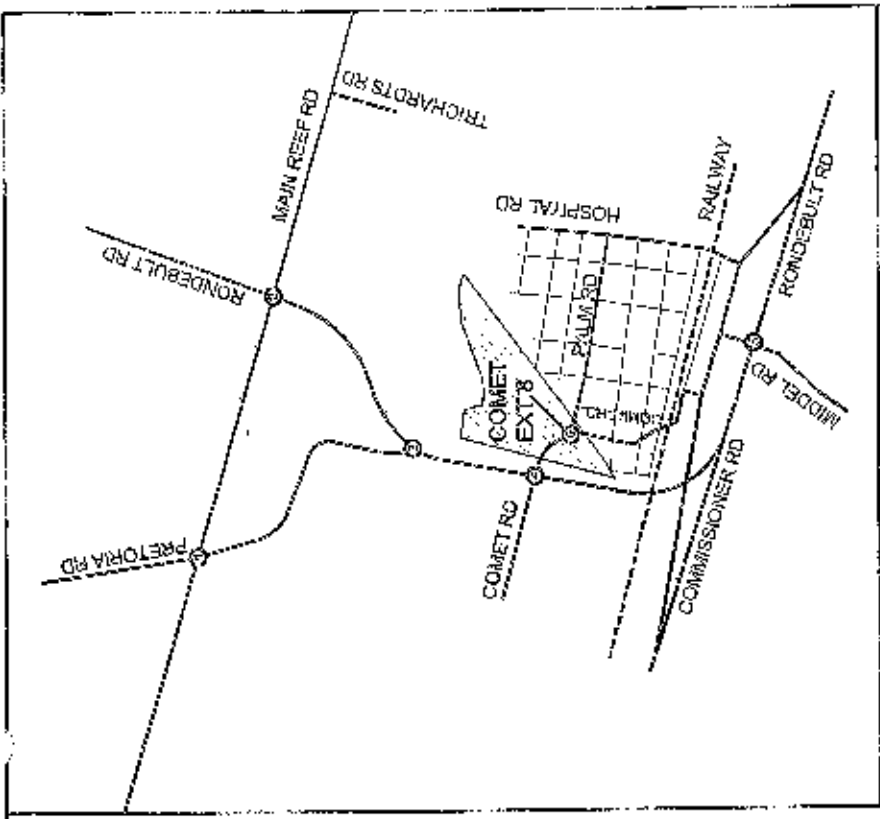
Trip Assignment  
AM Peak hour

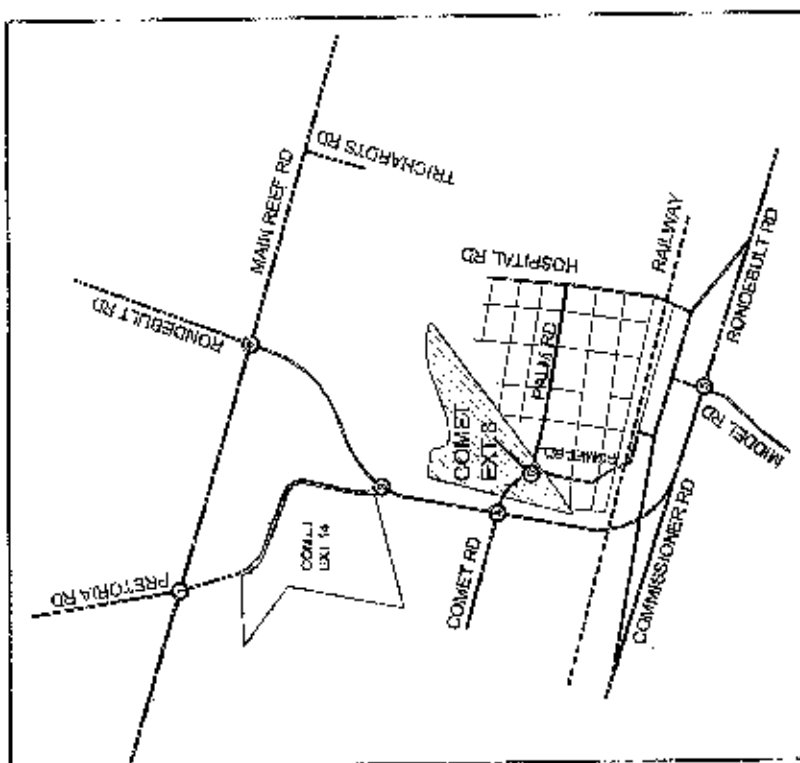
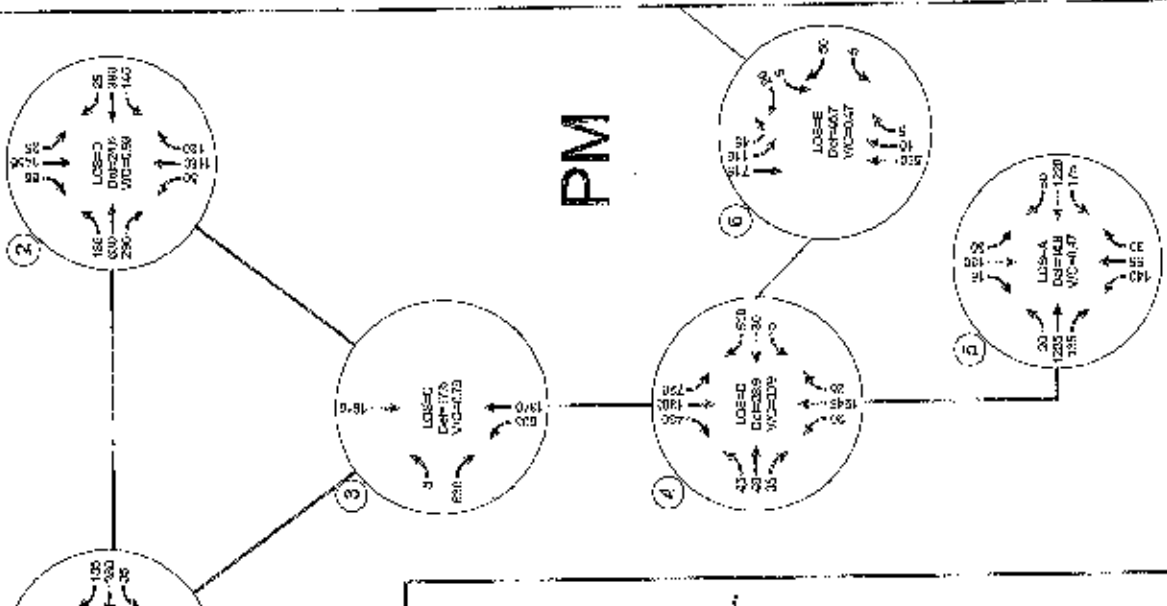
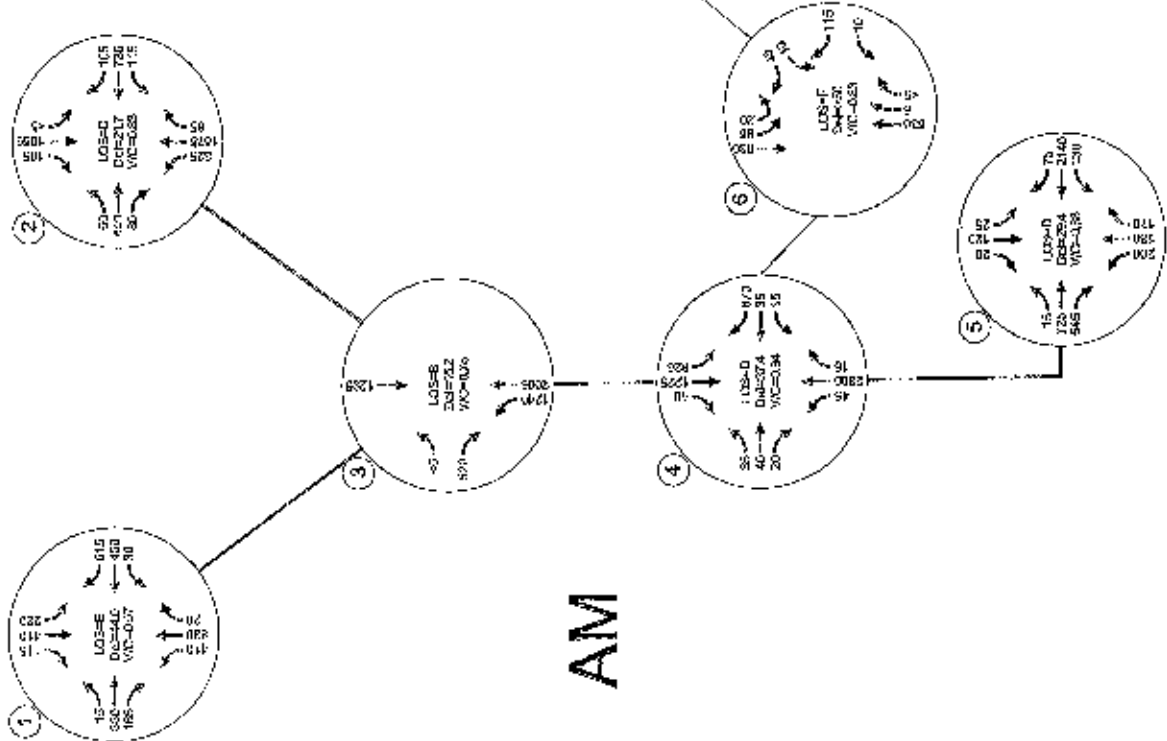
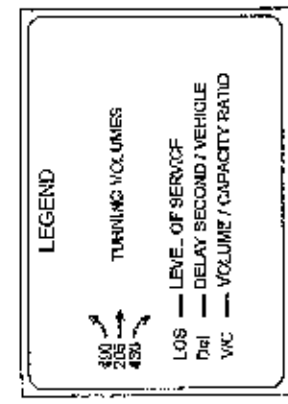
SCHEMATIC

2278.2\_Traffic\_Figure.dwg

4b





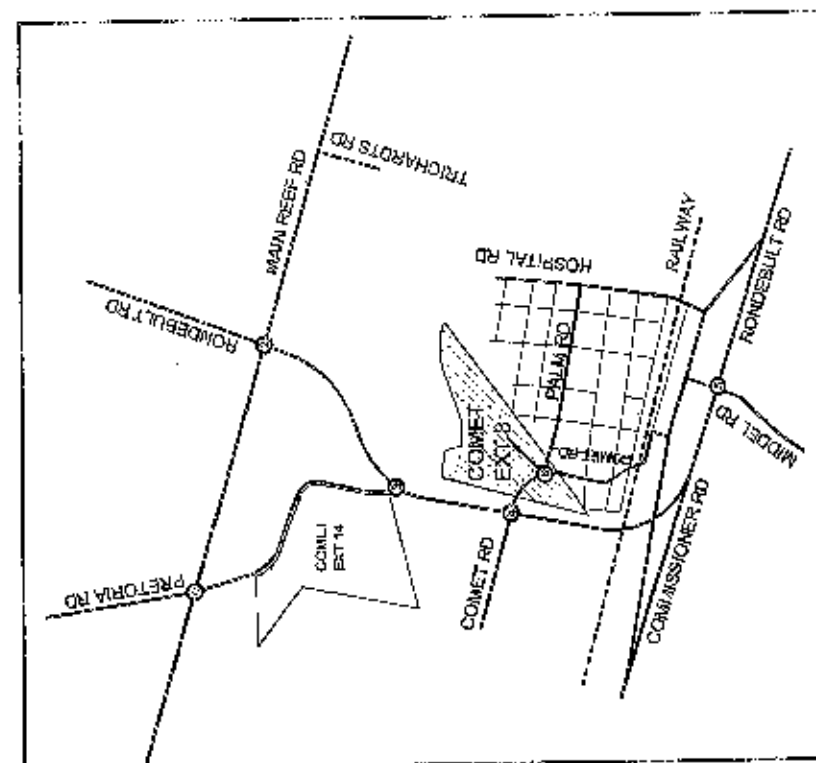
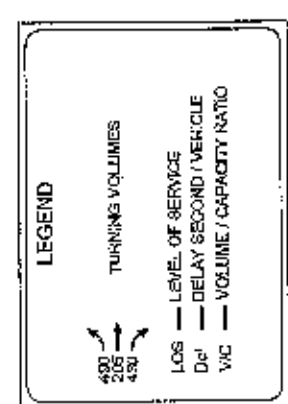
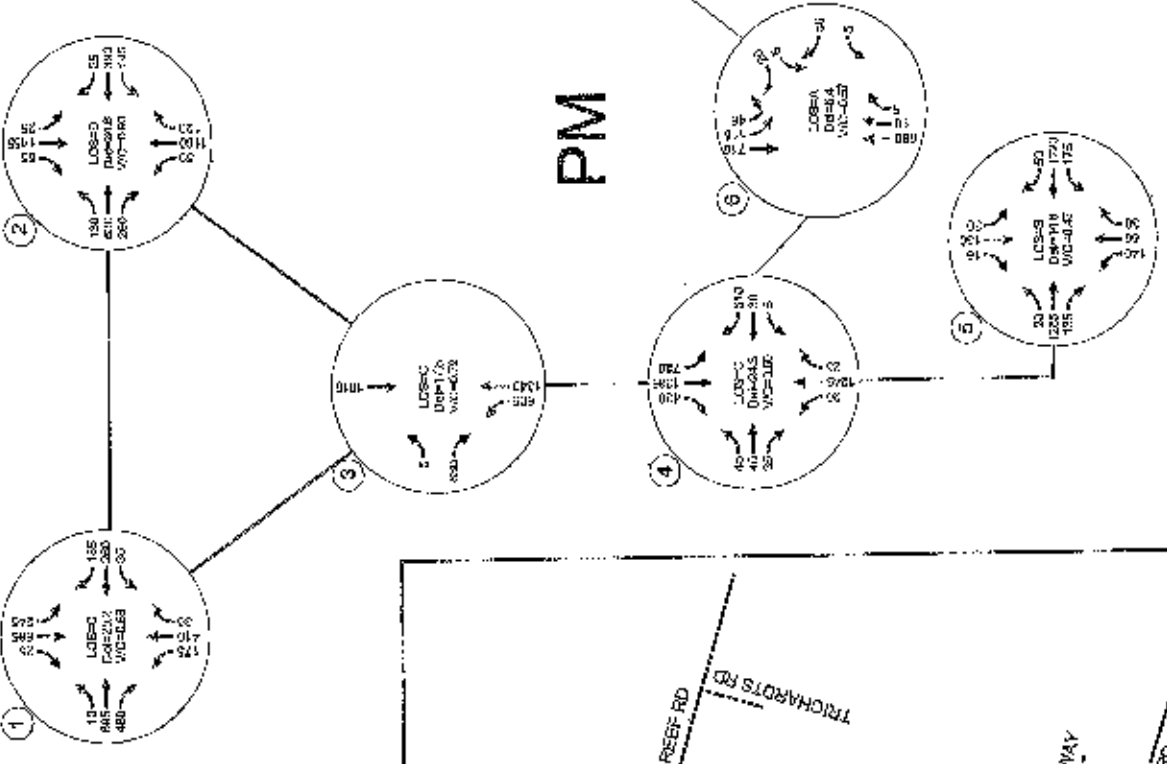
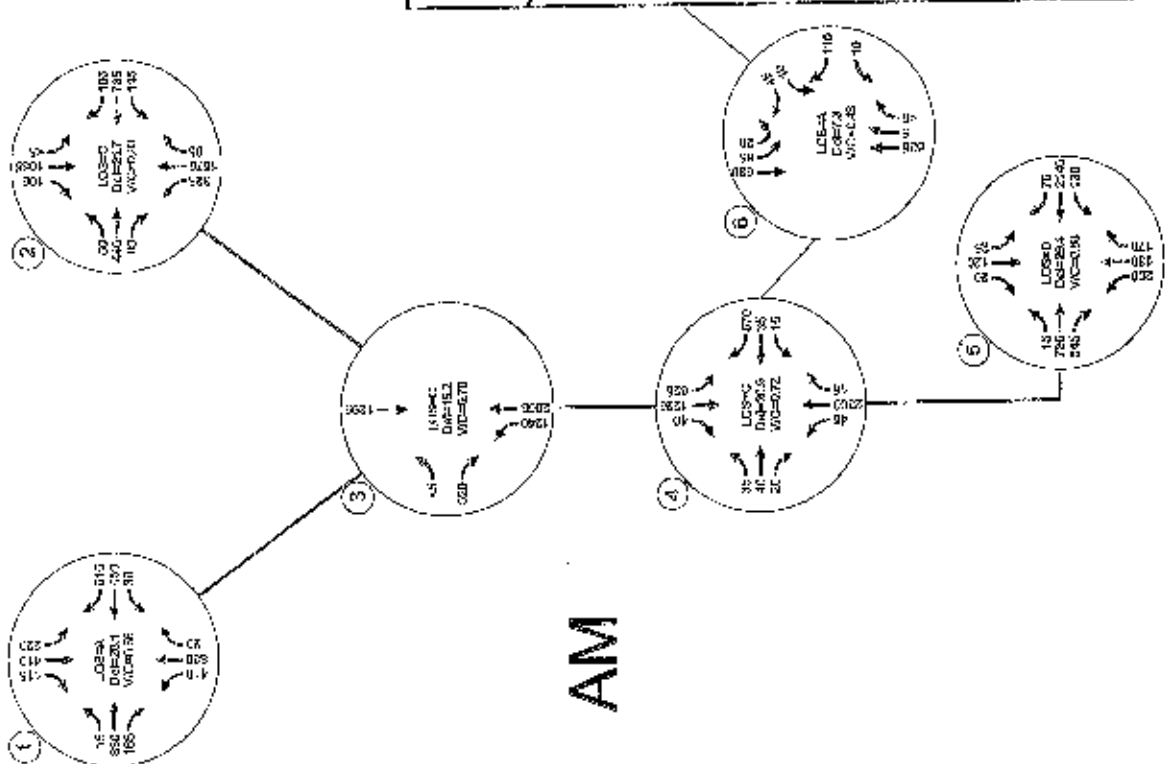


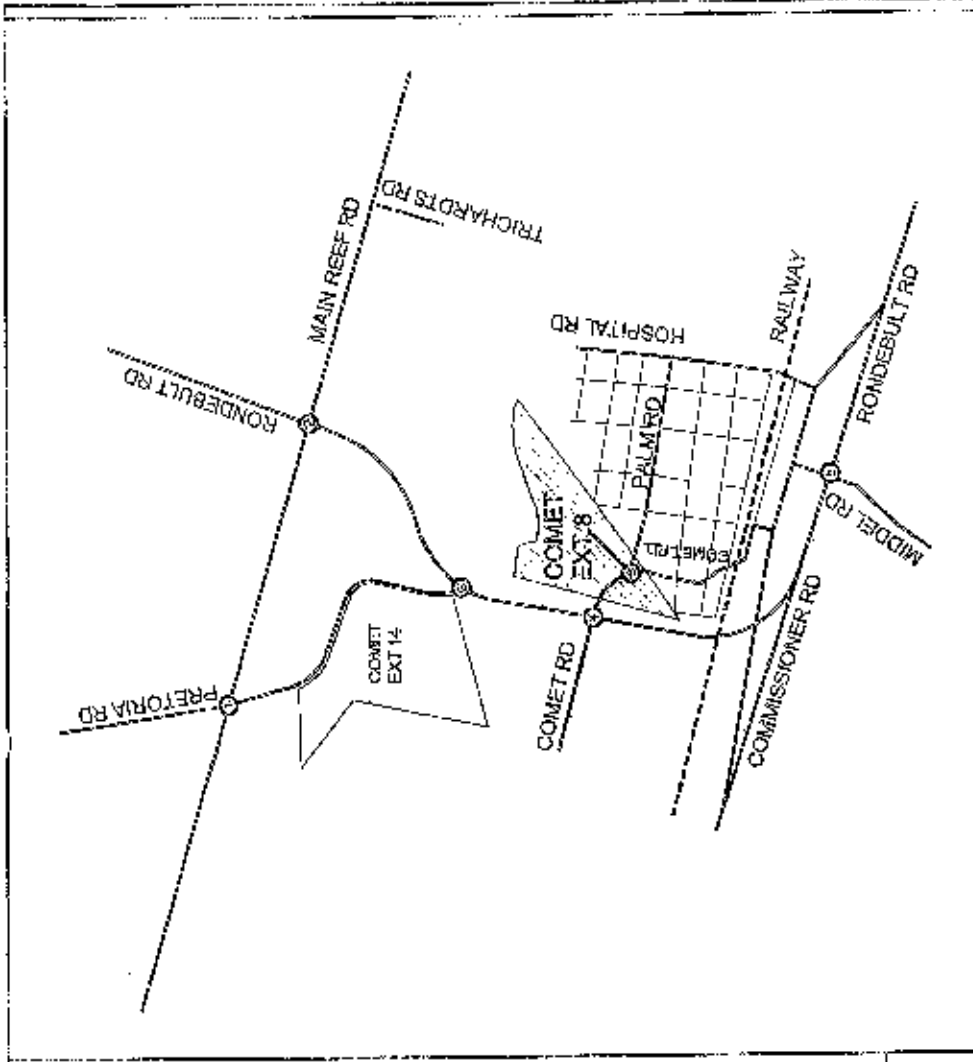
SCHEMATIC

2276.2 Traffic Figure.dwg

PROJECT:	Scenario 2: 2013 Traffic Volumes (Weekday AM & PM, Peak Hour) plus Latent Rights plus Development & Analysis Results	DATE:	5a
DRAWN:	Comet XS	CHECKED:	



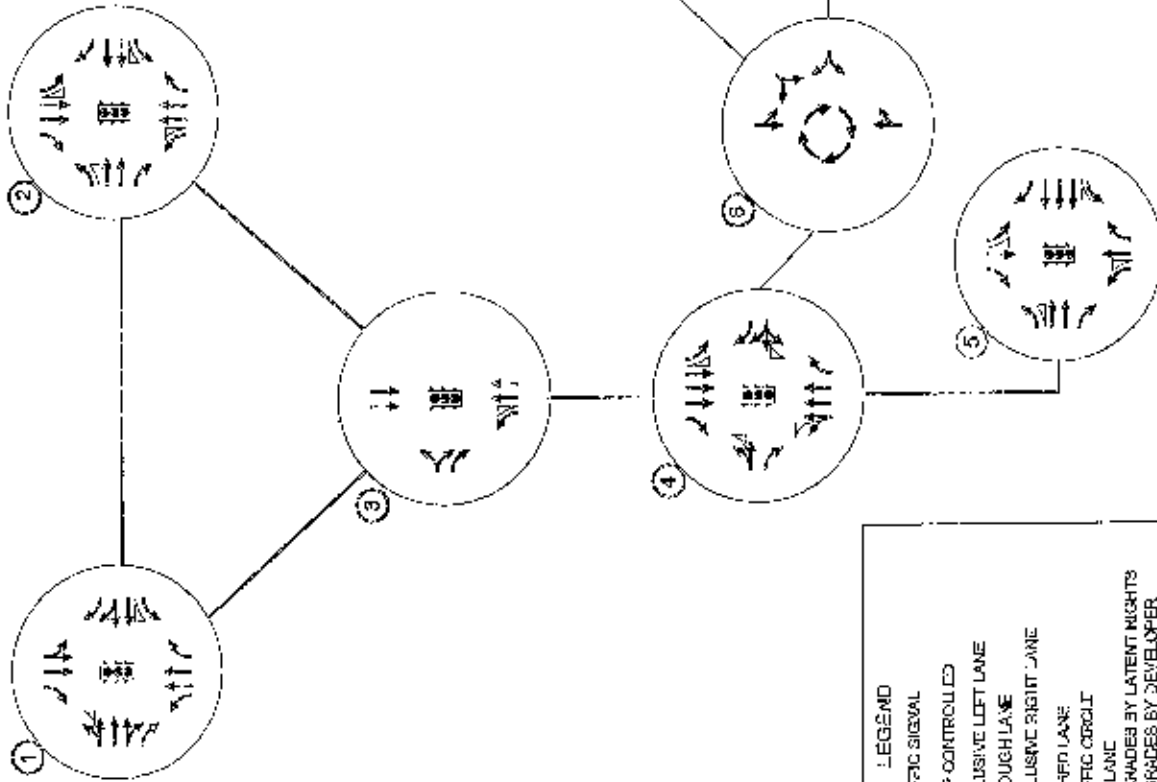




SCHEMATIC  
2278.2\_Traffic\_Figures.dwg  
00/00/00

Scenario 2: Proposed Intersection  
Geometry

5c



**LEGEND**

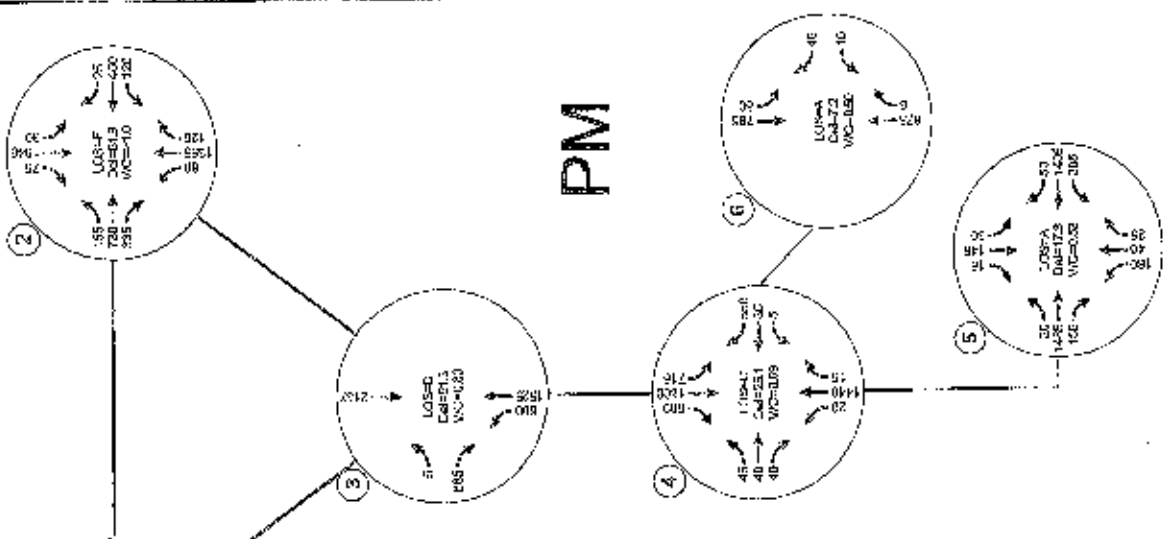
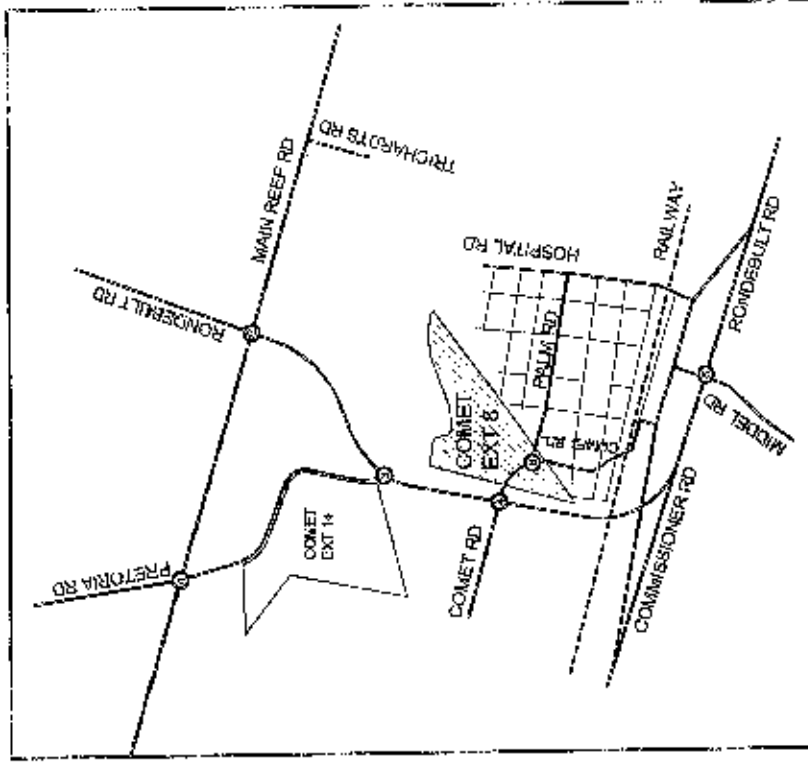
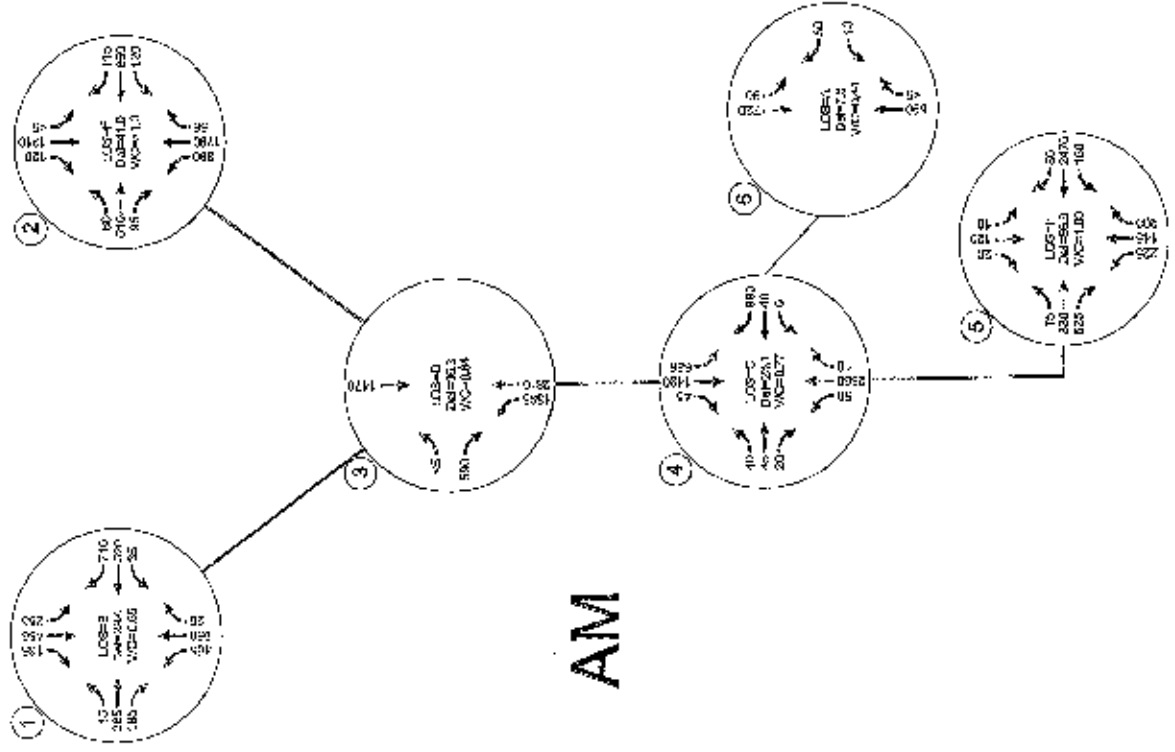
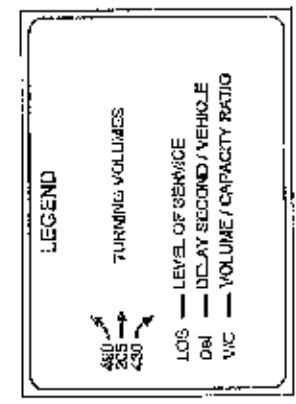
- TRAFFIC SIGNAL
- STOP CONTROLLED
- EXCLUSIVE LEFT LANE
- THROUGH LANE
- EXCLUSIVE RIGHT LANE
- SHARPO LANE
- TRAFFIC CIRCLE
- SLIP LANE
- UPGRADES BY LATENT RIGHTS
- UPGRADES BY DEVELOPER
- UPGRADES BY 'LATENT RIGHTS AND BACKGROUND

TRACING

Comet X5

Page: 01





SCHEMATIC: 227B.2 Traffic Figures.dwg

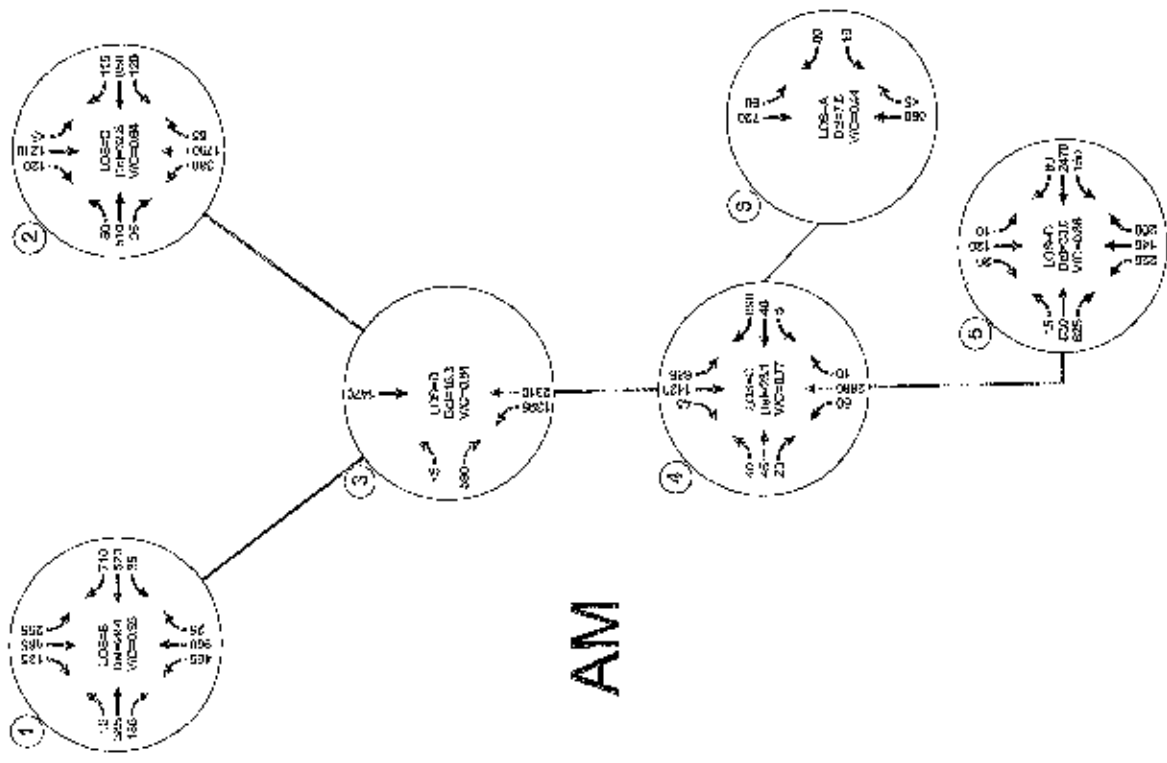
NUMBER: 6a

TRIP: Comet X8

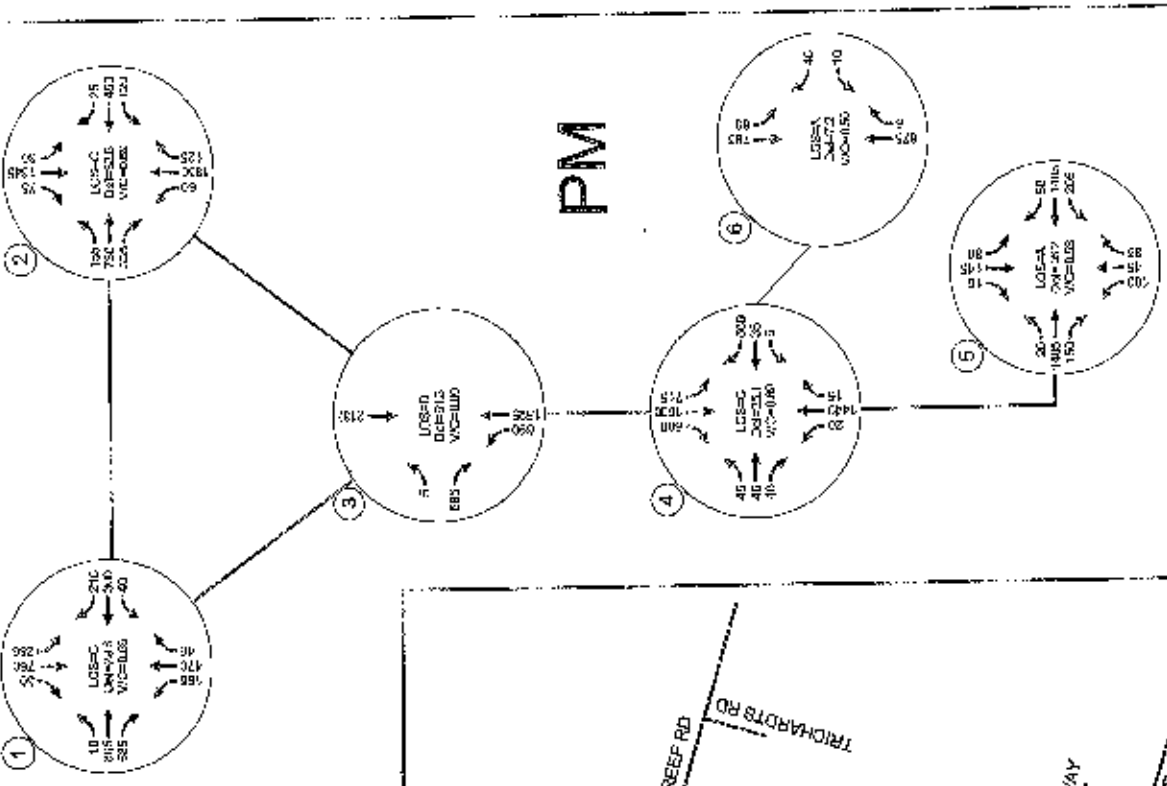
DATE: 01

Scenario 3: 2018 Future Traffic Volumes (AM & PM Peak Hour) with Latent Rights & Analysis Results





AM

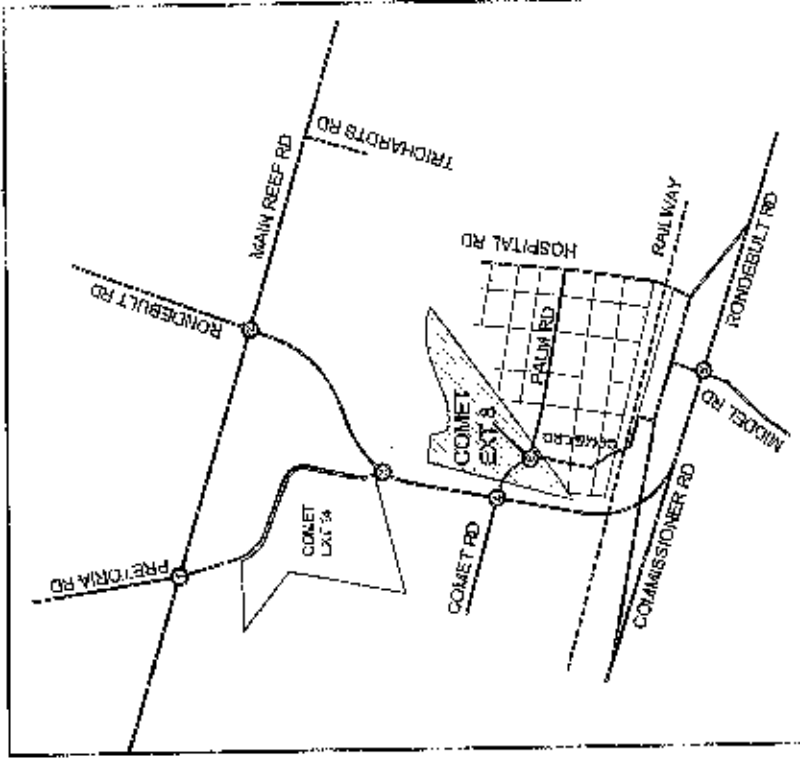


PM

**LEGEND**

TURNING VOLUMES  
 480  
 200  
 430

LOS — LEVEL OF SERVICE  
 Del — DELAY SECOND / VEHICLE  
 VIC — VOLUME / CAPACITY RATIO



SCHEMATIC  
 2278.2 Traffic Figure.dwg

Scenario 3u: 2018 Future Traffic Volumes (AM & PM Peak Hour) with Latent Rights including upgrades & Analysis Results

FIGURE

NUMBER

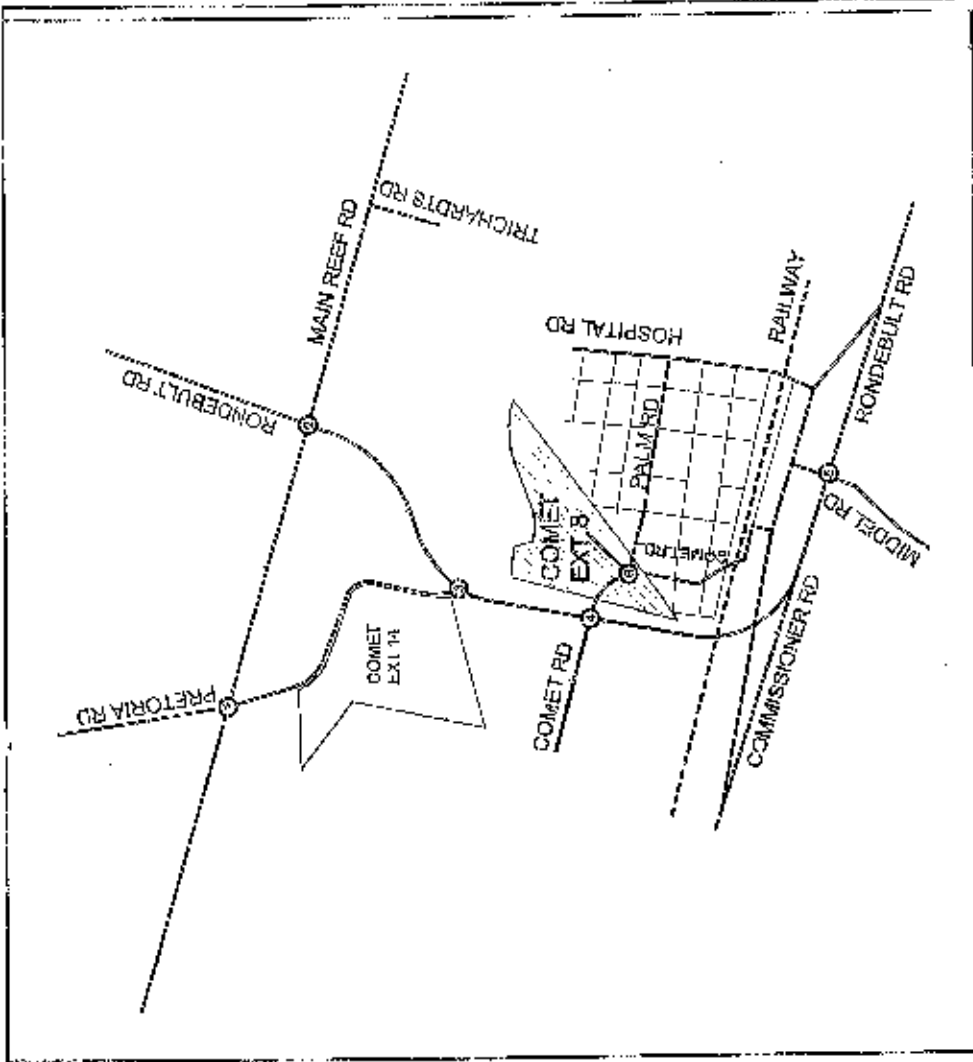
Comet X8

5b

FIGURE







SCHEMATIC

2276.2\_Traffic\_Figure.dwg

DATE

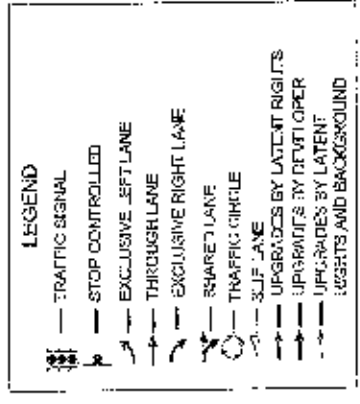
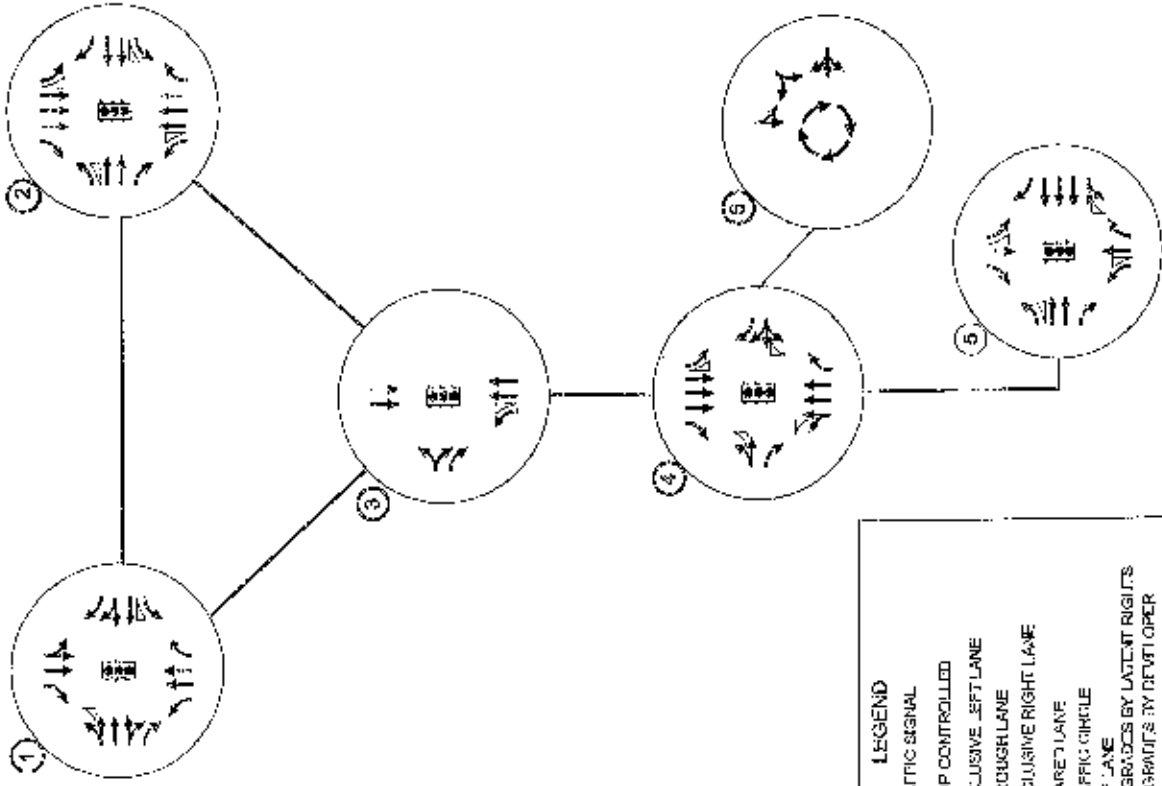
Scenario 3: Proposed Intersection  
Geometry

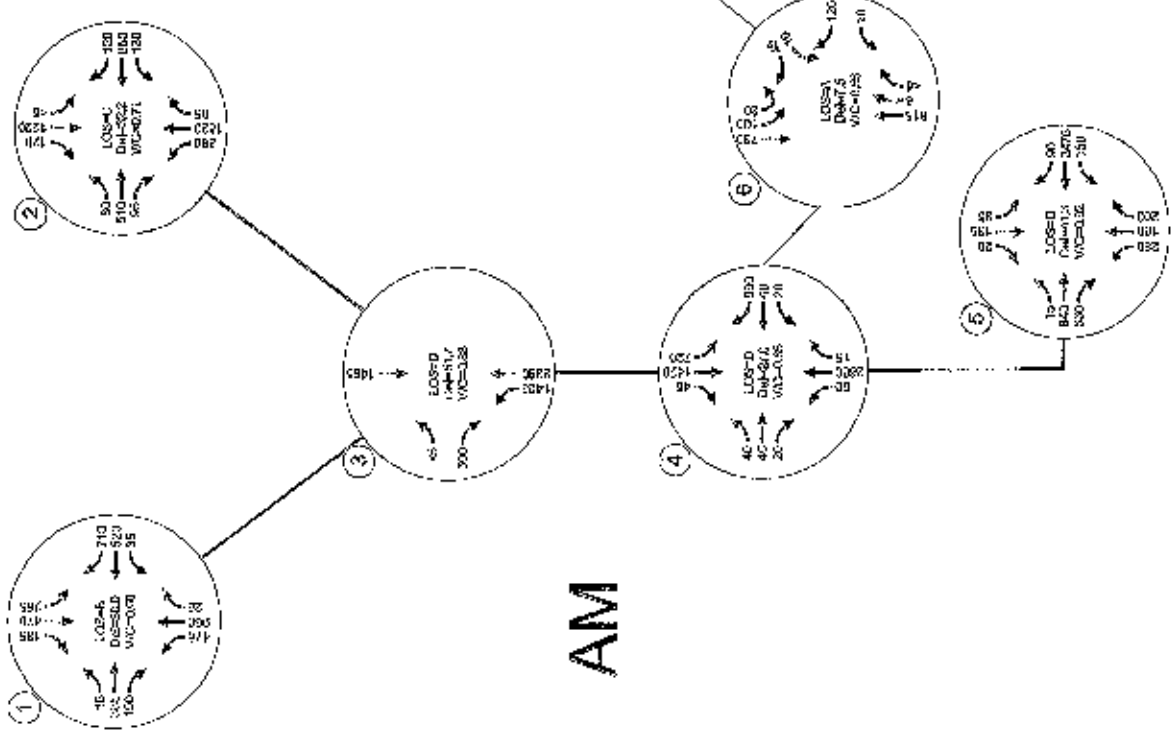
6C

FIGURE

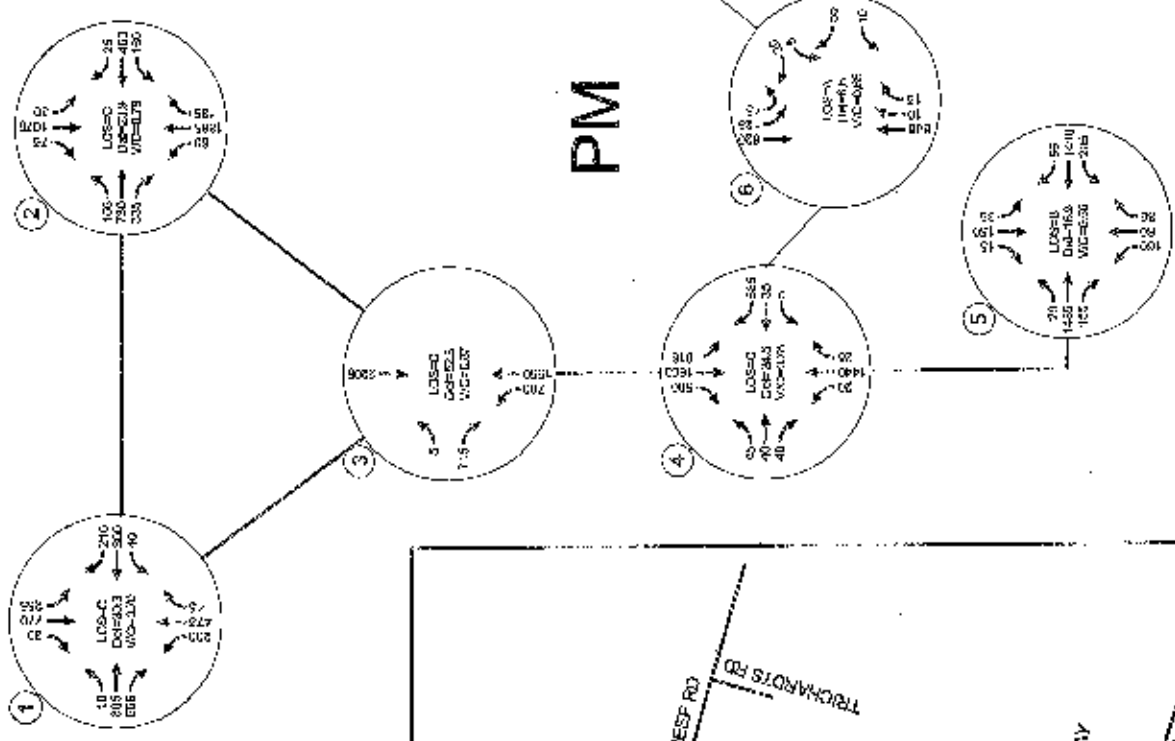
Comet X3

PROJECT

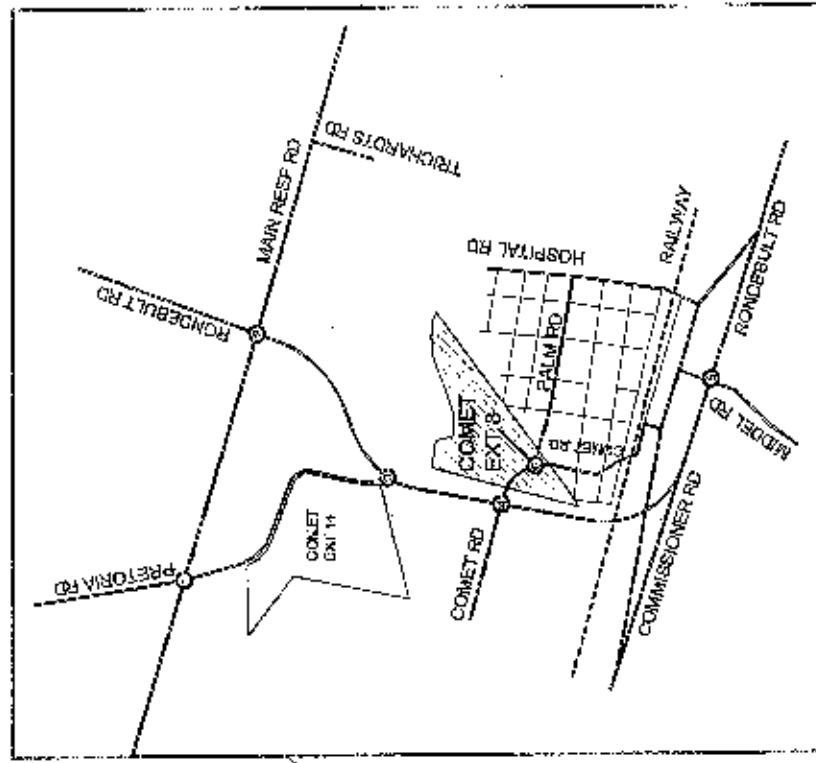
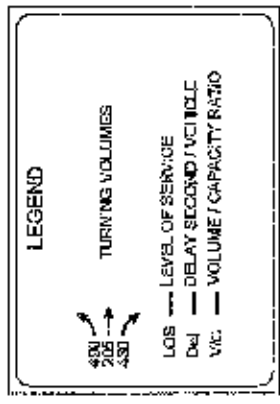




AM



PM



Comet X3

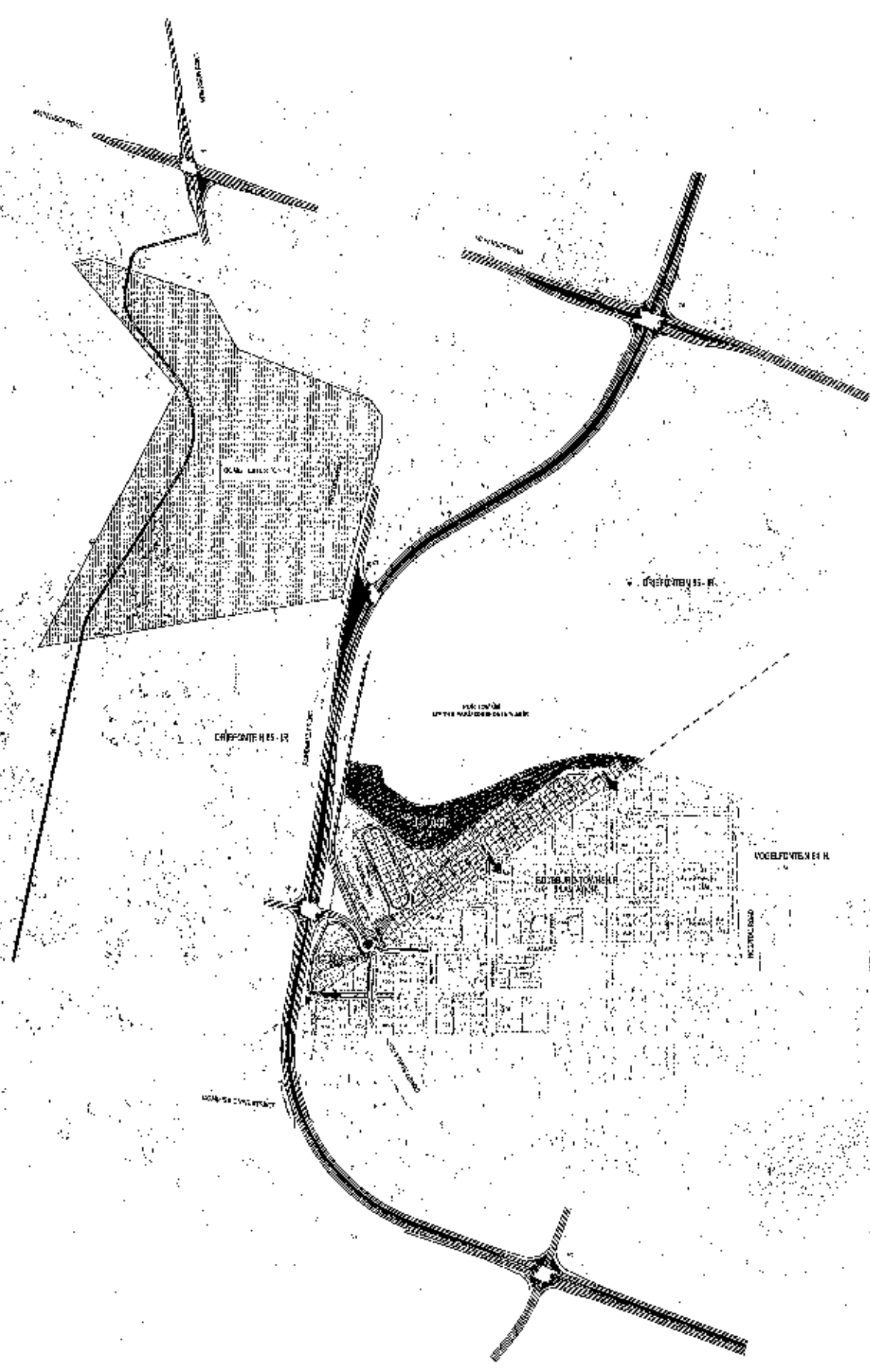
FIGURE

Scenario 4: 2018 Future Traffic Volumes (AM & PM Peak Hour) with Latent Rights plus Development & Analysis Results

SCHEMATIC  
 2276.2 Traffic Figures Only

NUMBER

7



AVAILABILITY OF ROAD RESERVE TO BE CLEAR LATER DURING DETAIL DESIGN OF ROAD UPGRADE

DATE: 10/15/2014  
 DRAWN BY: [Name]  
 CHECKED BY: [Name]

PROJECT: LOCAL LOTS  
 SHEET: 1 OF 1  
 SCALE: 1" = 100'

DATE: 10/15/2014  
 DRAWN BY: [Name]  
 CHECKED BY: [Name]

DATE: 10/15/2014  
 DRAWN BY: [Name]  
 CHECKED BY: [Name]

DATE: 10/15/2014  
 DRAWN BY: [Name]  
 CHECKED BY: [Name]

DATE: 10/15/2014  
 DRAWN BY: [Name]  
 CHECKED BY: [Name]

DATE: 10/15/2014  
 DRAWN BY: [Name]  
 CHECKED BY: [Name]

**Waterfall Investment Company**

10/15/2014

10/15/2014

**its**

10/15/2014

10/15/2014

**COMET EXTENTION 8  
(PORTION 406 OF THE FARM DRIEFONTEIN 85 IR)**

**APPENDIX C  
PROPOSED TOWNSHIP LAYOUT**

PROJECT: **PROPOSED TANGIER**  
**COMET EXTENSION 8**  
 3 LOTS OF PART OF PORTION 406 OF T.C.  
 OF THE TOWN OF BOKSBURG, N.S. 13  
 LOCAL AUTHORITY: BOKSBURG MUNICIPALITY  
 MUNICIPAL SYSTEM: M.S. 27



NO.	AREA	AREA	PERCENT	NO.	AREA	PERCENT
1	AREA 1	1.5	100	1	1.5	100
2	AREA 2	1.5	100	2	1.5	100
3	AREA 3	1.5	100	3	1.5	100
4	AREA 4	1.5	100	4	1.5	100
5	AREA 5	1.5	100	5	1.5	100
6	AREA 6	1.5	100	6	1.5	100
7	AREA 7	1.5	100	7	1.5	100
8	AREA 8	1.5	100	8	1.5	100
9	AREA 9	1.5	100	9	1.5	100
10	AREA 10	1.5	100	10	1.5	100

DATE OF PLAN: 12/15/2007  
 DRAWN BY: [Signature]  
 CHECKED BY: [Signature]  
 APPROVED BY: [Signature]

SCALE: 1:2,500  
 DRAWING NO: Comet85-IR  
 C1205-02-10  
 PARTIAL PLAN VIA US  
 CIRCULATION

**REMARKS:**

1. THE PLAN IS FOR THE PROPOSED TANGIER PROJECT.
2. THE PLAN IS FOR THE PROPOSED TANGIER PROJECT.
3. THE PLAN IS FOR THE PROPOSED TANGIER PROJECT.
4. THE PLAN IS FOR THE PROPOSED TANGIER PROJECT.
5. THE PLAN IS FOR THE PROPOSED TANGIER PROJECT.
6. THE PLAN IS FOR THE PROPOSED TANGIER PROJECT.
7. THE PLAN IS FOR THE PROPOSED TANGIER PROJECT.
8. THE PLAN IS FOR THE PROPOSED TANGIER PROJECT.
9. THE PLAN IS FOR THE PROPOSED TANGIER PROJECT.
10. THE PLAN IS FOR THE PROPOSED TANGIER PROJECT.

DATE: 12/15/2007  
 DRAWN BY: [Signature]  
 CHECKED BY: [Signature]  
 APPROVED BY: [Signature]

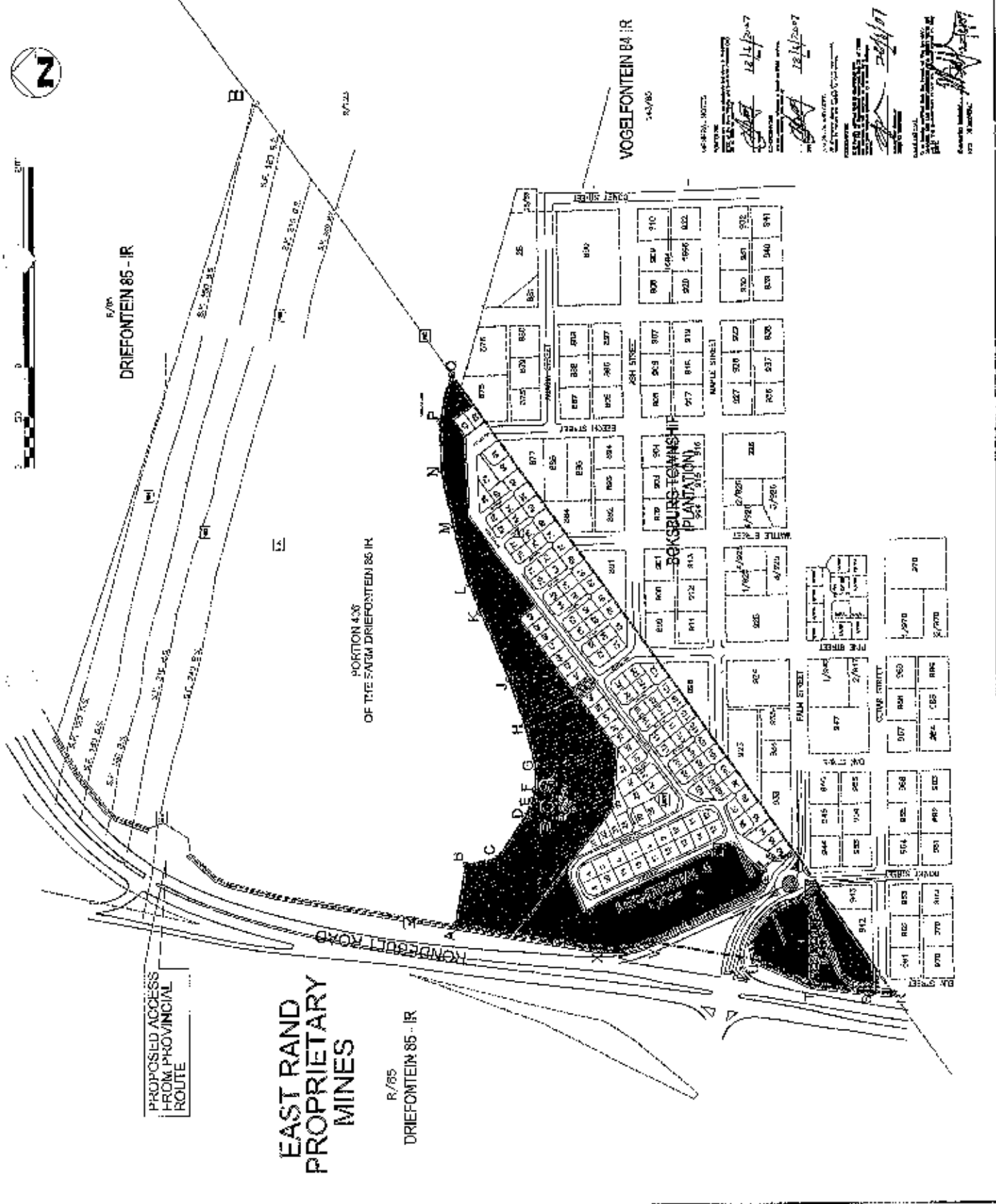


5/00  
**DRIEFONTEIN 85-IR**

PORTION 406  
 OF THE TOWN DRIEFONTEIN 85-IR

**VOGELFONTEIN 84-IR**  
 145/85

**BOKSBURG TOWNSHIP  
 PLANTATION**



**EAST RAND  
 PROPRIETARY  
 MINES**

R/85  
**DRIEFONTEIN 85-IR**

12/15/2007  
 12/15/2007  
 [Signatures and stamps]

**COMET EXTENTION 8  
(PORTION 406 OF THE FARM DRIEFONTEIN 85 IR)**

**APPENDIX D  
PREVIOUS COMMENTS**



**Ekurhuleni**  
METROPOLITAN MUNICIPALITY

Messrs Kwezi V3 Engineers  
P O Box 36155  
MENLO PARK  
0102

Fax No : (012) 426 6300

Attention : Mr J.G Zandberg

Enquiries : Johann Marx  
Tel : (011) 874 8871  
Fax : (011) 874 8682  
Our ref : 15/3/3 (JM 11.24)  
Date : 07 January 2009

**Regional Office: South**

Infrastructure Services:  
Roads, Transport & Civil Works  
SAAME Building  
c/o Queen & Spillbury Street  
GERMISTON

P O Box 146  
GERMISTON  
1400

Tel : +(2711) 874-7811  
Fax : +(2711) 874-8682  
[www.ekurhuleni.com](http://www.ekurhuleni.com)

Dear Sir

**SERVICES REPORT FOR THE PROPOSED DEVELOPMENT COMET EXTENSION 8**

Your letter, 219270 dated 29 October 2008, has reference.

Kindly, however, take note that Rondebuit Road (K 90) was constructed entirely by the erstwhile Boksburg City Council and therefore belongs to Ekurhuleni Metropolitan Municipality and not Gautrans as mentioned in your report. Similarly the maintenance of Main Reef Road was carried over to Council by Gautrans long ago.


Your proposal to do the construction according to Gautrans standards is however acceptable.

This Directorate would like to have the impact of this development on Rietfontein/Pretoria to the north of the development up to the N12 Freeway and Rondebuit Road to the south of the development to the N17 Freeway modelled and the improvement that need to be done to improve the level of service pointed out in order to plan and budget therefor.

It is incomprehensible why the improvements to the Rondebuit/Middle Road intersection are necessary and this Directorate wishes to know what impact this Development will have on Comet Road South.

It is further difficult to understand the reasoning for the widening of Rondebuit between intersections 3 and 4 only. Why is it not necessary to widen Rondebuit Road beyond these two intersections?. Further comment will be given on receipt of an amended report.

Yours faithfully

  
G J STRYDOM (Pr Eng)  
REGIONAL DIRECTOR: SOUTH  
INFRASTRUCTURE SERVICES:  
ROADS, TRANSPORT AND CIVIL WORKS  
/mr



**Ekurhuleni**  
METROPOLITAN MUNICIPALITY

**Regional Office: South**

Infrastructure Services:  
Roads, Transport & Civil Works  
SAAPE Building  
c/o Queen & Spilisbury Street  
GERMISTON

P O Box 145  
GERMISTON  
1400

Tel : +(2711) 871-7811  
Fax : +(2711) 874-0032  
[www.ekurhuleni.com](http://www.ekurhuleni.com)

Messrs ITS  
29 De Havilland Crescent  
Pro Park  
Building 1  
PERSEQUOR PARK  
0020

**Attention: Dr P Pretorius**

**Fax: 012 349 1665**

Enquiries : Rethabile Rapiletsa  
Tel : 011 8746628  
Fax : 011 8746682  
Our ref : 17/5/3/3 (RR 11,278)  
Date : 11 December 2008

Dear Sirs

**TRAFFIC IMPACT STUDY (REVISION 1): COMET EXTENSION 8**

Your report dated September 2008 has reference.

The contents of the traffic impact study for the proposed Comet Extension 8 is found to be in order, but this Directorate would have expected to have the Main Reef / Trichardts Intersection modelled as well.

Please update the study in this regard, for submission and further comments and/or approval by this Directorate.

Yours faithfully

  
**G J STRYDOM (Pr Eng)**  
**REGIONAL DIRECTOR: SOUTH**  
**INFRASTRUCTURE SERVICES:**  
**ROADS, TRANSPORT AND CIVIL WORKS**

Copy: Urban Dynamics  
Attention: D Van Der Merwe  
Fax: 011 482 4131



## REFERENCES

- Department of Transport, *South African Trip Generation Rates Manual*
- Institute of Transportation Engineers. *Trip Generation, 8<sup>th</sup> Edition. 2008.*
- Transportation Research Board. *Highway Capacity Manual, 2010*



**WorleyParsons**

resources & energy

EcoNomics

WATERFALL MANAGEMENT COMPANY

SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 8

---

## **Appendix 4 – Roads and Stormwater Drainage Plan**





**WorleyParsons**

resources & energy

EcoNomics

WATERFALL MANAGEMENT COMPANY

SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 8

---

## **Appendix 5 – Ekurhuleni Response: Water & Sewer**

# Memorandum



**Ekurhuleni**  
METROPOLITAN MUNICIPALITY

## Northern SDR

**To:** Kwezi V3 Engineers  
P O Box 36155  
Menlo Park  
0102

**Infrastructure Services**

**Our Ref:** 15/3/3 D5 DRFN  
**Your Ref:**  
**Tell:** (012) 425 6300  
**Fax:** (012) 460 1336

*Water Services*

Cnr CR Swart Drive and Pretoria Road  
**Kempton Park, 1620**

**From:** **INFRASTRUCTURE SERVICES**  
*Water Services*  
*(Northern Service Delivery Region)*

PO Box 13  
**Kempton Park, 1620**

**Tel:** (011) 398 2064  
**Fax:** (011) 394 9949

**E-mail:** [nagema@ekurhuleni.com](mailto:nagema@ekurhuleni.com)

[www.ekurhuleni.com](http://www.ekurhuleni.com)

**Date:** 03 July 2007

**SUBJECT: WATER AND SEWER SERVICES REQUEST ON PORTION 406 OF THE FARM DRIEFONTEIN 85 IR : COMMENTS**

Your letter regarding the servicing of the above mentioned development, dated 19 June 2007, refer.

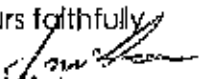
With respect to the provision of sewer and water engineering services to the above township, this Department wishes to make the following comments:

- Please note that this Department's Draft Design Specifications have to be adhered to (copies are available from this Department on request). You are advised to acquaint yourself with the contents of the document before construction commences.
- Only one connection to the existing 600 mm diameter water main located on the western boundary of the
- K90 will be maid available for the development as indicated.
- The static pressure of the connection point is  $\pm 40m$ .
- The water network has the capacity to supply the proposed development.
- As indicated on the attached plan, the sewer connection will be maid available on the existing sewer network as and when required.
- Please contact GLS to determine if the existing sewer network has the capacity to accommodate the sewer flows.
- The Developer will be responsible for providing or upgrading the necessary external and internal water- and sewer services, to service the each stand of the proposed township, to the satisfaction of this Department.
- The design and site supervision of the said services has to be done by a registered professional Civil Engineer, and has to be according to this Department's design specifications and requirements.
- Design drawings have to be submitted to this Department for approval prior to commencement of construction.

- After completion of the construction, the maintenance and operation of the services will be taken over by this Department.
- The cost of providing water and sewer services to the proposed development (as described above) will be for the account of the applicant.
- Only after the above have been complied with will the relevant certificates be issued.
- Please be advised that no bulk services contributions in respect of water and sewer are required.

It is trusted that the above meets with your approval. For any enquiries, Gwen Madiseng from this department (telephone number 398 2154) can be contacted.

Yours faithfully



MR J. McLean

**ACTING SENIOR PROJECT MANAGER: WATER SERVICES (NORTHERN SERVICE DELIVERY REGION)**

**Cc. Chief Area Engineer: Edenvale SDA**



**WorleyParsons**

resources & energy

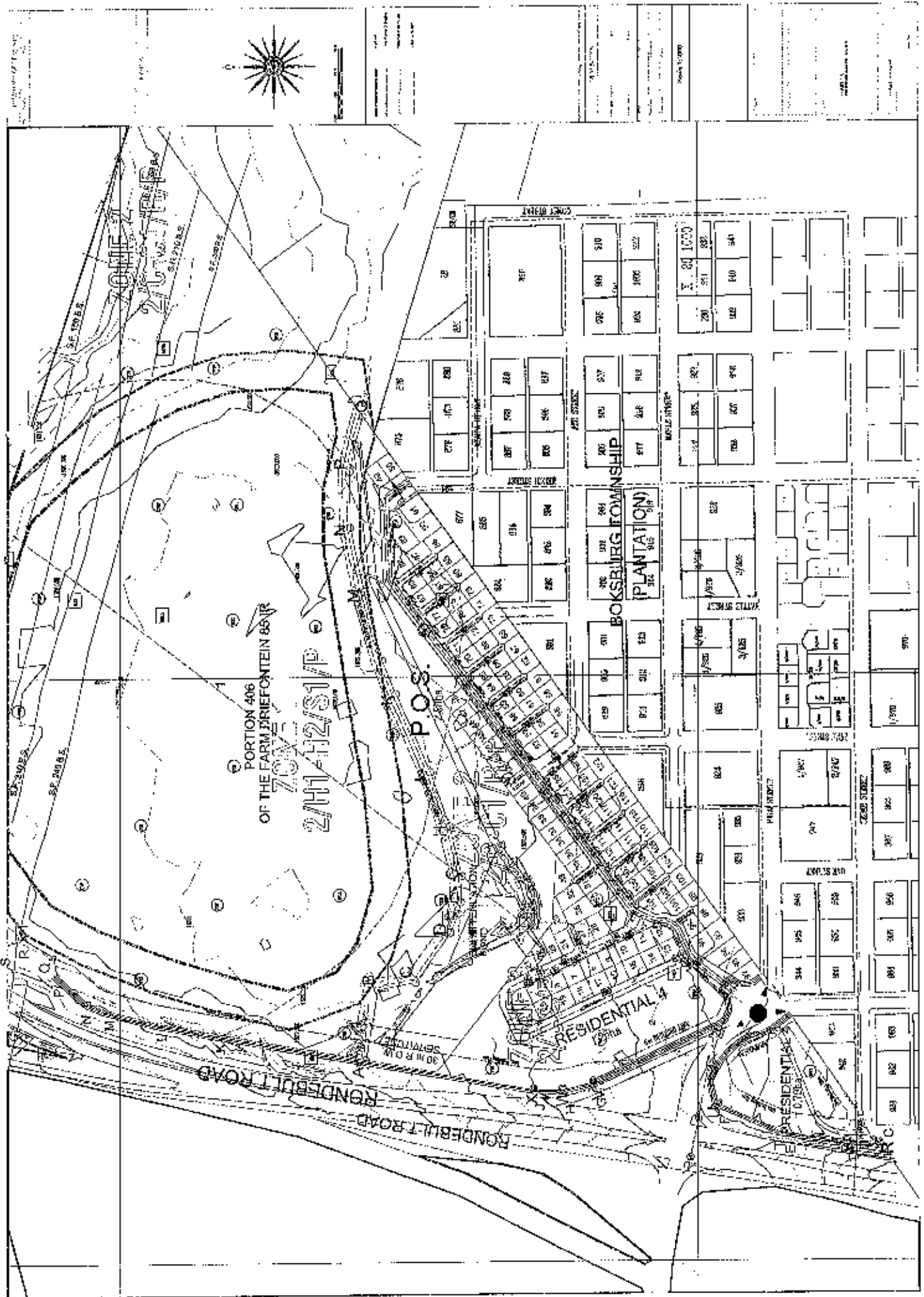
EcoNomics

WATERFALL MANAGEMENT COMPANY

SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 3

---

## Appendix 6 – Proposed Water Layout



Scale 1:5000  
Date of Issue: 1/1/2010  
Drawing No: 1/1/2010/1/1/2010

Parcel No.	Area (sqm)	Owner
101	1000	...
102	1000	...
103	1000	...
104	1000	...
105	1000	...
106	1000	...
107	1000	...
108	1000	...
109	1000	...
110	1000	...
111	1000	...
112	1000	...
113	1000	...
114	1000	...
115	1000	...
116	1000	...
117	1000	...
118	1000	...
119	1000	...
120	1000	...
121	1000	...
122	1000	...
123	1000	...
124	1000	...
125	1000	...
126	1000	...
127	1000	...
128	1000	...
129	1000	...
130	1000	...
131	1000	...
132	1000	...
133	1000	...
134	1000	...
135	1000	...
136	1000	...
137	1000	...
138	1000	...
139	1000	...
140	1000	...
141	1000	...
142	1000	...
143	1000	...
144	1000	...
145	1000	...
146	1000	...
147	1000	...
148	1000	...
149	1000	...
150	1000	...
151	1000	...
152	1000	...
153	1000	...
154	1000	...
155	1000	...
156	1000	...
157	1000	...
158	1000	...
159	1000	...
160	1000	...
161	1000	...
162	1000	...
163	1000	...
164	1000	...
165	1000	...
166	1000	...
167	1000	...
168	1000	...
169	1000	...
170	1000	...
171	1000	...
172	1000	...
173	1000	...
174	1000	...
175	1000	...
176	1000	...
177	1000	...
178	1000	...
179	1000	...
180	1000	...
181	1000	...
182	1000	...
183	1000	...
184	1000	...
185	1000	...
186	1000	...
187	1000	...
188	1000	...
189	1000	...
190	1000	...
191	1000	...
192	1000	...
193	1000	...
194	1000	...
195	1000	...
196	1000	...
197	1000	...
198	1000	...
199	1000	...
200	1000	...

PORTION 406  
OF THE FARM BIRIEFONTAIN 851R

ZONING ZONE 2/H/42/S1/P

POS

RESIDENTIAL 4

BOKSBERG TOWNSHIP  
(PLANTATION)

RONDIBULT ROAD

ROAD

ROAD

C.C.





**WorleyParsons**

resources & energy

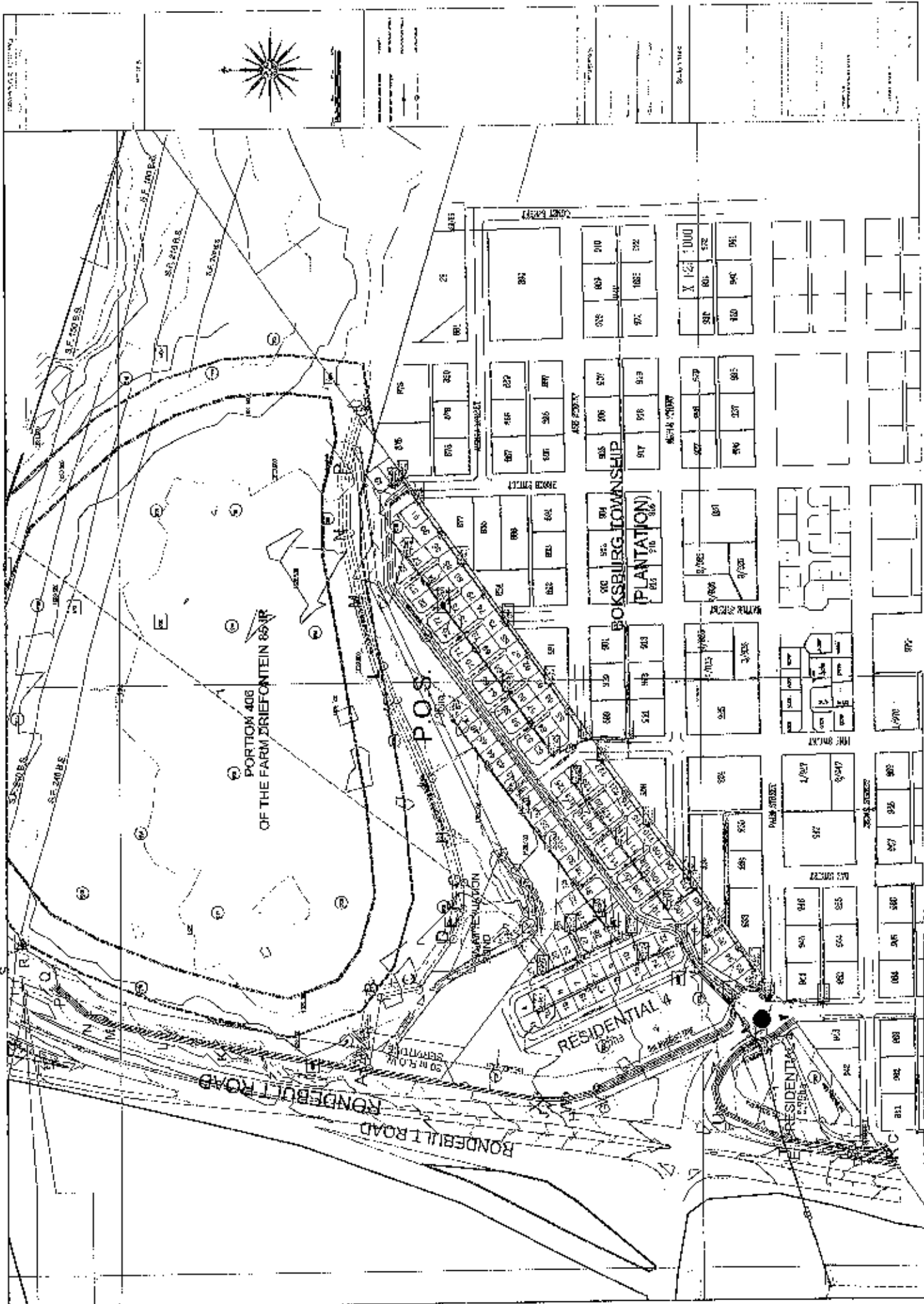
EcoNomics

WATERFALL MANAGEMENT COMPANY

SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 6

---

## **Appendix 7 – Proposed Sewer Network**





**WorleyParsons**

resources & energy

EcoNomics

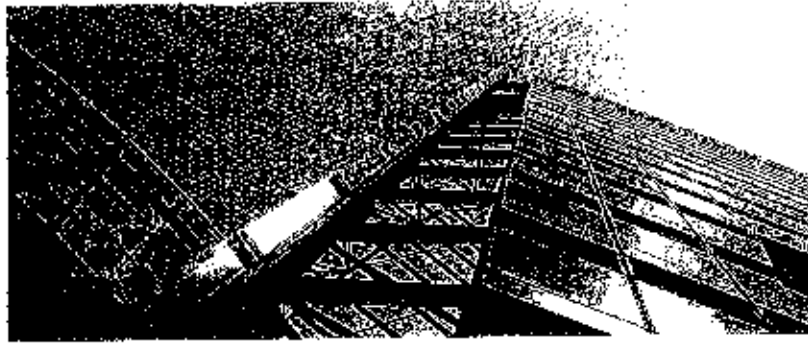
WATERFALL MANAGEMENT COMPANY

SERVICES REPORT FOR THE DEVELOPMENT KNOWN AS COMET EXTENSION 8

---

## **Appendix 8 – Proposed Electrical Services**

# MOTLA



**ELECTRICAL ENGINEERING  
SERVICES REPORT  
PROPOSED DEVELOPMENT OF COMET EXTENSION 8  
SITUATED ON PART OF PORTION 406 OF THE  
FARM DRIEFONTEIN No. 85 I.R.**

# **ELECTRICAL ENGINEERING SERVICES REPORT**

**PROPOSED DEVELOPMENT OF COMET EXTENSION 8  
SITUATED ON PART OF PORTION 406 OF THE  
FARM DRIEFONTEIN No. 85 I.R.**

Client:

**WATERFALL MANAGEMENT COMPANY  
PO BOX 2506  
SAXONWOLD  
2132  
Tel : 011 253 9222  
Fax : 011 253 9229**

Principle Consultant:

**WORLEYPARSONS RSA (PTY) LTD  
PO BOX 22  
SAXONWOLD  
MENLYN  
0083  
Tel : 012 745 2000  
Fax : 012 745 2001  
Email: [gerhard.zandberg@WorleyParsons.com](mailto:gerhard.zandberg@WorleyParsons.com)**

<b>DOCUMENT STATUS</b>	
The current status of this document is shown below.	
<b>Document Type</b>	Electrical Engineering Services Report
<b>Document Number</b>	10970-R01
<b>Version</b>	1 <sup>st</sup> Issue
<b>Issue Date</b>	4 June 2013
<b>Electronic File</b>	10970 - R01 - Comet X8 - Engineering Services Report - 20130604.docx

<b>Copyright and Confidentiality</b>	
© Copyright by Motla Consulting Engineers (Pty) Ltd – Copyright Act 98 of 1978, as amended, is applicable.	
This document is proprietary to Motla Consulting Engineers (Pty) Ltd. Motla Consulting Engineers submit this document to the client with the understanding that it will be held in strict confidence and will not be disclosed or used, in whole or in part, for any purpose without the prior written consent of Motla Consulting Engineers (Pty) Ltd. This document is subject to change without prior notice.	

<b>DOCUMENT HISTORY</b>			
The history of changes made to this document is shown below.			
Version	Date	Author	Summary of Changes
1	4 June 2013	AF Conradie	First issue

<b>APPROVAL</b>			
This document has been approved for publishing by:			
Action	Name/Designation	Signature	Date
Prepared by	AF Conradie Pr.Eng		4 June 2013
Reviewed by	AF Conradie Pr.Eng		4 June 2013
Approved by	JA Alberts Pr.Eng		4 June 2013

<b>DISTRIBUTION</b>	
Controlled copies of this document are distributed as follows:	
No.	Issued To
1	Waterfall Management Company
2	WorleyParsons RSA (Pty) Ltd
3	Motla Project File



## **PROPOSED DEVELOPMENT OF COMET EXT 8 SITUATED ON PART OF PORTION 406 OF THE FARM DRIEFONTEIN No. 85 I.R.**

### **ELECTRICAL ENGINEERING SERVICES REPORT**

---

#### **EXECUTIVE SUMMARY**

This report documents the expected requirements from the supply authority (Ekurhuleni Metropolitan Municipality (EMM)) for the provision of electrical services to the proposed development of Comet X8 on part of portion 406 of the farm Driefontein No 85 I.R, Boksburg.

The development requires an estimated 986kVA, which involves the installation of an electrical network from Angelo SAR substation, as electrical bulk supply is not available from the existing network. Two options are discussed of which the main difference is the building of a new 11kV switching substation for the proposed development. The stands are serviced by 4 x 315kVA 11000/415V miniature substations, a MV backbone ring network, a radial LV feeder network from the miniature substations, and distribution kiosks from where stands are connected.

It is recommended that the developer formally apply to EMM in order to electrically connect the proposed development, once the development is approved. EMM should further be kept abreast of the urgency of the connection, as their current application to Eskom to upgrade Angelo SAR substation may need to be updated to further increase the capacity of the substation to accommodate the proposed development.



# PROPOSED DEVELOPMENT OF COMET EXT 8 SITUATED ON PART OF PORTION 406 OF THE FARM DRIEFONTEIN No. 85 I.R.

## ELECTRICAL ENGINEERING SERVICES REPORT

### TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY</b> .....	<b>4</b>
<b>TABLE OF CONTENTS</b> .....	<b>5</b>
<b>1. INTRODUCTION</b> .....	<b>6</b>
1.1 SCOPE OF REPORT .....	6
1.2 APPOINTMENT .....	6
1.3 LOCALITY .....	6
1.4 INFORMATION OBTAINED .....	6
<b>2. EXISTING SERVICES</b> .....	<b>7</b>
2.1 ELECTRICAL .....	7
2.2 TELECOMMUNICATION .....	8
<b>3. NEW ELECTRICAL SERVICES REQUIREMENT</b> .....	<b>9</b>
3.1 LAND USE, AREAS AND ZONING .....	9
3.2 ELECTRICAL LOAD CALCULATION ASSUMPTIONS .....	9
3.2.1 National standards .....	9
3.2.2 Climate .....	10
3.2.3 Residential 1 .....	10
3.2.4 Residential 4 .....	11
3.2.5 Special .....	11
3.2.6 Roads .....	12
3.3 ESTIMATED LOAD REQUIREMENT .....	12
3.4 NEW ELECTRICAL INFRASTRUCTURE REQUIREMENTS .....	13
3.4.1 Option 1: .....	13
3.4.2 Option 2: .....	14
3.5 BULK SUPPLY AVAILABILITY .....	14
3.6 SERVICE REQUIREMENTS .....	16
3.7 APPLICATION PROCESS .....	17
3.8 RESPONSIBILITIES FOR MAINTENANCE AFTER INSTALLATION .....	17
<b>4. COST ESTIMATE</b> .....	<b>17</b>
4.1 CONSTRUCTION COST .....	17
4.2 BULK SUPPLY CONTRIBUTION COST .....	19
<b>5. RECOMMENDATION</b> .....	<b>19</b>
<b>6. ANNEXURES</b> .....	<b>19</b>
<b>ANNEXURE A</b> .....	<b>20</b>
<b>ANNEXURE B</b> .....	<b>21</b>
<b>ANNEXURE C</b> .....	<b>22</b>





## **PROPOSED DEVELOPMENT OF COMET EXT 8 SITUATED ON PART OF PORTION 406 OF THE FARM DRIEFONTEIN No. 85 I.R.**

### **ELECTRICAL ENGINEERING SERVICES REPORT**

---

#### **1. INTRODUCTION**

##### **1.1 Scope of Report**

This report provides information on the existing electrical services, as well as the electrical services required to cater for the proposed development of Comet Extension 8 situated on part of portion 406 of the farm Driefontein No. 85 I.R., Boksburg (hereinafter referred to as "the proposed development").

##### **1.2 Appointment**

Motla Consulting Engineers (Pty) Ltd has been appointed by WorleyParsons to prepare an Electrical Engineering Services Report based on the proposed development.

##### **1.3 Locality**

The proposed development is located on a part of portion 406 of the farm Driefontein No. 85 I.R., and forms part of the Ekurhuleni Metropolitan Municipality (EMM) in the Boksburg area, and is named Comet Extension 8. The approximate GPS coordinates of the proposed development is given as: S25°12'58.81" E28°14'14.21". The proposed development is indicated in Annexure A.

##### **1.4 Information obtained**

The site was visited and existing services were recorded for the said property and the surrounding area (including medium voltage network and equipment, low voltage network and equipment and telecommunication network).

The Ekurhuleni Metropolitan Municipality representative responsible for Planning in the Boksburg area is Mr Simon Mkanyeni and Mr Danie Erasmus, and a meeting



was set up with Mr Erasmus in order to obtain information related to the proposed development, electrical capacity in the area and project requirements.

## 2. EXISTING SERVICES

### 2.1 Electrical

There exist no infrastructure of any nature on the proposed development, with it being open veld at this stage. The existing established residential area located to the South of the proposed development is fully serviced with an underground medium voltage (MV) and low voltage (LV) electrical network.

A double circuit 150mm<sup>2</sup> 11kV PILC cable is installed in Comet street, turning right into Palm street. The area is serviced with a miniature substation situated in Palm street (near erf 933). A switching substation is located opposite erf 926.

The existing electrical network in the area to the South of the development does not have spare capacity available, and therefore the proposed development will not be fed from this particular network.

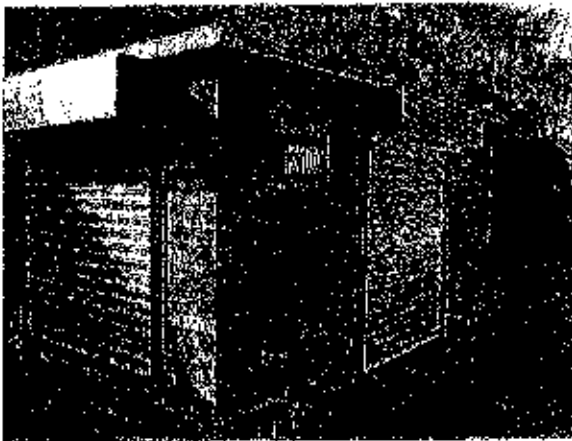


Figure 1: Miniature substation in Palm street (near erf 933)



Figure 2: Low voltage distribution kiosk

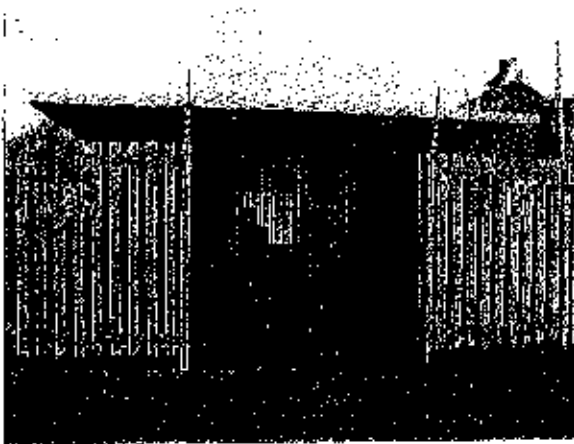


Figure 3: Switching substation in Palm street  
(opposite erf 926)

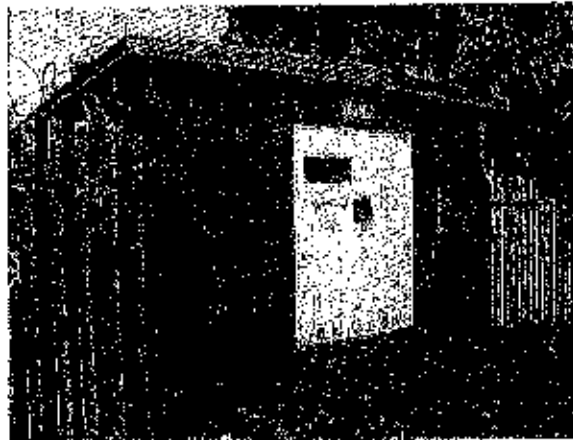


Figure 4: Switching substation in Hospital road  
(opposite c/o Hospital road and Cedar street)

## 2.2 Telecommunication

The existing telecommunication services installed in the adjoining residential area located to the South of the proposed development is an underground Telkom network. It is anticipated that a similar network will be required for the proposed development.

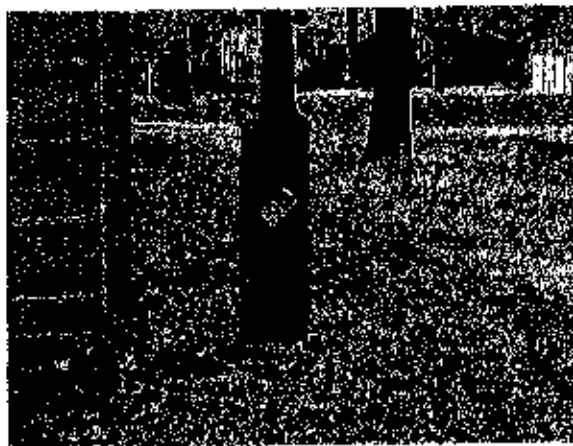


Figure 5: Underground Telkom network



### 3. NEW ELECTRICAL SERVICES REQUIREMENT

#### 3.1 Land Use, Areas and Zoning

The proposed development layout provided by WorleyParsons indicate the land use of the proposed development, also shown below in the table:

Zoning	Land use	Erf no's	No of stands	Total area (ha)	% township area
Residential 1	Detached houses – 240m <sup>2</sup> erven	3–40, 42–126	123	3.39 ha	32.31%
Residential 4	Residential dwelling units – 60 units per ha	1–2	2	2.04 ha	19.44%
Special	Conservation	41	1	1.25 ha	11.91%
P.O.S.	Park	127	1	2.98 ha	28.4%
Roads				0.83 ha	7.94%
			<b>128</b>	<b>10.49 ha</b>	<b>100%</b>

Table 1: Proposed development area

#### 3.2 Electrical load calculation assumptions

##### 3.2.1 National standards

SANS 204-1, "Energy efficiency in buildings" is used to calculate the require load. According to SANS 204-1:2008 (Energy efficiency in buildings, Part1: General requirements), the Boksburg area falls in zone 1, which is classified as "cold interior". By means of this and others, the estimate load requirement for the various land use parcels is calculated.

SANS 10400, "Building regulations" is used for specifying further energy efficiency measures, and some are listed here:



- A minimum of 50% of the hot water provided is to be by non-electrical resistance sources, i.e. Approved heat pump, solar geyser or gas geyser to be installed by licensed professional or specialist with all exposed hot water piping to be insulated with insulation with an R-value of 1. To comply with SANS 10400-XA Clause 4.1.
- Further regulations with regards to architecture and construction of buildings are listed in the current version of SANS 10400. These regulations aim to make buildings more energy efficient, and to reduce the building's dependence on electricity.

### 3.2.2 Climate

The Boksburg area has the following annual climatic statistics (source: [http://www.saexplorer.co.za/south-africa/climate/boksburg\\_climate.asp](http://www.saexplorer.co.za/south-africa/climate/boksburg_climate.asp)):

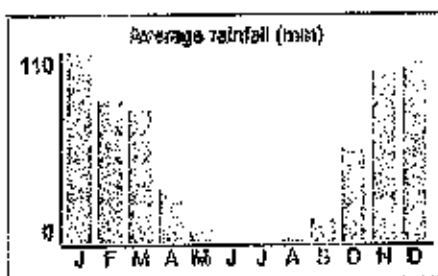


Figure 6: Average rainfall (mm)

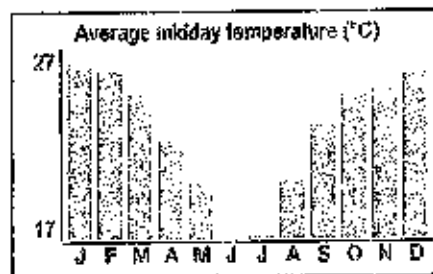


Figure 7: Average midday temperature (°C)

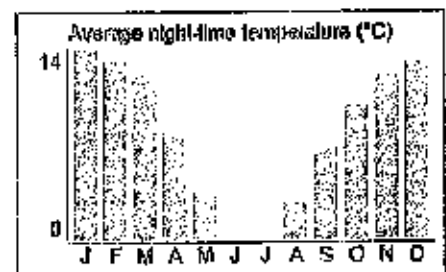


Figure 8: Average night-time temperature (°C)

The area has moderate to high maximum temperatures in the Summer, with temperatures falling to 0.2°C on average in the Winter. An assumption is made that the focus area would be on heating during the Winter, but that cooling may be required by some in the Summer.

### 3.2.3 Residential 1

It is assumed that the Res 1 stands on the proposed development envisage providing dwellings for medium income groups. Each stand will be serviced with a 60A single-phase service connection at the Ekurhuleni Metropolitan Municipality metering kiosk, with the main circuit breaker in each house being limited to 60A single-phase (curve 2). The recommended ADMD (after diversity maximum demand) per stand is estimated at 3.5kVA for the 240m<sup>2</sup> stands. However, EMM



require an ADMD of 4kVA per stand. The ADMD selected is due to the amount of stands, but also taking into account the medium income groups to be catered for.

It is recommended that the following energy efficiency measures be implemented:

- Solar water heating / Heat pumps
- Gas cooking

As it is hard to police these measures, the design should be done on the probability that some water heating and cooking will be done with electricity.

#### 3.2.4 Residential 4

It is assumed that the Res 4 stands on the proposed development envisage providing dwellings for low to medium income groups. The development on the two "Residential 4" stands will be serviced by EMM with a bulk connection at the stand boundary. The internal network will not be taken over by EMM. Each unit will be serviced with a 60A single-phase service connection at the Body Corporate metering kiosks, with the main circuit breaker in each house being limited to 60A single-phase (curve 2). The recommended ADMD (after diversity maximum demand) per stand is estimated at 3kVA, however EMM require an ADMD of 4kVA per stand. The zoning rights allow 60 units per hectare. The ADMD selected is due to the amount of units, but also taking into account the low to medium income groups to be catered for.

It is recommended that the following energy efficiency measures be implemented:

- Solar water heating / Heat pumps
- Gas cooking

As it is hard to police these measures, the design should be done on the probability that some water heating and cooking will be done with electricity.

#### 3.2.5 Special

Erf 41 is zoned as "special" with the land listed as "conservation". No structures will be erected on this erf, and therefore does not require an electrical connection.



### 3.2.6 Roads

The internal roads (including road reserves) in the proposed development use approximately 0.83ha. The internal roads are a combination of 18m, 10.5m and 6m wide road reserves. Each type of road has different characteristics which require different illumination levels for street lighting purposes, and require a variation of luminaires and lamp types, as well as pole spacing. With some assumptions made, the approximate length of the internal streets is calculated to 890m, which will require approximately 20 streetlights.

The position of services in the road reserve will be coordinated with the civil engineering services and EMM standard guidelines. **PROFESSIONAL FEES**

### 3.3 Estimated load requirement

The estimated load requirement for the proposed development is calculated as per the table below:

Stand							
Zoning	Land Use	No of Stands	No of Houses / Units	Area (m <sup>2</sup> )	ADMD (kVA/m <sup>2</sup> or kVA/res unit) (SANS 204)	Load (kVA)	
Residential 1	Detached houses – 240m <sup>2</sup> ervar.	123	123	29 908	4.0	492.00	
Residential 4	Residential dwelling units – 60 units per ha	1 (stand 1)	48	7 900	4.0	192.00	
Residential 4	Residential dwelling units – 50 units per ha	1 (stand 2)	75	12 500	4.0	300.00	
Special	Conservation	1	0	12 500	0	0.00	
P.O.S.	Park	1	0	29 800	0	0.00	
						<b>984.00</b> kVA	
Streetlights							
Street width (avg) (m)	Total area of all internal roads (m <sup>2</sup> )	Approximate percentage of road type	Approximate road length (m)	Streetlight pole spacing (m)	Streetlight quantity	Streetlight lamp rating (W)	Load (kVA)
18	0 800	0.15	69.17	40	2	70	0.14
10.5	3 300	0.60	476.29	45	11	70	0.77
6	5 200	0.25	345.83	50	7	70	0.49
			<b>891.29</b>		<b>20</b>		<b>1.40</b> kVA
<b>Total Load requirement:</b>						<b>985.40</b>	<b>kVA</b>

**Table 2: Estimated load requirement**



Table 2 indicate an estimated total load requirement of approximately 986kVA for the entire proposed development.

### 3.4 **New electrical infrastructure requirements**

The EMM planning engineer explained that in order for EMM to sign a services agreement with the developer, the proposed development will be viewed as part of the entire Comet Ext 8. It assumed for the purposes of this report that the SDP provided shows the entire Comet Ext 8, with the area to the North of the residential development being zoned as a wetland with no development possible in the future.

The EMM planning engineer further indicated that the requirements for an electrical connection is for the developer to build an 11kV electrical switching substation. A second option was discussed with the engineer, which only allows for a cable ring network through the development with no switching substation built. Although not approved by the engineer, it is given as an option in this report, and will be considered by the engineer once an application for electricity is made to EMM.

The options are discussed here:

#### 3.4.1 **Option 1:**

The requirements for option 1 is listed here:

- Double circuit 185mm<sup>2</sup> 3-core Cu PILC 6.35/11kV cables from Angelo SAR substation. The use of 300mm<sup>2</sup> 3-core Al PILC 6.35/11kV cable can also be investigated instead of copper cables.
- The cables above to be terminated in a new 11kV switching substation, equipped with metal-clad switchgear.
- A 70mm<sup>2</sup> 3-core Cu PILC 6.35/11kV cable ring network from the new 11kV switching substation installed throughout the proposed development.
- Various 11000/415V miniature substations (with a protective enclosure) installed in the proposed development.
- Low voltage electrical network supplied from miniature substations to service individual stands.





### 3.4.2 **Option 2:**

The requirements for option 2 is listed here:

- Double circuit 185mm<sup>2</sup> 3 core Cu PILC 6.35/11kV cables from Angelo SAR substation. The use of 300mm<sup>2</sup> 3-core Al PILC 6.35/11kV cable can also be investigated instead of copper cables.
- The 185mm<sup>2</sup> 3-core Cu PILC 6.35/11kV cables to be installed throughout the proposed development.
- Various 11000/415V miniature substations (with a protective enclosure) installed in the proposed development.
- Low voltage electrical network supplied from miniature substations to service individual stands.

### 3.5 **Bulk supply availability**

Bulk supply is currently not available from the existing electrical network bordering the proposed development. It is therefore required to install a network from Angelo SAR substation, located approximately 1.5 km North-West of the development (refer to figure 9 below).

Angelo SAR substation is primarily used to service the ERPM mine at 3,3kV. EMM has however applied to Eskom to upgrade the substation to an 11kV substation, and to increase the capacity thereof to 10MVA. EMM urged the developer to keep them abreast of the urgency of the proposed development, as they may need to update the application to further increase the capacity of the substation to accommodate the development.

Herewith a short summary of EMM's comments in 2008. The supply option received from EMM in 2013 differ from this. Once a formal application is made to EMM, these options will be discussed in detail where after the most suitable option can be selected.

*Bulk electrical supply not available. The nearest substation to the site is Witfield substation (located approximately 4km from the proposed development). Witfield substation was being upgraded at the time to a 3 x 30MVA substation. Spare capacity was estimated at approximately*

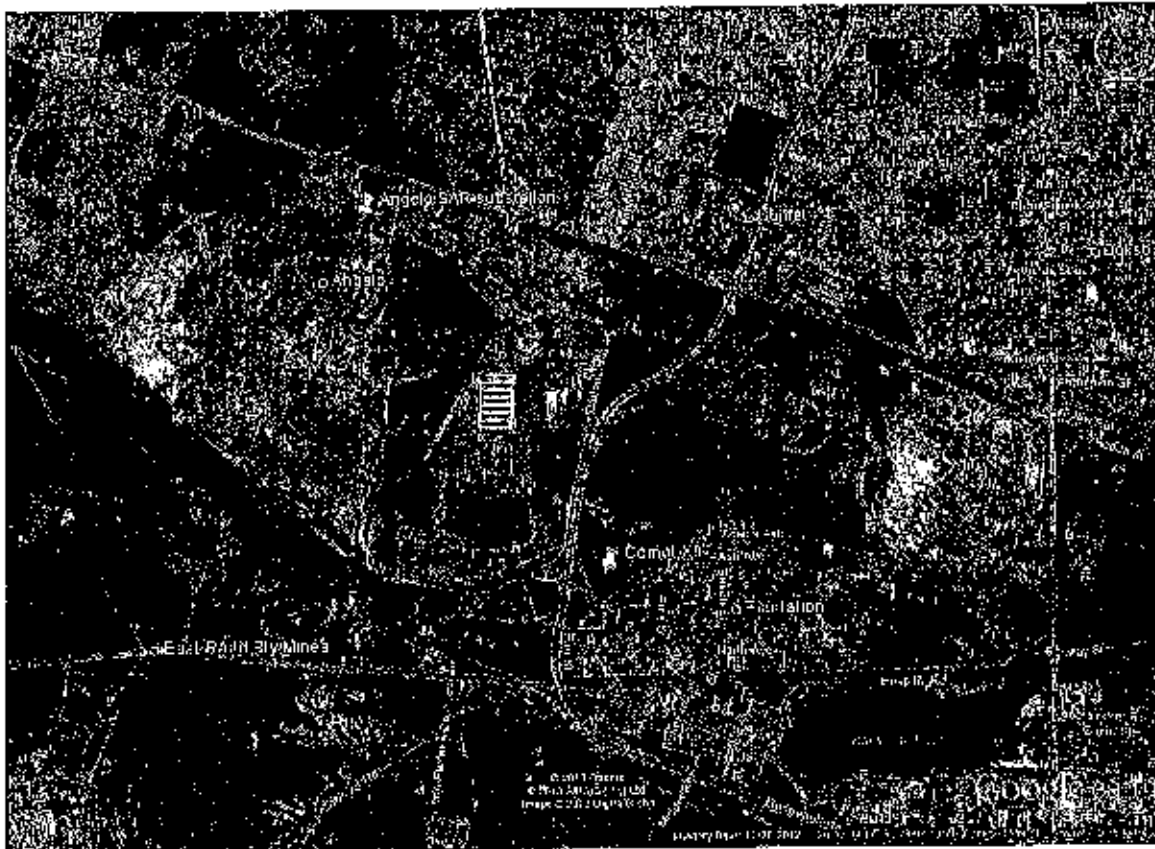


*20MVA once the upgrade has been completed. At the time, the substation upgrade was expected to be completed during the course of 2009.*

*At the time a new switching substation was planned for Comet X1 (fed from Witfield substation). Once completed, this will be the closest point of bulk power supply connection for Comet X8.*

EMM's bulk supply contribution policy stipulate that the developer is responsible to install the internal network of the development, and bulk supply contributions will be levied R1,500 per kVA. In such cases EMM is responsible to install the external (bulk) services. In cases where less than 150% of the required supply is available in the existing electrical network, or in cases where the proposed development is more than 1km from the EMM's supply, a deviation report is required. Comet Ext 8 will be dealt with as a deviation report, in light of the fact that the closest available bulk supply is located more than 1km away.

A deviation report entails that the developer is responsible to install the internal as well as the external services. Should the value of the external services be more than the calculated bulk supply contribution payable, then bulk supply contribution costs will be waived by EMM. If however the bulk supply contribution calculates to more than the value of the external services, then the developer is liable to pay the difference. It is anticipated that no bulk supply contribution costs will be payable in this case, due to the high cost of the double circuit cable network from Angelo SAR substation, which cost must be borne by the developer. It should however be noted that should a switching substation be required by EMM, the costs thereof will be calculated as part of the internal costs, due to it falling within the boundary of the development, as per EMM's policy and requirements.



**Figure 9: Angelo SAR substation location**

### 3.6 Servitude requirements

The EMM requirement for servitudes is as follow:

Type	Requirement
11kV and 415V cables	Installed 1m from the stand boundary in road reserve
11kV/415V Miniature substation	Installed in road reserve
Meter kiosk	Installed in road reserve
Medium voltage switching substation	Servitude on stands (i.e. not in road reserve) to accommodate switching substation building with equipment installed inside the building

**Table 3: Servitude requirements**



### 3.7 **Application process**

Application for electricity must be made with the EMM Boksburg Electrical planning department. A services agreement will need to be signed with EMM.

### 3.8 **Responsibilities for maintenance after installation**

The developer's attention is drawn to the following extract from the EMM's bulk supply contribution policy (paragraph 1.1 (c)):

*The engineering services agreement shall provide that the internal electrical engineering service shall vest in the Council (free from the obligation to pay any contribution) from the date of handover of the service or the date of publication of the relevant section 103 notice, whichever occurs last: Provided that the township owner shall in respect of such service remain responsible for the maintenance and / or replacement and / or rectification of faulty workmanship or materials until the development in the relevant township has taken up 60% of the electrical consumption as envisaged at the time the non-refundable contribution was calculated by the township owner's consultant.*

In lieu of this statement, it is important not to overstate the load requirement and ADMD.

## 4. **COST ESTIMATE**

### 4.1 **Construction cost**

The estimated cost to service each stand electrically is as follows.

Note: Escalation is not included below as the approval and development timeline is not available.



		Cost estimate: Option 1: With switching sub		
SECTION	DESCRIPTION	MATERIAL	LABOUR	TOTAL PRICE
SECTION 1	PRELIMINARY AND GENERAL	R -	R 302 664.72	R 302 664.72
SECTION 2	11KV SWITCHING SUB AND RELATED WORKS	R 1 785 000.00	R 237 500.00	R 2 022 500.00
SECTION 3	ANGELO SAR SUB RELATED WORKS	R 490 500.00	R 33 000.00	R 523 500.00
SECTION 4	CABLE WORKS	R 4 648 395.00	R 250 125.00	R 4 898 520.00
SECTION 5	EXCAVATION RELATED WORK	R 310 882.00	R 446 382.00	R 756 764.00
SECTION 6	MINIATURE SUBSTATION RELATED WORK	R 1 237 400.00	R 68 800.00	R 1 301 200.00
SECTION 7	METERING KIOSK RELATED WORK	R 258 500.00	R 26 400.00	R 284 900.00
SECTION 8	STREETLIGHTS	R 187 020.00	R 28 720.00	R 215 740.00
SECTION 9	TELECOMMUNICATION	R 63 500.00	R 22 200.00	R 85 700.00
SECTION 10	PROFESSIONAL FEES (EXCL DISBURSEMENTS)	R -	R 985 233.98	R 985 233.98
	<b>SUB TOTAL 1 (EXCL VAT):</b>	<b>R 8 980 697.00</b>	<b>R 2 945 025.70</b>	<b>R 11 926 722.70</b>
	<b>ADD 10% CONTINGENCIES:</b>			<b>R 1 192 672.27</b>
	<b>SUB TOTAL 2 (EXCL VAT):</b>			<b>R 12 459 394.97</b>
	<b>VAT @ 14%:</b>			<b>R 1 744 315.30</b>
	<b>TOTAL (INCL VAT &amp; CONTINGENCIES):</b>			<b>R 14 203 710.27</b>
		Cost estimate: Option 2: Without switching sub		
SECTION	DESCRIPTION	MATERIAL	LABOUR	TOTAL PRICE
SECTION 1	PRELIMINARY AND GENERAL	R -	R 255 566.82	R 255 566.82
SECTION 2	11KV SWITCHING SUB AND RELATED WORKS	R -	R -	R -
SECTION 3	ANGELO SAR SUB RELATED WORKS	R 490 500.00	R 33 000.00	R 523 500.00
SECTION 4	CABLE WORKS	R 5 091 275.00	R 259 815.00	R 5 351 090.00
SECTION 5	EXCAVATION RELATED WORK	R 310 882.00	R 446 382.00	R 756 764.00
SECTION 6	MINIATURE SUBSTATION RELATED WORK	R 1 237 400.00	R 68 800.00	R 1 301 200.00
SECTION 7	METERING KIOSK RELATED WORK	R 258 500.00	R 26 400.00	R 284 900.00
SECTION 8	STREETLIGHTS	R 187 020.00	R 28 720.00	R 215 740.00
SECTION 9	TELECOMMUNICATION	R 63 500.00	R 22 200.00	R 85 700.00
SECTION 10	PROFESSIONAL FEES (EXCL DISBURSEMENTS)	R -	R 789 701.47	R 789 701.47
	<b>SUB TOTAL 1 (EXCL VAT):</b>	<b>R 7 638 577.00</b>	<b>R 1 925 585.29</b>	<b>R 9 564 162.29</b>
	<b>ADD 10% CONTINGENCIES:</b>			<b>R 956 416.23</b>
	<b>SUB TOTAL 2 (EXCL VAT):</b>			<b>R 10 520 578.52</b>
	<b>VAT @ 14%:</b>			<b>R 1 472 880.93</b>
	<b>TOTAL (INCL VAT &amp; CONTINGENCIES):</b>			<b>R 11 993 459.51</b>

Table 4: Cost estimate



#### 4.2 **Bulk supply contribution cost**

The bulk supply contribution payable for the proposed development is as listed and quantified below. It is envisaged that this fee will be waived by EMM due to the fact the proposed development is a deviation from the policy, and furthermore that the estimated cost of the external services to be installed by the developer is more than the calculated bulk supply contribution:

<b>Estimated bulk load requirement (kVA):</b>	<b>985</b>
<b>EMM's bulk supply contribution payable per kVA:</b>	<b>R 1 500.00</b>
<b>Bulk supply contribution payable:</b>	<b>R 1 479 000.00</b>
<b>Estimate cost of external (bulk) services (included in paragraph 4.1): Option 1 &amp; 2: (switching sub and related works are seen as part of internal services)</b>	<b>R 4 497 974.00</b>

**Table 5: Bulk supply contribution**

#### 5. **RECOMMENDATION**

It is recommended that application to EMM be made as soon as possible, in order for them to include the proposed development in their application to Eskom to upgrade Angelo SAR substation. Negotiations with EMM electricity department will follow thereafter in how bulk supply will be provided to the development (with or without a switching substation).

#### 6. **ANNEXURES**

<b>Annexure</b>	<b>Description</b>
A	Layout plan
B	Proposed 11kV bulk supply: Option 1
C	Proposed 11kV bulk supply: Option 2

**Table 6: List of annexures**



## **ANNEXURE A**

### **Layout Plan**

**PROPOSED TRASSARD  
COMET EXTENSION 8**  
BY ORDER OF THE BOARD OF ENGINEERS OF THE  
PROVINCE OF ONTARIO, CANADA  
LEGISLATION: ENGINEERING ACT  
REGULATION: PROFESSIONAL ENGINEERS' REGULATIONS, 1997



NO.	DATE	BY	DESCRIPTION
1	12/15/07	...	...
2	...	...	...

**GENERAL NOTES:**  
1. THIS PLAN IS TO BE CONSIDERED AS A PRELIMINARY DESIGN PLAN.  
2. THE CLIENT IS RESPONSIBLE FOR THE ACCURACY OF THE DATA FURNISHED TO THE ENGINEER.

**PROJECTIONS:**  
1. THE PLAN IS DRAWN TO THE FOLLOWING PROJECTIONS:  
2. THE PLAN IS DRAWN TO THE FOLLOWING PROJECTIONS:

**AVENUES:**  
1. THE PLAN IS DRAWN TO THE FOLLOWING PROJECTIONS:  
2. THE PLAN IS DRAWN TO THE FOLLOWING PROJECTIONS:

**OWNER:** SOUTHNET  
**DATE:** 12/20/11  
**DRAWN BY:** ...  
**CHECKED BY:** ...

**LEGEND:**  
...  
**SCALE:** 1:200  
**DATE:** 12/20/11  
**BY:** ...



DRIEFONTEIN 85 - IR

VOGELFONTEIN 84 IR

BOKSBURG TOWNSHIP  
(PLANTATION)

18/12/2017

19/12/2017

10/1/2018

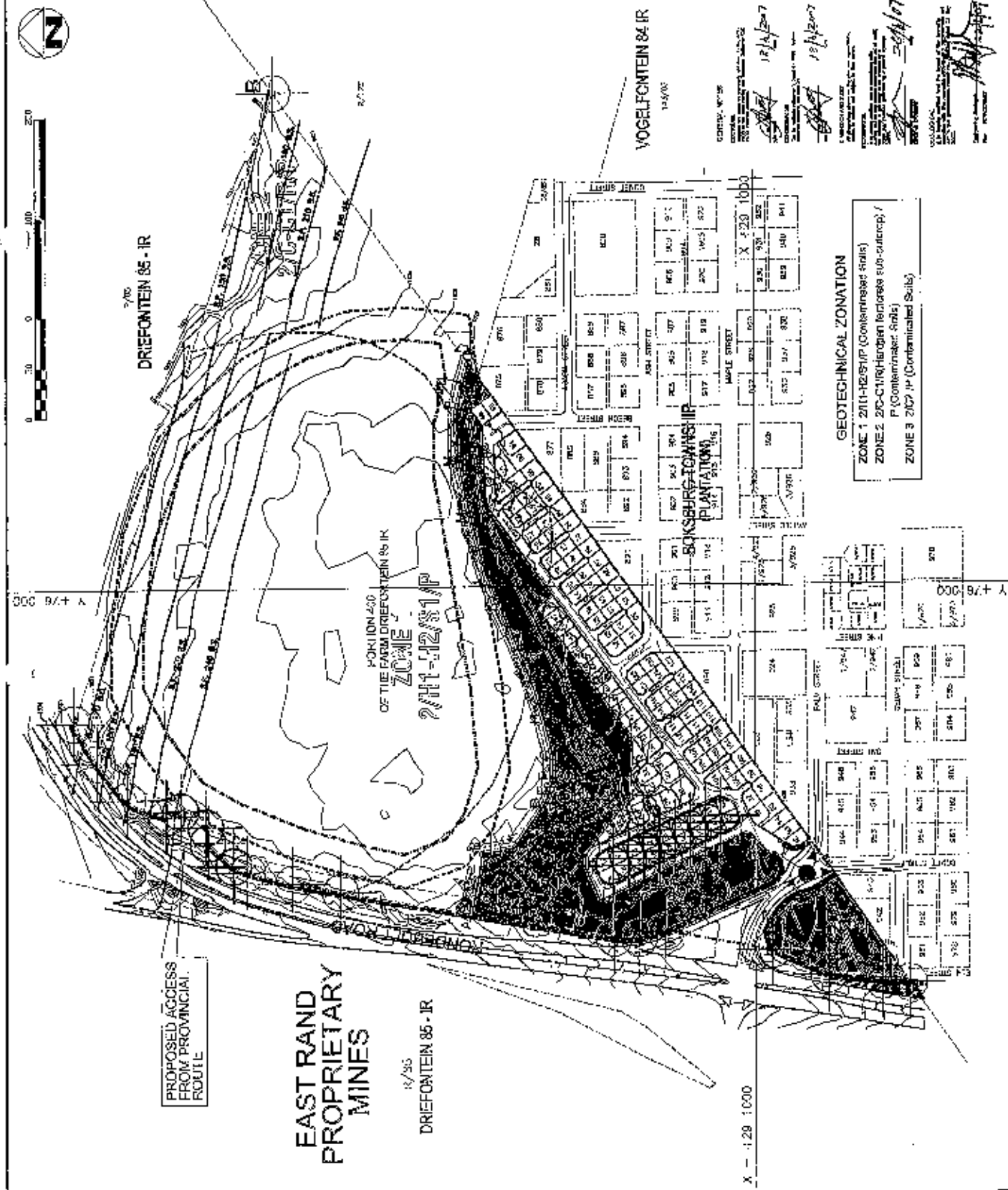
PROPOSED ACCESS  
FROM PROVINCIAL  
ROUTE

**EAST RAND  
PROPRIETARY  
MINES**

12/35  
DRIEFONTEIN 85 - IR

**GEOTECHNICAL ZONATION**  
ZONE 1 2H11-H2B5-IP (Contaminated Soils)  
ZONE 2 2B-C1H9-H10B9N (acidic sulphate outcrop) /  
P (Contaminated Soils)  
ZONE 3 2C07-IP (Contaminated Soils)

X - 1:29 1:000







## **ANNEXURE B**

### **Proposed 11kV bulk supply: Option 1**



**MOTLA**  
MOTOR OIL  
LUBRICANTS  
TOLL FREE 1-800-4-A-MOTLA

CONTRACT NO.                       
CUSTOMER                       
ADDRESS                       
CITY                       
STATE                       
ZIP                     

DATE                       
TIME                       
MILEAGE                     

TECHNICIAN                       
SALES                       
SALES                     

SALES                       
SALES                       
SALES                     

SALES                       
SALES                       
SALES                     

SALES                       
SALES                       
SALES                     

SALES                       
SALES                       
SALES                     

SALES                       
SALES                       
SALES                     

SALES                       
SALES                       
SALES                     

DATE	MILEAGE	TECHNICIAN	SALES

13-25

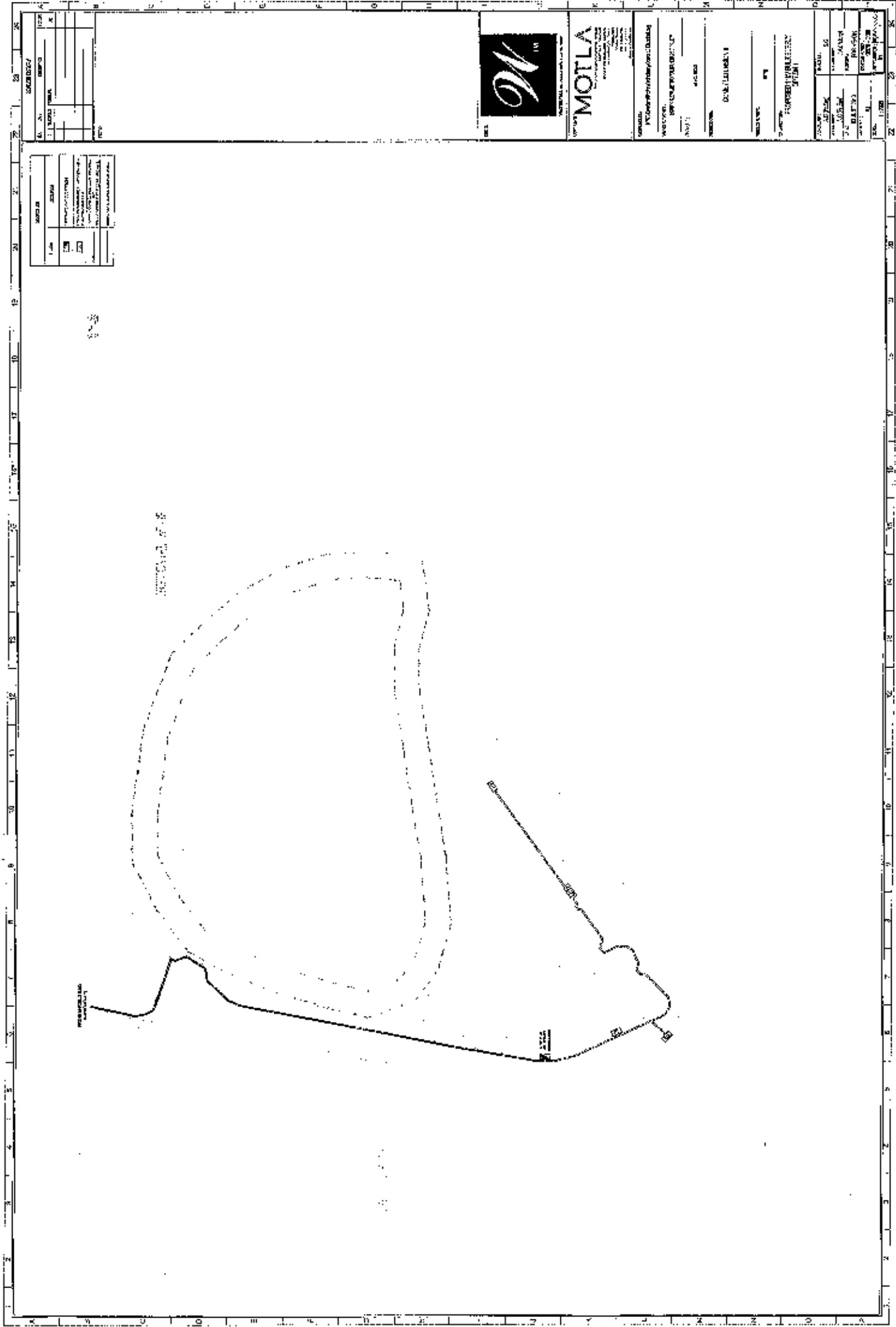
13-25

13-25

13-25

13-25

13-25





## **ANNEXURE C**

### **Proposed 11kV bulk supply: Option 2**

PROJECT NO.		11238	
DATE		12/20/11	
DRAWN BY		J. W. ...	
CHECKED BY		...	
APPROVED BY		...	
SCALE		AS SHOWN	
SHEET NO.		1	
TOTAL SHEETS		1	

PROJECT NO.	11238
DATE	12/20/11
DRAWN BY	J. W. ...
CHECKED BY	...
APPROVED BY	...
SCALE	AS SHOWN
SHEET NO.	1
TOTAL SHEETS	1



**MOTLA**  
 MOTOROLA  
 COMMUNICATIONS  
 INCORPORATED  
 100 NORTH ZEEB ROAD  
 CHANDLER, AZ 85226-4099  
 PHONE: 480.486.1000  
 FAX: 480.486.1001  
 WWW.MOTLA.COM

PROJECT NO.	11238
DATE	12/20/11
DRAWN BY	J. W. ...
CHECKED BY	...
APPROVED BY	...
SCALE	AS SHOWN
SHEET NO.	1
TOTAL SHEETS	1