

# BHP BILLITON IRON ORE NEWMAN TOWNSHIP ELECTRICITY SUPPLY


## ANNUAL AUDIT REPORT ON COMPLIANCE MONITORING SYSTEMS 2016/2017 FINANCIAL YEAR

REVISION A

29/08/2017

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## EXECUTIVE SUMMARY

The township of Newman is located approximately 1,200km to the north of Perth, within the Shire of East Pilbara. The electricity network is owned, governed and operated by BHP Billiton Iron Ore Supply Authority (BHPBIOSA). The network encompasses the township of Newman, the Airport, Capricorn Roadhouse, town water supply bore field and a few other connections in the adjacent areas.

In accordance with WA Electricity Industry Code 2005 (the Code), the electrical supply authorities must publish a report setting out the information described in Schedule 1 of the Code for each financial-year (FY). This document, known as the *Annual Audit Report*, is to provide the detailed report on the Network Quality & Reliability of Supply. The Code also requires the supply authority to arrange an independent audit and subsequent report on the procedures and systems that the distributor has in place for monitoring its compliance to the Code's Part 2. APD were engaged by BHPBIOSA as the independent consultant to undertake the audit process and prepare the report.

The audit interviews were undertaken on the 18<sup>th</sup> July 2017 at BHPBIOSA's Newman offices, with majority of relevant stakeholders and resources were available to APD. As a result of the audit process and interviews, the following key observations were made:

- The introduction of industry experts has brought more utilities based personnel into the BHPBIOSA's team, which allows the company to improve in-house skillsets and capabilities in terms of primary plant maintenance and testing.
- BHPBIOSA have increased training opportunities for the network operation & maintenance teams, through both on-going in-house courses as well as continuous interaction with external stakeholders.
- A shortage in the resources allocated to the inspection process was identified. The main issues identified are related to the administrative works required for the task. Additional resources and improved data entry procedures are recommended to address the problem.



















The results for 2016/2017 audit are shown in the table titled 'Audit Scorecard' (presented in the overleaf). General improvement compared to last FY are noted, especially in the following areas:






- Integration and application of the new Inspection System Plan (ISP);
- Improved utilization of the network controller role to monitor and control the network during outages. This in turn has assisted with timely restoration of the supply as well as improved outage records keeping, used to better identify the root-cause of the issues.
- Continual focus toward maintaining and improving network reliability and supply quality through regular monitoring and targeted asset replacement program, based on the fault frequency and criticality as well as the failure mode.

The principal area in which BHPBIOSA can make improvement in the coming FYs are:

- Continuous PQ monitoring of the LV network to ensure compliant supply at the customer's point of connection (specially with increasing unbalanced loads); and
- Better resource allocation and improved documentation procedures for inspection works.

With respects to the holistic electrical network, the recent PQ measurements indicate that BHPBIOSA has undergone noteworthy improvements with respect to the quality and reliability of electricity supply to Newman township. The basic electrical parameters of voltage, frequency and voltage total harmonic distortion were consistently stable and well within compliance-levels.

Audit Scorecard		
Audit Description	Audit Overall Rating	
	2015/2016	2016/2017
<i>The Electricity Industry Code 2005 Part 2 Division 1 – Quality Standards – Section 6 - Voltage Fluctuations</i>		
<i>The Electricity Industry Code 2005 Part 2 Division 1 – Quality Standards – Section 7 - Harmonic Distortion</i>		
<i>The Electricity Industry Code 2005 Part 2 Division 1 – Quality Standards – Voltage Level</i>		
<i>The Electricity Industry Code 2005 Part 2 Division 1 – Quality Standards – Frequency</i>		
<i>The Electricity Industry Code 2005 Part 2 Division 2 – Standards for the interruption of supply to individual customers – Section 9 – General standard of reliability</i>		
<i>The Electricity Industry Code 2005 Part 2 Division 2 – Standards for the interruption of supply to individual customers – Section 10 – Duty to reduce effect of interruption</i>		
<i>The Electricity Industry Code 2005 Part 2 Division 2 – Standards for the interruption of supply to individual customers – Section 11 – Planned Interruptions</i>		
<i>The Electricity Industry Code 2005 Part 2 Division 2 – Standards for the interruption of supply to individual customers – Section 12 – Significant Interruptions to Small Customers</i>		
<i>The Electricity Industry Code 2005 Part 2 Division 3 – Standards for the duration of interruption of supply in particular areas – Section 13 – Standard for Other Areas (Newman Township system 290mins)</i>		

Overall Compliance Rating	Description	
	High	Best practice quality processes and systems
	Medium – High	Above average quality processes and systems
	Medium	Adequate quality processes and systems
	Low – Medium	Quality systems and processes require further development.
	Low	Quality systems and processes require major further development

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# 1. INTRODUCTION

BHP Billiton Iron Ore (BHPBIO) is one of the world's major suppliers of iron ore and is based in the Pilbara region of Western Australia. The township of Newman is located approximately 1200km to the north of Perth, within the Shire of East Pilbara. It is the main town for the Mt Whaleback iron ore mine, Mining Area C and several smaller satellite mines.

The electricity network is owned, governed and operated by BHP Billiton Iron Ore Supply Authority (BHPBIOSA). The network encompasses the township of Newman, Newman Airport, Capricorn Roadhouse, town water supply bore field, Mt Whaleback iron ore mine and several smaller mine leases in the adjacent areas.

At present, the township of Newman has approximately 2,395 premises comprised of a mixture of residential and commercial customers.

In accordance with Western Australia Electricity Industry Code 2005 (the Code), the electrical supply authority must publish a report setting out the information described in Schedule 1 of the Code, in respect to each year ending on 30<sup>th</sup> of June. This document, known as the annual audit report, is to provide the full suite of information outlined in Schedule 1 of the Code, relating to the Network Quality and Reliability of Supply.

The Code is effectively written in four parts plus a reporting-requirements schedule; namely:

1. Part 1: Preliminary information associated with term of reference.
2. Part 2: Quality and reliability standards, which is further partitioned into 4 *divisions*.
3. Part 3: Payment to customers for lack of regulatory adherence.
4. Part 4: Incidental duties as a Supply Authority.
5. Schedule 1: Information to be published in this report.

As per the Code's Division 3 Section 26 Performance Reporting: BHPBIOSA as distributor is required to arrange an independent audit, and subsequent report, on the operation of the systems that the distributor has in place for monitoring its compliance to the Code's Part 2.

APD were engaged by BHPBIOSA to undertake the required audit and report on the current compliance monitoring processes and systems that BHPBIOSA have in place to ensure compliance with the Code.

## 2. SCOPE OF AUDIT

The scope of audit was limited to the review of the policies, guidelines, processes, systems and procedures that BHPBIOSA currently have in place to ensure that the network is complying with the following performance requirements specified in the Code:

- Part 2, Division 1 – Quality Standards, Section 6(2) – Voltage Fluctuations
- Part 2, Division 1 – Quality Standards, Section 7 – Harmonics
- Part 2, Division 1 – Quality Standards, Section 8 – Duty to disconnect if damage may result, Note (a) Voltage Levels Compliance
- Part 2, Division 1 – Quality Standards, Section 8 – Duty to disconnect if damage may result, Note (b) Frequency Levels Compliance
- Part 2, Division 1 – Quality Standards, Section 8 – Duty to disconnect if damage may result
- Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 9 – General standard of reliability
- Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 10 – Duty to reduce effect of interruption
- Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 11 – Planned interruptions
- Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 12 – Significant interruptions to small use customers
- Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 13 - Standards prescribed for particular areas.

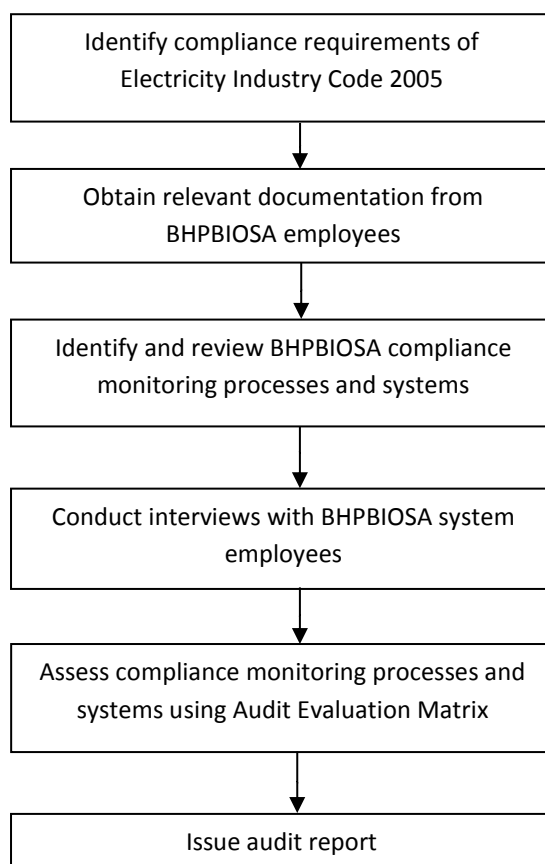
The audit scope covered the electricity network supplying the gazetted township of Newman, Newman Airport and the town water supply bore field. The electricity network supplying the mining infrastructures at Mt Whaleback Iron mine and all other mine leases in the surrounding of the township of Newman were not required to form part of the audit.

Refer to Appendix A for the geographical map of the township of Newman.

## 3. AUDIT METHODOLOGY

### 3.1. Audit Flowchart

The methodology applied to perform the audit is as per the following flowchart:



### 3.2. Audit Evaluation Matrix

The audit assessment was carried out as per the following procedures:






1. Review if BHPBIOSA have adequate systems, documented processes and guidelines, plans, and procedures in place to ensure compliance with each of the performance provisions defined in the Code. Assess the current monitoring processes and systems using the ten criteria shown in Table 1 below. Assign a performance ranking of Low, Medium, or High to each criterion.
2. Based on the ten performance rankings assigned, determine the overall compliance rating. The overall compliance rating indicates the effectiveness of the monitoring processes and systems in achieving compliance with each of the provisions.
3. Compare all overall compliance ratings with the preceding year's results. Improvements are measured in percentage. A 33% improvement means the overall rating has improved either from Low to Medium, or from Medium to High. An improvement from Low to High is equivalent to 66% of improvement.



**Table 1 | Audit of compliance management systems and processes evaluation matrix**

Item	Description	Description of Ranking			
		Low	Medium	High	
1	Process	Documented Process	Process in place documentation requires further development	Process is documented	Strong documentation and may comply with ISO9001
2		Process fully integrated with corporate management systems	Requires development	Linkage with management reporting	Full integration with corporate IT system
3		Demonstration of operator understanding of the documented process	Training required	Employee understanding	Strong employee understanding and evidence of training systems
4		Evidence that the process is followed and records are kept as per process	Records available but not easily accessible or auditable	Adequate records available over full compliance periods	Auditable records available over full compliance periods with mandatory defined fields
5	Continuous Improvement	KPIs are in place	KPIs in place	KPIs are in place with some understanding by operators	Evidence that KPIs are in place and comprehensively understood by all operators
6		Reporting system supports continuous improvement	Requires development	Reporting systems exist at some levels	Reporting systems in place clearly showing gaps and trends of performance
7		Evidence action taken	Requires development	Evidence of reactive response	Evidence that gaps and trends are proactively actioned
8	Measurement Tools	Suitability of PQ measurement devices	PQ device has partial PQ functions and not fully compliant to AS61000.4.30	PQ device has full PQ functions but not fully compliant to AS61000.4.30	PQ device has full PQ functions and fully compliant to AS61000.4.30
9		Data collection methodology of the PQ measurement devices	Data manually extracted and analysed	Data extracted automatically over communications link. Data collection only.	Data extracted automatically over communications link with data analysis at the device.
10		Method of PQ measurement devices deployment	Portable devices not permanently fixed to the network.	Devices permanently installed on the network at strategic locations	Permanently fixed to the network and integrated into the network management control on a real time basis.
11		Overall Ranking	Refer to Table 2 for descriptions		

**Table 2 | Overall compliance rating table**

Overall Compliance Rating	Description	
	High	Best practice quality processes and systems
	Medium – High	Above average quality processes and systems
	Medium	Adequate quality processes and systems
	Low – Medium	Quality systems and processes require further development.
	Low	Quality systems and processes require major further development

## 4. AUDIT RESULTS

The audit assessed the performance and suitability of the compliance monitoring systems and processes that BHPBIOSA have in place to ensure compliance with each of the provisions under The Code's Part 2 Divisions 1, 2 and 3.

### 4.1. Part 2, Division 1 – Quality Standards - Section 6(2), 7 & 8 (a)(b)

Sections 6(2), 7 and 8(a) (b) relate to flicker, harmonics, voltage magnitude and frequency respectively.


The following notes relate to the Code's PQ compatibility levels:

- According to Section 6(2), the voltage fluctuation of electricity supplied must not exceed the compatibility levels of  $P_{st}=1.0$  and  $P_{Tt}=0.8$  set out in Part 3.7 clause 3 of AS/NZS 61000:2001.
- According to Section 7, the standard for the harmonic voltage distortion levels of electricity supplied is a distortion level that is less than the compatibility levels set out in a table in the same section.
- In accordance with AS3000:2007, the voltage levels of the electrical network must be maintained at +10% and -6% of the supply voltage of 240V single-phase.
- According to Section 8, the frequency must be maintained at +/- 2.5% of 50 cycles per second.

Appropriate process and system are required to identify and record any breaches of the compatibility levels, and to keep track of the remedies undertaken to eliminate the breaches.

Table 3 (next page) shows the evaluation matrix for BHPBIOSA in relation to Part 2 Division 1 Section 6(2), 7 & 8 (a) (b) of the Code.

**Table 3 | Part 2 Division 1 Section 6(2), 7 & 8 (a) (b) - Evaluation Matrix**

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Med	High		
1	Process	Processes in place and documented			✓	10%	Note 1
2		Process fully integrated with corporate management systems			✓	0%	No changes
3		Demonstrated operator understanding of the process			✓	0%	No changes
4		Evidence that the process is followed and records are kept as per process			✓	33%	Note 2
5	Continuous Improvement	KPIs are in place		✓		0%	No changes
6		Reporting system supports continuous improvement		✓		0%	No changes
7		Evidence action taken - continuous improvement			✓	33%	Note 3 & 4
8	Measurement Tools	Suitability of PQ measurement devices			✓	0%	No changes
9		Data collection methodology of the PQ measurement devices		✓		0%	No changes
10		Method of PQ measurement devices deployment	✓			10%	Note 5
11		Overall Ranking					

**Note 1:** As noted from the previous FY15/16 audit and interviewees comments the Inspection System Plan (ISP) was in the process of being updated from the 2005 version to the latest 2016 version. This document in conjunction with a manual on the ISP has been approved and implemented during this financial year (FY16/17). Further revisions and reformatting is being undertaken to continually improve this document.

**Note 2:** BHPBIOISA have displayed further improvements to the fault recording process, evidenced through changes to the structure of the department. As a result, BHPBIOISA have begun to better utilize the role of network controller to monitor and control the network and outages. Utilizing the network controller in this manner has created a centralized system for outage information, as such the availability and consistency of the outage information is further streamlined. In terms of root cause analysis this enables systemic issues to be identified more succinctly.

**Note 3:** As evident by interviewee discussions BHPBIOISA is undertaking continuous improvement. This is evident from comments regarding systemic faults relating to outages caused by wildlife (bird strikes). BHPBIOISA is continuing an active project to implement bird coverings on the overhead

(O/H) lines, in addition inputs into projects to improve the design specifications for O/H poles have been made. This input includes the implementation of covering the cross arms to prevent birds nesting within the cross arms and subsequently prevent predatory birds from striking with the O/H lines when aggressing these nesting birds.

**Note 4:** As evident from interviewee discussions BHPBIO have successfully implemented a project to bring online existing capacitor banks within the BHP Junction Substation to assist with voltage control and reactive power, hence providing an improved voltage profile across the network. In addition, further projects are underway to introduce additional reactive/voltage control equipment within the BHPBIO network in the upcoming financial year.

**Note 5:** As evident by interviewee's comments and research, BHPBIO are continuing to obtain information regarding the installation of permanent PQ measurement devices at various locations within the Newman Township. This is further evidenced by the installation of a metering outlet (3-Phase GPO) within selected pad-mount substations for the purpose of deploying a portable PQ measurement device across the Newman Township on a rotating basis to identify potential locations for permanent measurement devices to assess the holistic power quality of the network. It is noted that a strategy has been implemented within the BHPBIO SAP system which raises a work order periodically (monthly) to relocate the portable logger.


## 4.2.Part 2, Division 2 – Standards for the Interruption of Supply to Individual Customers, Section 9 & Section 10

Sections 9 and 10 relate to General Standard of Reliability; and Duty to Reduce Effect of Interruption respectively.

According to this provision, a transmitter or distributor must, *so far as is reasonably practicable*, ensure that the supply of electricity to a customer is maintained and the occurrence and duration of interruptions is kept to a minimum. According to this provision, it is not a breach of section 9 of the Code for BHPBIOSA to interrupt the supply of electricity to a customer for the purpose of maintaining or alter the network if the length of the interruption does not exceed 4 hours and BHPBIOSA have given notice of the proposed interruption to the customer not less than 72 hours before the start of the interruption. If it is not reasonably practicable to provide more than 72 hours of notice; notice should be given at the earliest practicable time before the start of interruption.

Table 4 shows the evaluation matrix for BHPBIOSA in relation to Part 2 Division 2 Section 9 & 10 of the Code.

**Table 4 | Part 2 Division 2 Section 9 & 10 - Evaluation Matrix**

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Med	High		
1	Process	Processes in place and documented			✓	10%	Note 6
2		Process fully integrated with corporate management systems		✓		0%	No change
3		Demonstrated operator understanding of the process			✓	0%	No change
4		Evidence that the process is followed and records are kept as per process			✓	0%	No change
5	Continuous Improvement	KPIs are in place			✓	0%	No change
6		Reporting system supports continuous improvement			✓	0%	No change
7		Evidence action taken - continuous improvement			✓	10%	Note 7
8		Overall Ranking					

**Note 6:** Where necessary, BHPBIOSA have the capability to deploy temporary diesel generation units to supply customers locally during the planned outage period. Note that no temporary generation was employed in FY16/17, largely due to the extensive N-1 capabilities of the Newman Township network, which where possible is given priority implementation over temporary generation units to ensure customers supply is maintained.

**Note 7:** BHPBIOSA have developed and begun the process of implementing a relay test instruction – best practices document. This document is designed to improve the quality assurance and reliability of the reporting and maintenance of protection relays and protection control schemes. Through the implementation of this best practices document a number of commissioning issues were identified and where possible rectified, i.e., protection grading issues.


### 4.3.Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 11; Section 12; and Division 3 Section 13

Sections 11, 12, and Division 3 Section 13 relate to Planned Interruptions, Significant Interruptions and Standards prescribed for particular areas respectively.

An appropriate system is required to record all the scheduled outages that BHPBIOSA plan to undertaken in each year. An efficient process should be in place for providing notifications to each of the customers that will be affected by planned interruptions in compliance with the provision.

Table 5 shows the evaluation matrix for BHPBIOSA in relation to Part 2 Division 2 Section 11, 12 & Division 3 Section 13 of the Code.

**Table 5 | Part 2 Division 2 Section 11, 12 & Division 3 Section 13 - Evaluation Matrix**

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Med	High		
1	Process	Processes in place and documented		✓		10%	Note 8
2		Process fully integrated with corporate management systems		✓		0%	No change
3		Demonstrated operator understanding of the process			✓	0%	No change
4		Evidence that the process is followed and records are kept as per process		✓		0%	No change
5	Continuous Improvement	KPIs are in place			✓	0%	No change
6		Reporting system supports continuous improvement			✓	0%	No change
7		Evidence action taken - continuous improvement			✓	0%	No change
8		Overall Ranking					

**Note 8:** As evident by interviewee discussions, BHPBIOSA provide notification of planned outages within the following timeframes:

- General customers - 72hrs notice in advance; and
- Life support customers - 168hrs in advance.



## 4.4.Audit Observations

The following observations were made throughout the audit process:

1. The BHPBIOSA employees that are involved in managing power quality understand the need to:
  - Ensure compliance with The Code's requirements;
  - Expediently rectify network disturbances that affect the quality of supply to customers; and
  - Extend the monitoring capability of the LV network.
2. The BHPBIOSA employees demonstrated a clear understanding of their roles and responsibilities in maintaining supply reliability and minimising the duration and frequency of interruptions to the customers.
3. The BHPBIOSA employees demonstrated a clear understanding of the systems and processes involved in managing planned and unplanned outages.
4. The BHPBIOSA engineering team demonstrated sound understanding of the potential interferences that affect the power supply quality of the network, evident from discussions with BHPBIOSA employees regarding the changeover of three phase air-conditioning units to single phase units and the potential harmonic and load balance issues expected.
5. Relevant BHPBIOSA interviewees demonstrated a concise understanding of their responsibilities under Part 2 Division 2 Section 12 of the Electricity Code to remedy the causes of interruptions to small use customers or enter into alternative arrangements if the supply has been interrupted for more than 12 hours continuously, or more than the permitted number of times.
6. BHPBIOSA continue to utilise a retailing and billing contractor (Agility, previously MBC Global) to facilitate as a 24/7 customer call centre for complaints, as well Agility manages the retailing and billing services. Complaints made through Agility are filtered through to BHPBIOSA as required. The number of power quality related complaints was nil which corresponds with the observed physical quality of the network supply.
7. In the 2016/2017 period, BHPBIOSA has continued the process of replacing ageing or defective pole top transformers; the implementation of this process is supported through standardised preferred distribution transformer rating and supplier. Additionally, BHPBIO has continued the process of replacing ageing or defective Oil Circuit Breakers (OCBs). Completion of this OCB replacement project is expected within the 2017/2018 financial year.
8. BHPBIOSA team demonstrated a sound understanding of the need to improve the monitoring capabilities of the network through permanent PQ monitoring of the LV network. The installation of permanent PQ monitoring systems would provide proactive monitoring for network quality and would give BHPBIOSA a greater visibility of network and adverse PQ events occurring close to (or being caused by) LV customers. The installation of three phase metering outlets within selected pad-mount substations enables BHPBIOSA to deploy a portable PQ measurement device across the Newman Township on a rotating basis to identify potential locations for permanent measurement devices to assess the holistic power quality of the network. It is noted that a strategy has been implemented within the BHPBIOSA SAP system which raises a work order periodically (monthly) to relocate the portable logger.
9. BHPBIOSA have undergone significant changes to the structure of the division. Previously under the governance of Non-Process Infrastructure (NPI), BHPBIOSA is now governed under the title of Western Australian Iron Ore (WAIO) Maintenance – HV & Power. Figure 1 below details the basic structure for the leadership roles within the WAIO Maintenance – HV & Power team.

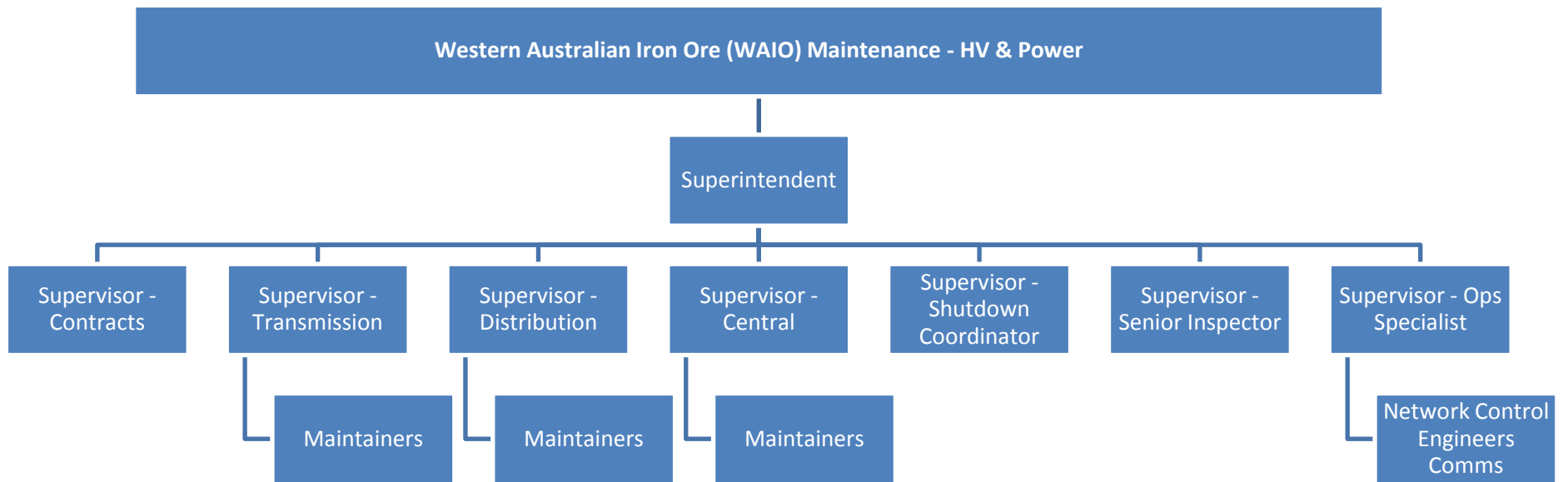


Figure 1 | Leadership Organisational Structure

10. The continual improvement of the Network Controller role in the previous financial year has been successful with the role acting as a central point to monitor and control the network and outages. Utilizing the network controller in this manner has created a centralized system for outage information, as such the availability and consistency of the outage information is further streamlined. In term of root cause analysis this enables systemic issues to be identified more succinctly.
11. BHPBIOSA employees are conscious of network performance and appear to take an active and responsible stance to underperforming assets, including:
  - Replacement of ageing and defective primary equipment, i.e., distribution transformers within the township and oil circuit breakers;
  - Continuation of a preventative program to reduce the number of wildlife related outages (bird strikes). This preventative program includes applying bird coverings on the O/H lines where possible, as well as interaction with project teams to improve the design specifications of O/H poles, i.e., implementing covers on the cross arms to prevent birds nesting within the cross arms and subsequently prevent predatory birds from striking with the O/H lines when aggressing these nesting birds; and
  - Introduction of a Relay Test Instruction to improve the quality assurance and reliability of the reporting and maintenance of protection relays and protection control schemes. Through the implementation of this best practices document a number of commissioning issues were identified and where possible rectified, i.e., protection grading issues.
12. As evident by interviewee's discussions, BHPBIOSA have portable standby generators in place to cater for extended planned or unplanned interruptions. However, no temporary generation was deployed for the financial year ending June 2017. This is largely due to the extensive N-1 capabilities of the Newman Township network.
13. BHPBIOSA currently supply three customers with special health needs who rely on electricity for life support.
14. BHPBIOSA previously worked under the 2005 Inspection System Plan (ISP), however within the 2016/2017 FY approval from Energy Safety has been obtained for the new 2016 ISP and accompanying manual, as such BHPBIOSA now works under the 2016 ISP and manual.
15. The following feedback was conveyed through the audit process:
  - The introduction of industry experts has brought more utilities based personnel into the team, this implementation allows BHPBIOSA to improve in-house skillsets and capabilities in terms of relay testing (protection systems) and primary plant testing.
  - Positive feedback was conveyed regarding the utilisation of the network control and the network controller role. It is noted that network control is now the central point of contact prior to entering switchyards and for switching.
  - BHPBIOSA has increased training opportunities for the maintainers. Recent training undertaken surrounded the maintenance and testing of tap changers.
  - A shortage in the resources allocated to the inspection process was identified. The main shortage identified related to the administrative works required for the task. An amount of double handling was identified in regard to data entry and inspection processes, i.e., the process surrounding notice of completions requires a significant amount of re-entry of the same document or information.

## 5. CONCLUSIONS & RECOMMENDATIONS

The audit interviews were undertaken on the 18<sup>th</sup> July 2017 at BHPBIOSA's Newman offices; with most of the relevant stakeholders made themselves available for the audit process. It was noted by several interviewees that positive change within the business had occurred since the previous reporting period.

Within the 2016/17 reporting period BHPBIOSA underwent significant changes and restructures to the division. The most notable change being the transfer of BHPBIOSA from being under the governance of the Non-Process Infrastructure (NPI) division to being classed under the Western Australian Iron Ore (WAIO) Maintenance – HV & Power division.

Within the 2016/17 reporting period the most significant improvement was the positive utilisation of network control and the network controller role. This utilisation has enabled BHPBIOSA to create a centralized system for outage information, as such the availability and consistency of the outage information is further streamlined. In term of root cause analysis this enables systemic issues to be identified more succinctly.

BHPBIOSA continue to demonstrate a pro-active response to improving the reliability of Newman's electrical network. The positive response is evident from the strategic replacement of underperforming equipment as well as installation of assets to improve network capacity and reliability, for example:

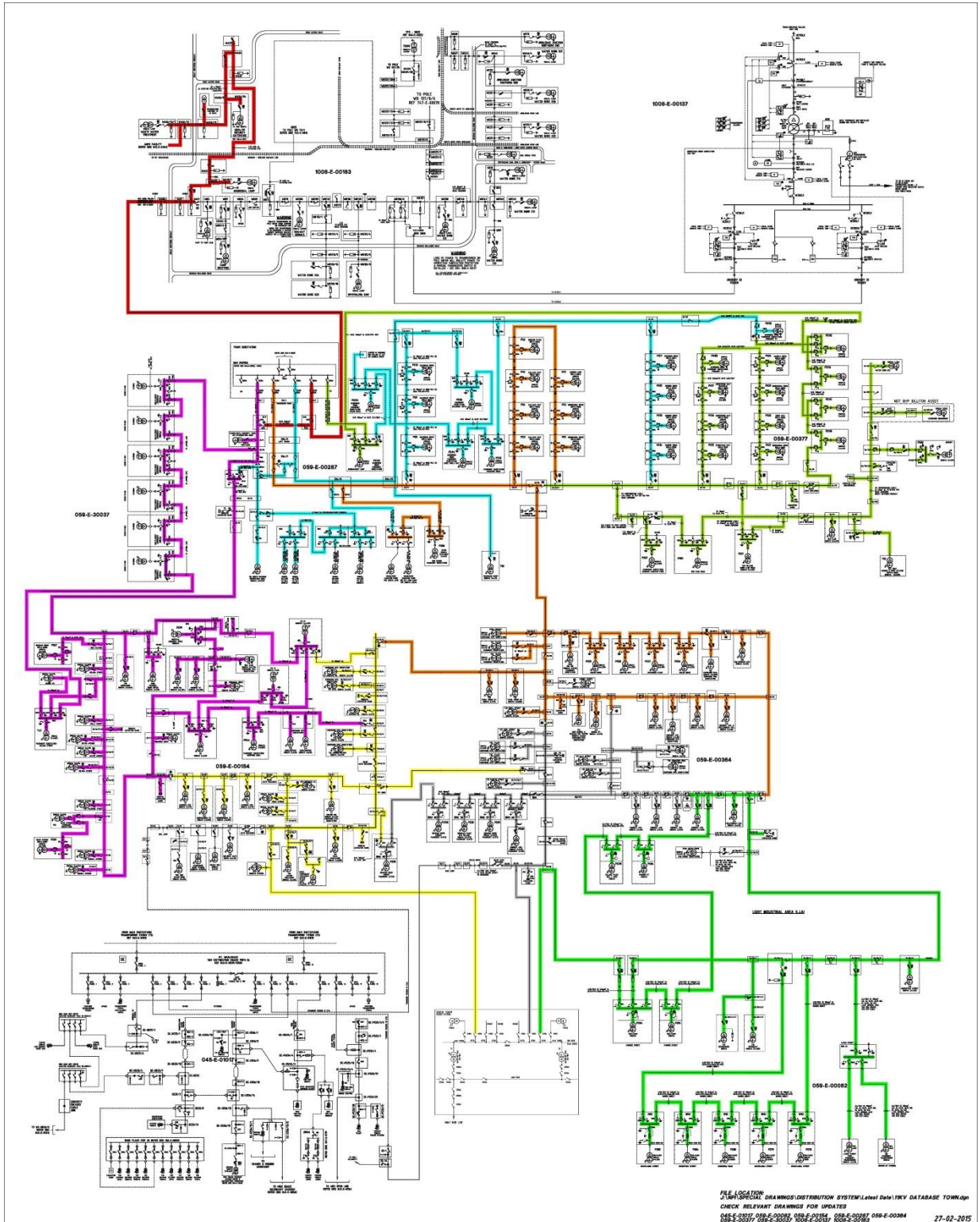
- Multiple ageing or defective pole top distribution transformers were replaced;
- Continuation of a preventative program to reduce the number of wildlife related outages (bird strikes), which involves the installation of bird coverings on the O/H lines, cross arms and improved recloser operations; and
- In addition to these replacements and installations, the implementation of a Relay Test Instruction which increased the ability to identify potential protection grading issues at the commissioning stage of works.

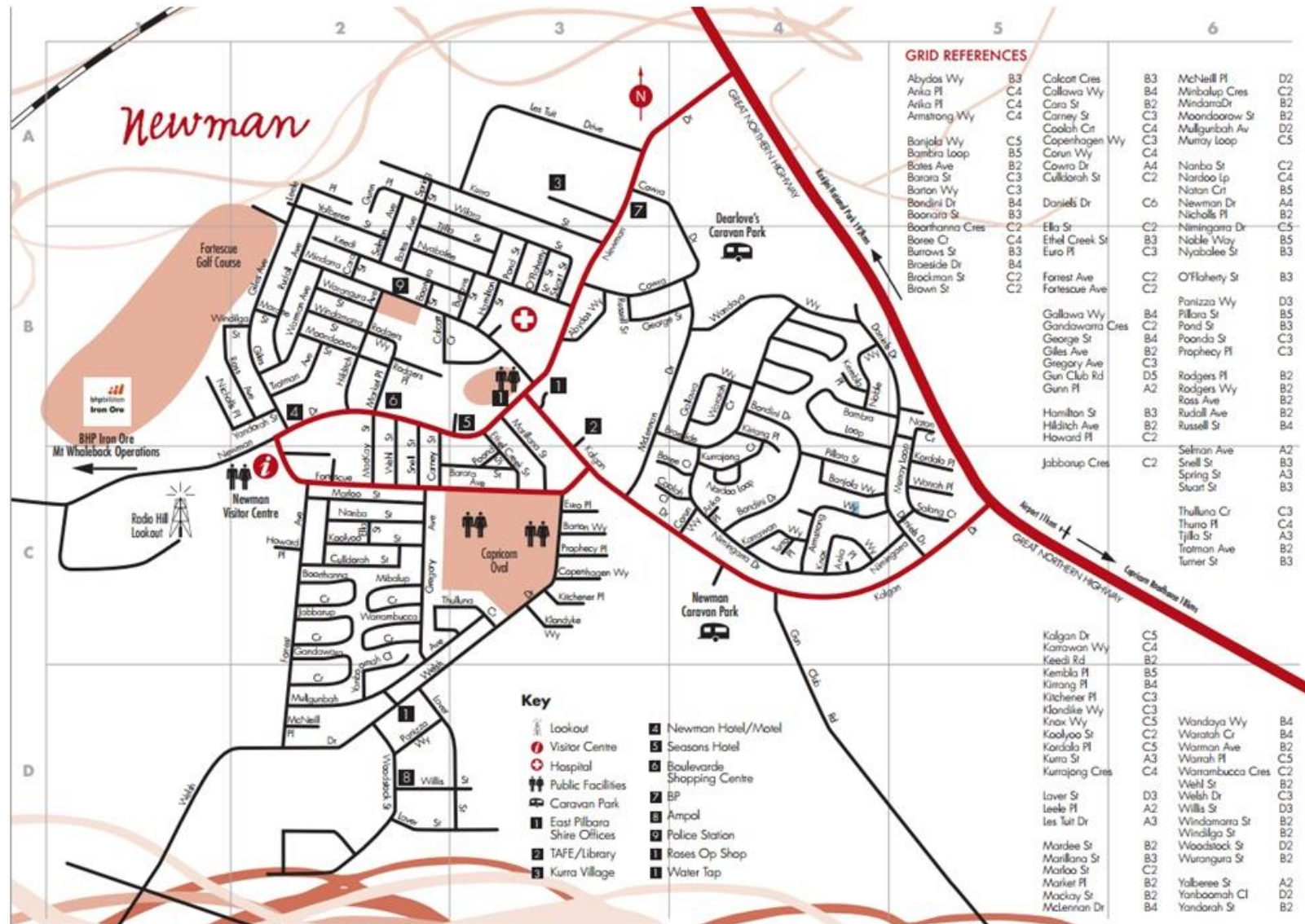
With respects to the holistic electrical network, the recent PQ metering data indicates that Newman's electrical network has undergone noteworthy improvements to maintain its reputation as a robust and inherently good network. The basic electrical parameters of voltage, frequency and voltage total harmonic distortion were consistently stable and well within compliance-levels. The only exception was the individual Voltage Harmonic Distortions for the feeders supplied from Town Substation. The magnitude of the voltage's even harmonics (specifically 6<sup>th</sup> order) were found to occasionally exceed the limits set by AS 61000:2001, which in turn indicates the presence of unbalanced 3-phase loads with possible DC component in the network. This is not a problem of major concern at the present time (as observed for <1% of the measurements). However, should it exacerbate in coming years, then mitigation measures may be required to ensure quality of supply.

There are 2 main areas where BHPBIOSA can continue to develop further:

- Further investigation and advancement toward implementing permanent PQ monitoring of the LV network in order to ensure compliant supply at the customer's point of connection as per Part 2 Section 5 of the Electricity Code; and
- Investigation into the shortage in the resources allocated to the inspection process as identified by the audit process. The main shortage identified related to the administrative works required for the task as well as the lost time due to the double handling in regard to data entry and inspection processes, i.e., the process surrounding notice of completions.

# APPENDIX A NEWMAN TOWNSHIP (SLD & MAP)





## APPENDIX B BHPBIOSA CUSTOMER REGISTER

Refer to the attached.

Substation	Feeder	TX/RMU/REC	Street/Location	Houses	Units	Other	Total Consumers
Town	TC1						548
Town	TC2						141
Town	TC3						610
Town	TC4						152
Southtown	STS1						160
Southtown	STS2						567
Southtown	STS3						
Southtown	STS4						
Southtown	STS5						
Southtown	STS6						217
Town	TC1	PS1	Nimingarra Dr	17			17
Town	TC1	PS2	Nimingarra Dr	19			19
Town	TC1	PS28	Kalgan Drv			1	1
Town	TC1	PS3	Callawa Way	21			21
Town	TC1	PS34	Highchool			2	2
Town	TC1	PS38	Gregory	32		1	33
Town	TC1	PS4	Callawa Way	14	8		22
Town	TC1	PS5	Callawa Way	26	9		35
Town	TC1	PS50	Marilanna St		24		24
Town	TC1	PS51	Marilanna St		16		16
Town	TC1	PS56	Welsh Drv	23			23
Town	TC1	PS57	Kitchner	24			24
Town	TC1	PS58	Barton Way	15			15
Town	TC1	PS59	Welsh Drv	20			20
Town	TC1	PS6	Kirrang Pl	16			16
Town	TC1	PS62	Mia Mia			1	1
Town	TC1	PS68	Capricorn Oval			5	5
Town	TC1	PS7	Nardo Loop	18			18
Town	TC1	PS86	Red Sands			1	1
Town	TC1	T23	Snell St	29			29
Town	TC1	T24	Ethel Crk St	28			28
Town	TC1	T25	Ethel Crk St	27			27
Town	TC1	T29	Nanba	23			23
Town	TC1	T39	Gregory	35			35
Town	TC1	T45	Gregory	23			23
Town	TC1	T52	Mullgumbah	21			21
Town	TC1	T55	Carney	25			25
Town	TC1	T77	Gregory	22			22
Town	TC1	T85	Newman Drv			1	1
Town	TC1	T93	Newman Drv			1	1
Town	TC2	Kurra Village TX1&4					0
Town	TC2	Kurra Village TX2&3					0
Town	TC2	PS10	McLennan Drv		16	1	17
Town	TC2	PS11	Braeside Drv	19			19
Town	TC2	PS110	Pingandy St				0
Town	TC2	PS114	Weeli Wolli Way				0
Town	TC2	PS12	Bondini	19		1	20
Town	TC2	PS124	Dales Rd	1			1
Town	TC2	PS13	Bondini	20			20
Town	TC2	PS14	Bondini	18			18
Town	TC2	PS32	Braeside Drv				0
Town	TC2	PS36	Kalamina Vista				0
Town	TC2	PS8	McLennan Drv		25	1	26
Town	TC2	PS9	McLennan Drv		16	1	17
Town	TC2	T81	BMX Area			2	2
Town	TC2	T83	Sewerage Pump			1	1
Town	TC3	PS104	Les Tutt Drv	54			54
Town	TC3	PS105	Snappy Gum	42			42
Town	TC3	PS106	Bloodwood	55			55
Town	TC3	PS107	Les Tutt Drv	34			34
Town	TC3	PS108	Les Tutt Drv			1	1
Town	TC3	PS109	Les Tutt Drv	2			2
Town	TC3	PS123	Newman Club			2	2
Town	TC3	PS41	Newman House			2	2
Town	TC3	PS44	Shopping Centre Pools				0
Town	TC3	PS47	Wilara st	19			19
Town	TC3	PS53	Giles Ave				0
Town	TC3	PS61	Kurra St	33			33
Town	TC3	PS67	Fire Stn	1	1	1	3
Town	TC3	PS69	Giles Ave			1	1
Town	TC3	PS82	Shire			3	3
Town	TC3	PS97	Boomerang Oval				1
Town	TC3	PS99	Hospital	2		2	4



Town	TC3	T1	Mindarra	26			26
Town	TC3	T10	Rudall Ave	23			23
Town	TC3	T11	Rudall Ave	28			28
Town	TC3	T12	Burrows	36			36
Town	TC3	T14	Mindarra	11	8	1	20
Town	TC3	T15	Yalberree	43			43
Town	TC3	T16	Bates Ave	24			24
Town	TC3	T17	Tjilla	30			30
Town	TC3	T18	Wilara st	31			31
Town	TC3	T21	Wilara st	22		1	23
Town	TC3	T32	Ambulance	23		1	24
Town	TC3	T71	Bates Ave	22			22
Town	TC3	T8	Pools			2	2
Town	TC3	T9	Keedi Rd	22			22
Town	TC4	Airport				1	1
Town	TC4	Capricorn Roadhouse	HWY			1	1
Town	TC4	Gun Club				1	1
Town	TC4	K21	Water Bore near airport				0
Town	TC4	PS103	Pingandy	26			26
Town	TC4	PS115	Daniels Drv				0
Town	TC4	PS116	Sub Rd 6 New Area				0
Town	TC4	PS117	Sub Rd 7 New Area				0
Town	TC4	PS118	Daniels Drv				0
Town	TC4	PS125	Bubbacurry Loop	4			4
Town	TC4	PS15	Karrawan	19			19
Town	TC4	PS16	Armstrong	10			10
Town	TC4	PS17	Armstrong		10		10
Town	TC4	PS21	Nimingarra	20			20
Town	TC4	PS22	Knox	12			12
Town	TC4	PS23	Nimingarra	8	15		23
Town	TC4	PS24	Daniels	8	14		22
Town	TC4	PS27	Newman Caravan Park			1	1
Town	TC4	PS31	Eco-Village Gun Club Rd			1	1
Town	TC4	PS81	Gun Club Rd			1	1
Town	TC4	T92	Corner B				0
Southtown	STS1	AB1	Lendlease			1	1
Southtown	STS1	PS119	Pillage Pl			2	2
Southtown	STS1	PS25	Laver St			20	20
Southtown	STS1	PS26	Welsh Drv			9	9
Southtown	STS1	PS78	Shovelanna			2	2
Southtown	STS1	PS79	Shovelanna			9	9
Southtown	STS1	PS80	Wonmonna Rd			5	5
Southtown	STS1	PS84	Woodstock			3	3
Southtown	STS1	PS85	Shovelanna			7	7
Southtown	STS1	PS94	Pardoo St			7	7
Southtown	STS1	PS95	Pardoo St			7	7
Southtown	STS1	PS96	Pardoo			8	8
Southtown	STS1	T48	Forrest	31			31
Southtown	STS1	T49	Mullgumbah	28			28
Southtown	STS1	T66	Woodstock			19	19
Southtown	STS1	T86	Newman Speedway			1	1
Southtown	STS1	T87	Motocross Track			1	1
Southtown	STS2	PS102	Golf Links Rd	35			35
Southtown	STS2	PS29	Howard Drv	23		1	24
Southtown	STS2	PS30	Nicholls Pl	9		1	10
Southtown	STS2	PS60	Forrest Ave	15			15
Southtown	STS2	PS70	Jabberup Cres	28			28
Southtown	STS2	PS98	Newman Dr	20			20
Southtown	STS2	T22	Wehl St	19			19
Southtown	STS2	T28	Fortescue		192		192
Southtown	STS2	T30	Koolyou St	26			26
Southtown	STS2	T31	Marloo	28			28
Southtown	STS2	T33	Fortescue				0
Southtown	STS2	T35	Culldorah	33			33
Southtown	STS2	T36	Forrest Ave	39			39
Southtown	STS2	T37	Forrest Ave	40			40
Southtown	STS2	T43	Forrest Ave	33			33
Southtown	STS2	T72	Ella st	25			25
Southtown	STS3						
Southtown	STS4						
Southtown	STS5						
Southtown	STS6	PS111	Hilditch Ave			7	7
Southtown	STS6	PS113	Temp WTP			1	1
Southtown	STS6	PS120	Newman Drv			1	1

Southtown	STS6	PS121	Newman Drv			1	1
Southtown	STS6	PS122	Newman Drv			1	1
Southtown	STS6	PS127	New WTP			1	1
Southtown	STS6	PS73	Shops			5	5
Southtown	STS6	T19	Ross Ave	29			29
Southtown	STS6	T2	Warman Ave	41			41
Southtown	STS6	T20	Ross Ave	13			13
Southtown	STS6	T3	Moodoorow St	47			47
Southtown	STS6	T4	Warman	23			23
Southtown	STS6	T42	Windamarra	23			23
Southtown	STS6	T6	Newman Drv			1	1
Southtown	STS6	T64	PMG Aviation			1	1
Southtown	STS6	T65	Newman WTP				0
Southtown	STS6	T7	Newman Drv			1	1
Southtown	STS6	T80	Old LIA			10	10
Southtown	STS6	T94	Yanderah	8		3	11