GOLDEN SUN MOTH MONITORING 2015

York Park

SMEC Australia Pty Ltd

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EXECUTIVE SUMMARY

Introduction

SMEC Australia Pty Ltd prepared this monitoring report on behalf of the ACT Government Land Development Agency to meet the 2016 annual reporting requirements of the *Potential shading impacts on York Park golden sun monitoring plan* (RJPL 2014a, the monitoring plan)., primarily the year 3 golden sun moth (*Synemon plana,* GSM) flying moth survey, pupa case search and vegetation condition assessment conducted in 2015 in accordance with the monitoring plan.

Results

Data is provided in summarised form suitable for incorporation into future trend analysis. All survey data is presented Appendices A and C. Meteorological data obtained for Canberra Airport from the Bureau of Meteorology is summarised in Appendices C and D.

The key results are:

- Flying GSM were recorded in moderate numbers at the beginning of the flying season (i.e. mid-November) but decreased quickly to low number by early December. Flying moth abundance was roughly consistent with previous surveys;
- A total of six pupae cases were found, consistent with the very low detection in previous survey surveys. This detection rate is too low to enable meaningful BACI analysis of pupae cases;
- Vegetation condition was generally lower in comparison to previous surveys, particularly the 2014 survey, however this was more pronounced within the control zone and is likely to be attributable to survey timing and seasonal conditions;
- Data could be downloaded from only two of the four soil temperature data loggers due to a manufacturer's software upgrade error;
- It is not possible to make any judgements relating to long-term trends in GSM abundance or vegetation condition based on the three years of monitoring data collected to date.

This report fulfils the reporting requirements for GSM monitoring at the York Park for year 3 as specified in the monitoring plan (RJPL 2014a).

Recommendations

It is recommended that data loggers be replaced with a more reliable model prior to winter 2016. In addition, discussions with should DoE be undertaken to review the following recommended amendments to the GSM monitoring plan:

- the pupae case surveys and associated analyses should be removed from the monitoring plan as detection of pupae cases is insufficient for meaningful analysis;
- the importance of monitoring soil temperatures should be reviewed after one additional full season of monitoring, and, if there is no substantial difference in soil temperatures within shaded and unshaded areas after this period, potentially removed from the monitoring plan.

1. INTRODUCTION

SMEC Australia Pty Ltd prepared this monitoring report on behalf of Section 22 Barton Pty Ltd to meet the 2015 annual reporting requirements of the *Potential shading impacts on York Park golden sun monitoring plan* (RJPL 2014a, the monitoring plan). The monitoring plan was developed to meet Commonwealth *Environment Protection Biodiversity Conservation 1999 Act* (EPBC Act) approval decision (*EPBC 2012/6606*) conditions for development of a hotel and carpark at Block 14 Section 22 Barton (14/22 Barton). The report contains detailed descriptions of the site, proposed actions and monitoring procedures (RJPL 2014a).

This report presents the Year 3 baseline monitoring surveys undertaken in spring and summer 2015 for flying golden sun moth (*Synemon plana*, GSM), GSM pupae cases and vegetation condition at York Park.

Year 1 and Year 2 baseline surveys are presented in the York Park Golden Sun Moth Monitoring 2013 survey report (RJPL 2014b) and 2014 survey report (RJPL 2015) and, where relevant, have been referenced for comparison. Limited assessment and analysis of the monitoring data is possible after the 3rd year of data collection during the 2015 GSM flying season, and BACI analysis is not to be commenced until after the 5th year of data collection (RJPL 2014a).

2. METHODS

2.1 Regional GSM Information

GSM information, including sightings, general locations and activity levels around the ACT region were shared by researchers and consultants via email on a weekly basis during the GSM flying season. As this communication was intermittent, no summary of GSM activity recorded throughout the region could be produced.

2.2 Flying Moth Surveys

As specified in the monitoring plan (RJPL 2014a), flying GSM surveys were conducted in a manner consistent with the ACT Government (2010a) GSM survey guidelines and with the annual monitoring approach presented in Umwelt (*in prep*), as follows:

- Flying GSMs would be counted along two 100 m transects along the long axis of York Park (Figure 1) and recorded as number of GSM per 100 m transect.
- The transect survey would be undertaken three times approximately half an hour apart.
- To compare baseline GSM activity levels with post-shading GSM activity levels, two sets of rotational point counts, involving 10 repeated, 30 second rotational counts, would be conducted at one site in the centre of the York Park GSM site between the transect surveys (Figure 1). All GSM seen in a radius of 25 m are to be recorded. Any individuals that re-crossed the observer's visual path were double counted. Averages were calculated from the ten rotations at each point to provide number of GSM per 30 second rotation. Data recorded using this approach is comparable with data collected by Umwelt (Australia) Pty Ltd for the year 1 and year 2 surveys (RJPL 2014b, RJPL 2015).
- To compare activity levels in the northern and southern ends of the York Park GSM site, two sets of rotational point counts, involving 10 repeated, 30 second rotational counts, would be conducted at two sites approximately one third and two thirds of the way along the centre line of York Park GSM site between the transect surveys (Figure 1), i.e. approximately 25 m from each end. All GSM seen in a radius of 25 m are to be recorded. Any individuals that re-cross the observer's visual path would be double counted. Averages were calculated from the ten rotations at each point to provide a number of GSM per 30 second rotation.

The start of the GSM flying season was confirmed using known reference sites in the ACT, including York Park, and consultation with the ACT GSM monitoring group. In practice, suitable daily weather conditions determine repeat survey timings and shorter survey return times of no less than 3 days may be applied.

Other on-site weather data was recorded during all field surveys of flying GSM to assist with interpreting the GSM survey results on a year to year basis. The following data was recorded during flying moth surveys:

- wind speed and direction
- air temperature
- cloud cover.

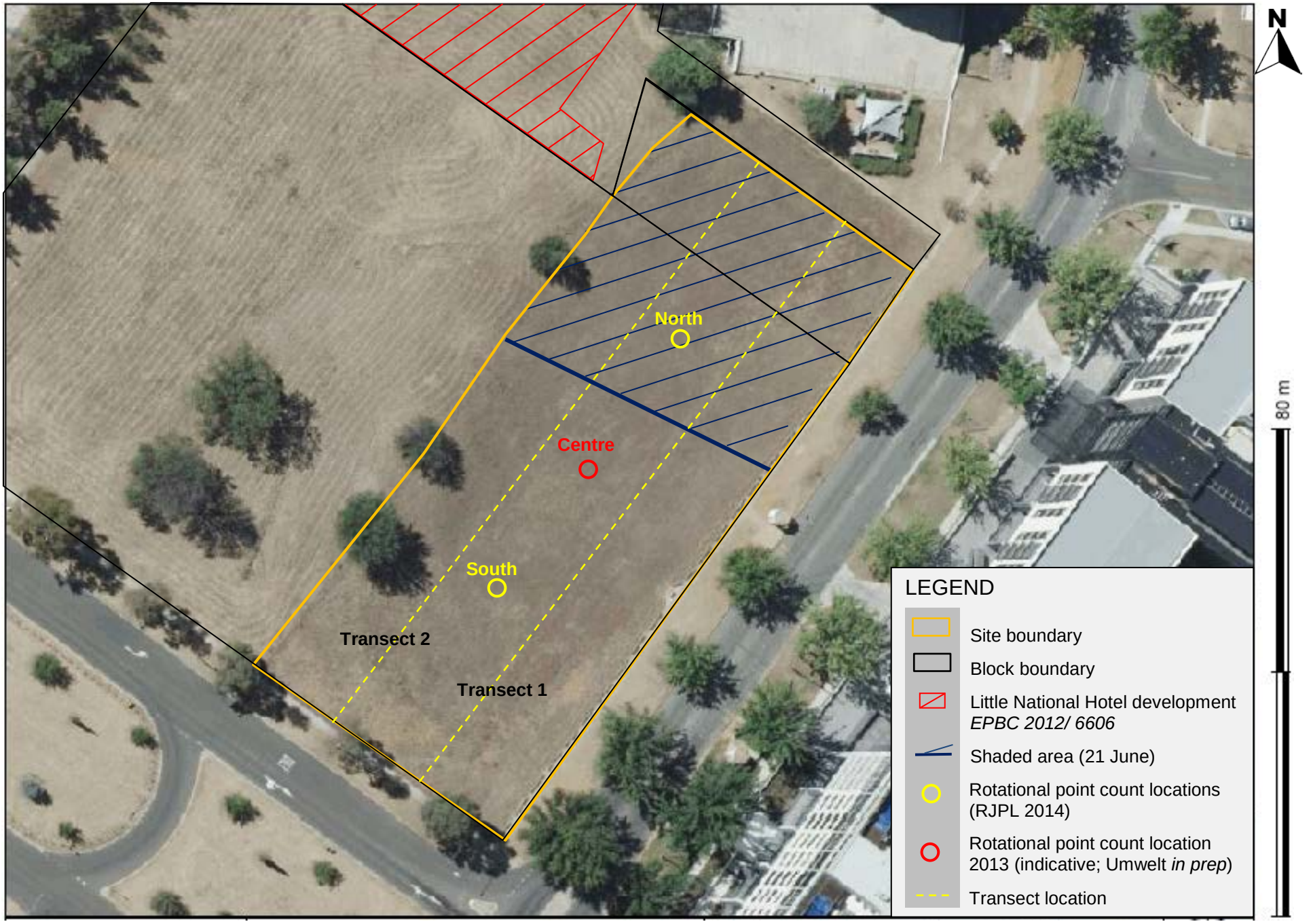

Figure 1. York Park GSM site flying moth survey details 2015.

2.3 Survey Area and Quadrat Placement

The survey area defined in the monitoring plan (RJPL 2014a) incorporates the York Park GSM site, and excludes the area now developed for road access to 14/22 Barton and areas of exotic perennial grasses and native *Poa* and *Themeda* plantings (Rowell 2012). As specified in the monitoring plan, the site is stratified into the following four zones for the pupae case surveys and vegetation assessments:

- Zone 1a: shaded by the proposed development at 14/22 Barton (impact)
- Zone 1b: shaded by the proposed development at 14/22 Barton and potentially shaded by the proposed development at Part 3/22 Barton (impact)
- Zone 2a: unshaded by the proposed development at 14/22 Barton and unshaded by the proposed development at Part 3/22 Barton (control)
- Zone 2b: unshaded by the proposed development at 14/22 Barton but potentially shaded by the proposed development at Part 3/22 Barton (control).

Twenty-four, 1 m^2 quadrats were established across the site at the beginning of the year 1 baseline survey season (RJPL 2014b). Each of these locations was approximately relocated using GPS locations and the map provided in the monitoring plan (RJPL 2014a). Plots were marked using wire pegs and plastic tags installed flush with the ground to permit relocation of the quadrats for repeat sampling during the season. All plot markers were removed at the end of the season. Figure 2 shows the York Park and GSM transect and plot locations and quadrat placement.

2.4 Pupae Case Monitoring

Pupae case surveys were conducted as specified in the monitoring plan (RJPL 2014a). Pupae cases were counted in each of the 24 quadrats approximately every two weeks over a six week period (i.e. 3 times) during the GSM flying period from early-to-mid November until late December. All cases detected were removed for identification (e.g. using microscopy). This would ensure that individual pupae cases were counted in one survey only.

2.5 Vegetation Monitoring

Data recorded for each quadrat included:

- all species present
- the dominant species (single or multiple)
- cover / abundance (%) using the Braun-Blanquet cover / abundance classes outlined in ACT Government (2010b).

Floristic value scores were calculated from abundance data based on Rehwinkel (2007) consistent with ACT Government (2010b).

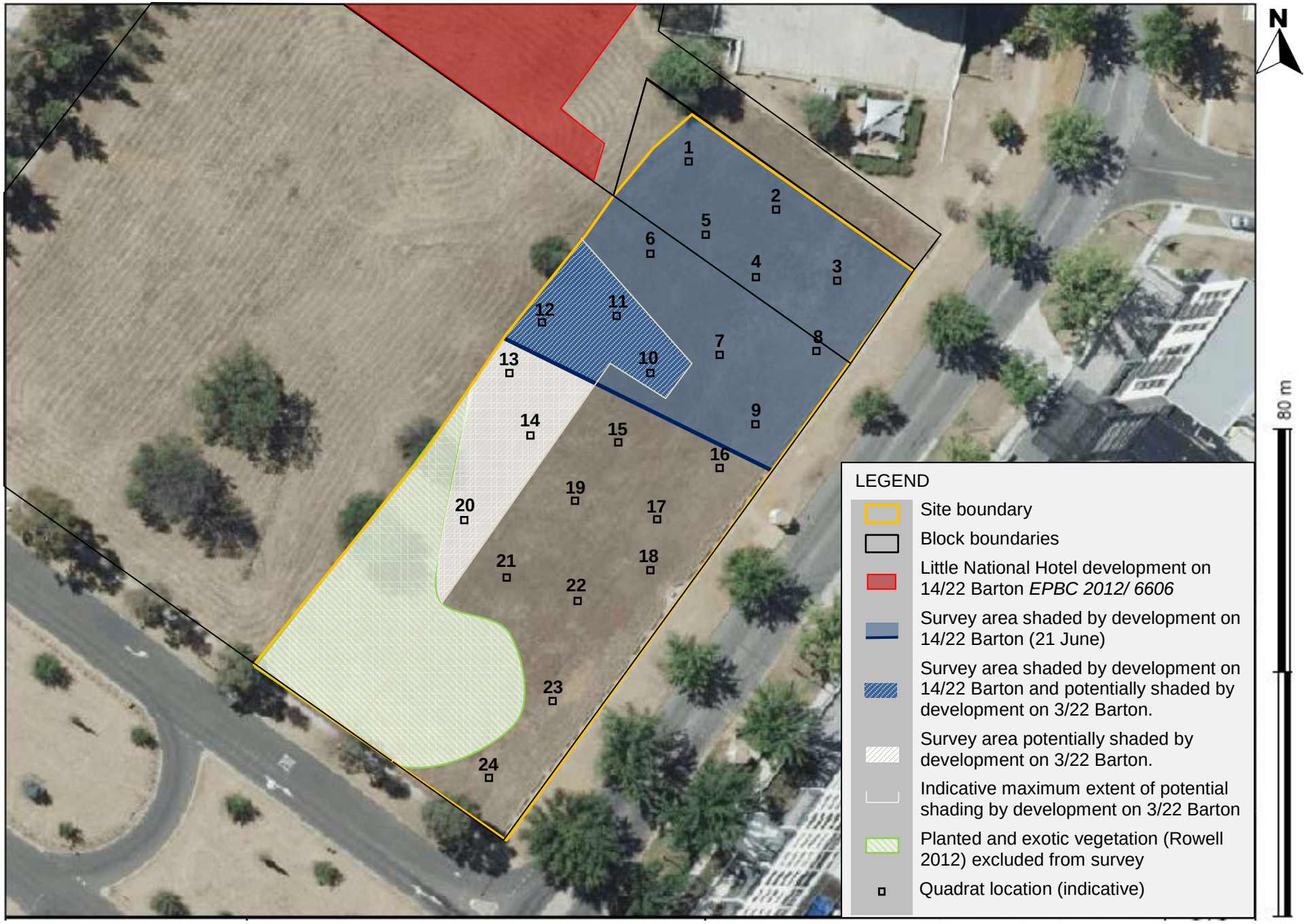

Figure 2. York Park pupae case and vegetation quadrat locations.

2.6 Soil Temperature Monitoring

On-site soil temperature monitoring in shaded and un-shaded areas commenced on 21 October 2014. One temperature logger were recovered on the 18 December 2015 and the other three temperature loggers were recovered on 1 February 2016.

2.7 Meteorological Data

Meteorological data from Canberra Airport was obtained for the period 2013-2015 to assist in the interpretation of potential shading impacts.

3. RESULTS

3.1 Regional GSM Information

GSM were first observed flying in the ACT on 18 November 2015 and were confirmed to be flying in moderate numbers at multiple sites in the ACT in mid to late November 2015 (A. Rowell, pers. comm.). The flying season was confirmed to have started throughout the region by the end of the third week of November 2015, which was approximately two weeks later than flying was confirmed in 2014. This delay is believed to be due to regular rain in early November. Peak activity in the ACT region is thought to have occurred around late November, with GSM activity tapering off into early December and finishing by mid-December (A. Rowell, pers. comm.).

3.2 Flying Moth Surveys

Flying GSM were surveyed according to the method specified in the monitoring plan (RJPL 2014a) on three occasions approximately two weeks apart during the GSM flying period. Table 3-1 presents the dates and weather conditions of each survey. All surveys were conducted on suitable days. Other consultants and researchers also conducted surveys at various sites in the Canberra region and detected flying GSM (CPR, unpublished data).

Table 3-1. Site conditions during flying moth surveys.

Date	Max Temperature (ºC)	Rainfall (mm)	Wind speed and direction	Cloud cover
19/11/2015	34.5	0	Calm	Fine
25/11/2015	25.0	0	2.3 km/h NNW	Fine
1/12/2015	25.0	0	Gentle breeze (4 km/h E)	Fine, no cloud

Appendix A presents the complete dataset for the flying moth surveys. Table 3-2 and

Table 3-3 present aggregated survey results for transect surveys and rotational point counts respectively.

Table 3-2. Summary of flying GSM numbers - Transect surveys.

Transect	Transect location	Average (1dp)
Transect 1	East	10.2
Transect 2	West	8.6
Combined		9.4

Table 3-3. Summary of flying GSM numbers - Point count surveys.

Time	Location	Average (1dp)	Range
N/A	North	1.4	1 - 5
12:00	Centre	1.9	0 - 8
12:15	Centre	3.0	1 - 12
Centre Combined	Centre	2.4	1 - 12
N/A	South	2.0	0 - 7

3.3 Pupae Case Surveys

Pupa case surveys were conducted according to the method specified in the monitoring plan (RJPL 2014a) on three occasions. Surveys were undertaken on 25 November 2015, 1 December 2015 and 15 December 2015.

Appendix B presents the complete pupa case survey dataset. Table 3-4 presents a summary of the pupa case survey results for the control and impact zones. The location of pupae cases recorded in York Park is shown in Figure 3. Low pupa case numbers were recorded, i.e. three pupae cases were recorded in Zone 1a, two pupae cases were recorded in Zone 2a and one pupa case was recorded in Zone 1b. No pupae cases were recorded in Zone 2b.

Table 3-4. Summary of the pupae case surveys within control and impact sites.

	Pupae cases	
Zone	**Average (1dp)**	**Maximum number**
Zone 1a	0.3	2
Zone 1b	0.3	1
Zone 1 (impact)	**0.3**	**2**
Zone 2a	0.2	1
Zone 2b	0.0	0
Zone 2 (control)	**0.1**	**1**

3.4 Vegetation Surveys

Dominant species, percentage cover and complete species lists, including Braun-Blanquet abundance scores, were collected for each quadrat. All data is presented in Appendix C. Species recorded are shown relative to the York Park GSM site cumulative species list of Rowell (2012) and RJPL (2014a), with a summary of the floristic value calculations for each quadrat. Table 3-5 presents a summary of the key vegetation quality indicators for the control and impact zones. The location of quadrats where a floristic score of 4 or greater was recorded are shown in Figure 3.

Table 3-5. Vegetation survey summary for the control and impact sites.

Zone	**Floristic score**		**Native species**	**Exotic species**	**Cover (%)**
	Average (1dp)	**Maximum**	**Average Number (1dp)**		**Average**
Zone 1a	1.3	4	5.0	5.3	72
Zone 1b	1.6	4	5.6	5.0	83
Zone 1 (impact)	**1.4**	**4**	**5.2**	**5.2**	**75**
Zone 2a	0.3	2	4.3	5.7	79
Zone 2b	0.2	1	3.4	5.7	65
Zone 2 (control)	**0.3**	**2**	**3.7**	**5.7**	**77**

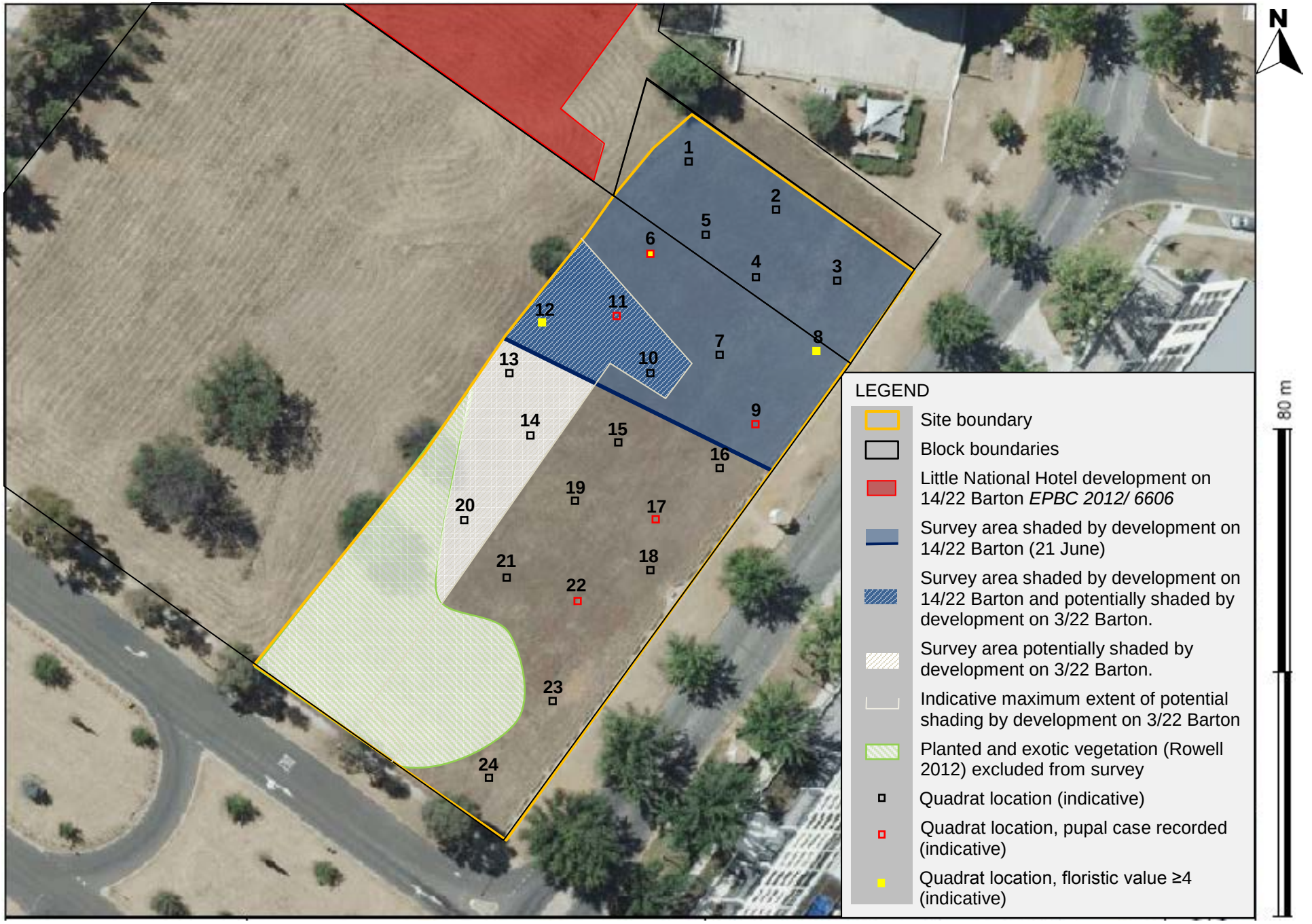

Figure 3. York Park pupae case and vegetation survey summary.

3.5 Soil Temperature Monitoring

One soil temperature logger (Zone 1b) was recovered on 18t December 2015. The other three soil temperature loggers were recovered on 2 February 2016.

Data could not be downloaded from two of the data loggers recovered (i.e. Zone 1a and 2a). Discussion from the wholesaler identified that since the last download, an update in the software has caused some data loggers to be locked with a password and retrieving data from these temperature loggers is impossible. Due to the software changes, subsoil temperature data for further analysis is unavailable for Zone 1a and Zone 2a.

The maximum daily and minimum daily temperatures recorded by the loggers are presented in Appendix D. Table 3-6 presents the mean monthly temperature, mean maximum daily temperature and mean minimum daily temperature by month. Complete soil temperature data files are provided with this report.

Table 3-6. Soil temperature data recorded at York Park.

	Zone 1b			Zone 2b		
Month	**Mean (ºC)**	**Mean Daily Max (ºC)**	**Mean Daily Min (ºC)**	**Mean (ºC)**	**Mean Daily Max (ºC)**	**Mean Daily Min (ºC)**
October 2014 (16 days)	16.6	20.0	13.7	17.5	20.8	14.8
November 2014	22.7	21.4	14.7	24.2	22.4	15.4
December 2014	24.0	27.3	18.9	24.8	29.6	20.3
January 2015	24.8	28.6	21.8	25.2	28.9	22.3
February 2015	24.3	27.9	21.5	24.6	28.8	21.9
March 2015	22.3	26.4	19.2	22.6	26.6	19.5
April 2015	15.9	18.0	14.2	16.0	18.2	14.1
May 2015	11.5	13.5	9.8	11.6	13.7	9.7
June 2015	7.7	9.4	6.2	8.1	9.9	6.6
July 2015	6.7	8.4	5.4	6.9	8.6	5.5
August 2015	8.7	11.0	6.9	8.9	11.1	7.1
September 2015	19.3	15.8	9.9	20.0	16.1	10.2
October 2015	19.3	23.2	16.2	20.0	24.2	16.9
November 2015	21.4	27.6	18.9	22.4	29.6	20.3
December 2015	25.5	27.7	20.2	27.2	28.6	21.0

Figure 4 shows a plot of mean monthly soil temperatures recorded at York Park in 2014 and 2015 in each of the zones for which data is available. The plot indicates that differences in winter soil temperatures between the control and impact zones are negligible, particularly during winter, with the difference in monthly mean temperature between the control and impact sites varying between 0.1˚C and 0.4˚C between May and August, within the ±0.5˚C recording error of the temperature data loggers. The divergence in summer temperatures between the control and impact zones occurred in both seasons, but is not caused by shading impacts, as the site is unshaded during this period. Winter temperatures in Zones 1a and 2b were lower in 2015 relative to 2014. The consistency in this shift between both the impact (1b) and control (2b) zones indicates that this change is not due to shading impacts, but is likely to be due to yearly differences in seasonal conditions. This interpretation is consistent with the meteorological data presented in Section 3.6.

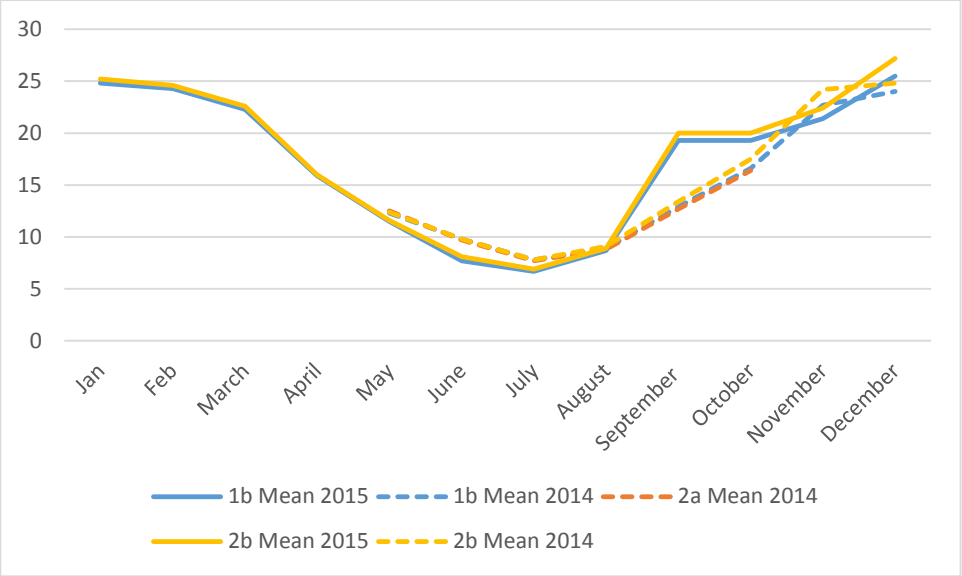

Figure 4. Comparison of mean monthly soil temperatures between zones and between years.

3.6 Meteorological Data

Figure 5 presents monthly rainfall and average daily maximum and minimum air temperatures recorded at Canberra Airport from 2013 to 2015. Figure 6 shows the monthly average daily maximum and minimum soil temperatures, recorded at 10 cm depth from 2013 to 2015 at the Canberra Airport, although some data is missing for 2013, limiting comparison between years. The soil temperature data (Figure 6) confirms the cooler winter soil temperatures recorded in 2015 relative to 2014 at York Park (Figure 4).

Figure 7 shows, in more detail, daily maximum soil temperature and daily precipitation during the GSM flying season (i.e. October to December). The Bureau of Meteorology was unable to provide soil temperature data for November and December 2013, restricting comparison between 2013 and 2014.

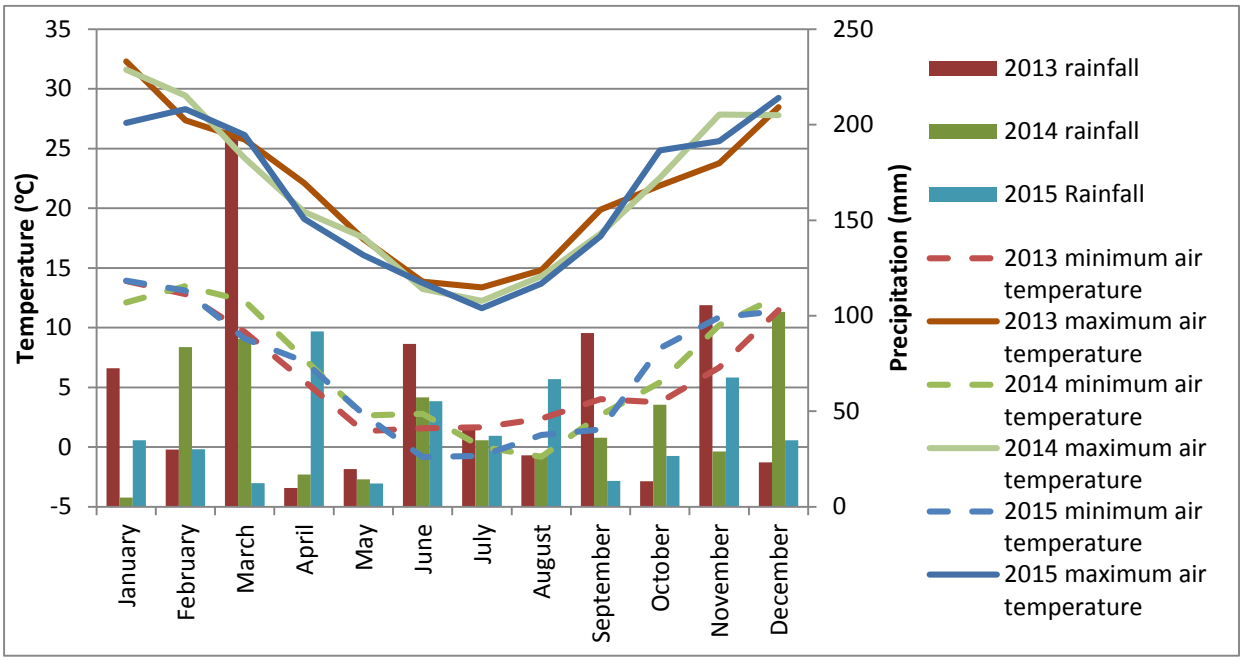

Figure 5. Monthly rainfall and average daily maximum and minimum air temperature.

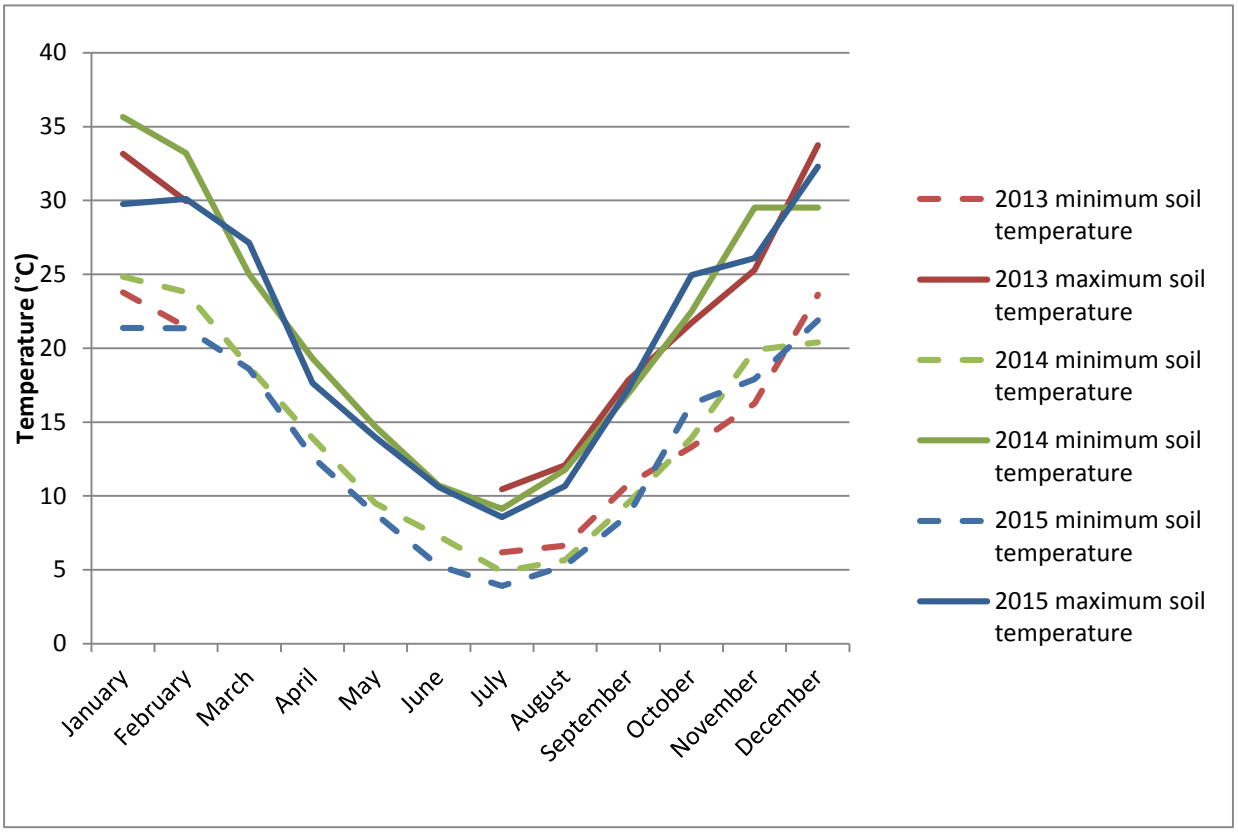

Figure 6. Monthly average daily maximum and minimum soil temperature (10 cm depth) at Canberra Airport.

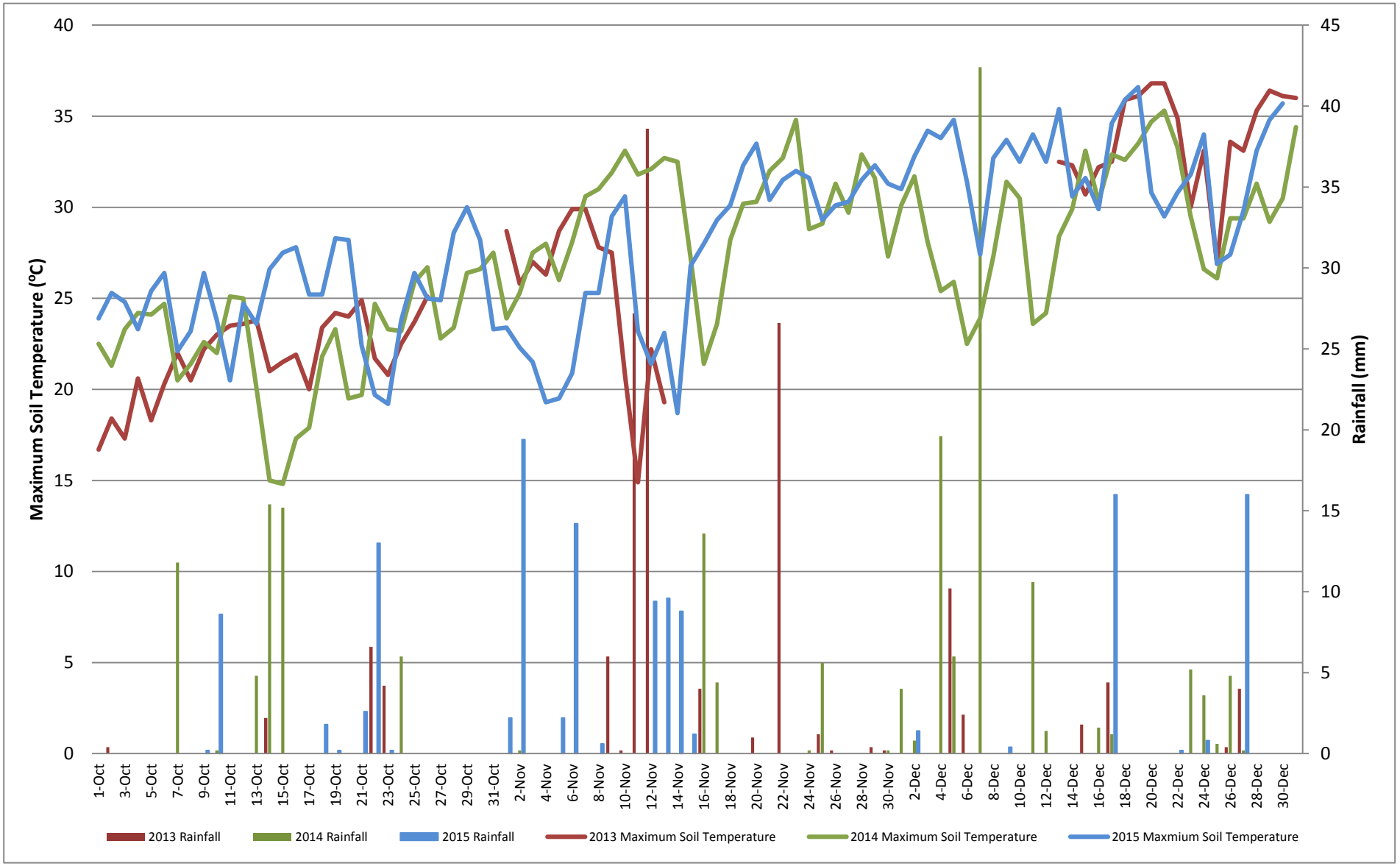

Figure 7. Maximum daily soil temperature and daily rainfall at Canberra Airport during the GSM flying period.

4. INTERPRETATION AND COMPARISON WITH PREVIOUS RESULTS

4.1 Ecological Interpretation

Winter shading of the impact zone of the York Park GSM site commenced in 2015; however, there were no changes in GSM flying moth activity, pupae case counts or vegetation condition, which were unlikely to be due to natural seasonal variation in conditions.

All flying moth surveys were undertaken during the peak period of GSM activity in the Canberra area and are consequently valid representations of GSM activity levels at the York Park GSM site. Flying moth numbers observed were consistently low to moderate during the surveys based on the semi-quantitative GSM site assessment method developed by David Hogg Pty Ltd (2010). Negligible difference was observed between GSM numbers observed during rotational point counts in the northern end and the southern end of York Park. Consistent with previous surveys, marginally greater GSM numbers were observed along the eastern transect than along the western transect.

Six GSM pupae cases were recorded during the pupae case surveys; four cases in the impact zone and two in the control zone (Figure 3). This represents a very low rate of detection despite applying approximately six times the survey effort recommended by Richter (2013). The pupae cases observed indicate that GSM are breeding within York Park, but the low number and scattered locations recorded do not permit any conclusions to be drawn as to whether GSM favour any part of York Park. These very low pupae case numbers are indicative of the generally low GSM numbers at York Park and the challenges when conducting pupae surveys, i.e. pupae case distribution is highly variable and unpredictable.

Quadrats varied in floristic value, diversity, vegetation cover and weed presence, but overall were indicative of degraded natural temperate grassland. Vegetation in three quadrats in the impact zones (Figure 3) had a floristic score of four, nominally meeting the criteria of Rehwinkel *et al.* (2007) for inclusion in the natural temperate grassland endangered ecological community. Floristic scores in the control zone were generally lower, with a 1.25 difference in the average floristic score from the impact to the control zones. Sites in the impact zone had marginally higher native and exotic species diversity compared to the control zone. No difference was recorded between vegetation cover for the impact and control zones. The lower diversity and floristic scores recorded in 2015 relative to 2014 is likely attributable to the substantially drier season and the late timing of the survey reducing the number of native forbs observed.

Overall, the year 3 baseline surveys demonstrate that GSM are present in low to moderate numbers at the York Park GSM site, with pupae cases detected at very low numbers, in both the control and impact areas. Vegetation surveys confirmed that the York Park GSM site supports partially degraded natural temperate grassland, the majority of which is potential GSM breeding habitat.

4.2 Comparison with Year 1 – Year 2 Baseline Data

1.1.1 Flying moth surveys

Flying moths numbers during the 2015 flying season (Figure 8) were generally lower than recorded in 2014 (RJPL 2015) but higher than recorded in 2013 (RJPL 2014b). For the transect surveys, the average number of moths observed per transect in the 2015 flying season was 9.4, less than 11.0 during the 2014 survey (RJPL 2015) but higher than 4.4 observed during the 2013 survey (RJPL 2014b). Similarly, the

combined average number of moths observed per count at the central point in 2015 was 2.4, lower than 2014 survey (i.e. 7.7), but substantially greater than recorded during the 2013 survey (i.e. 0.9). These observation rates generally fall within the classification of low or low to moderate GSM activity based on the semi-quantitative GSM site assessment method developed by David Hogg Pty Ltd (2010).

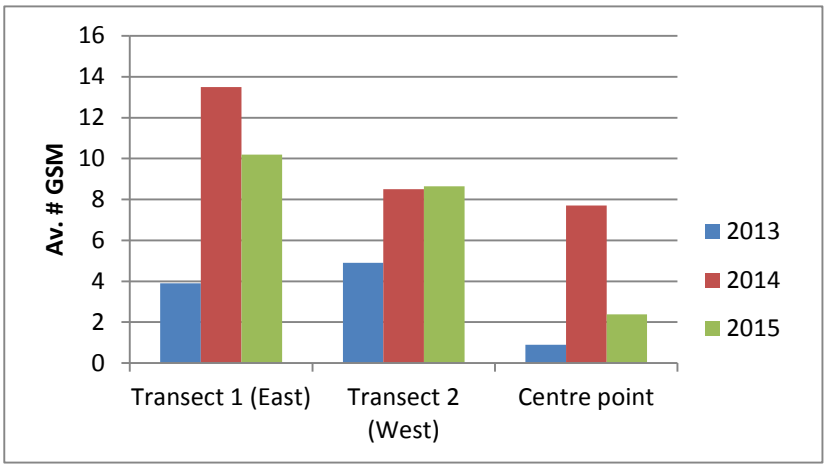

Figure 8. Average number of GSM observed on transect and centre point surveys by year.

As the surveys were conducted at similar points during the season and conditions were generally comparable, it is likely that this variation is due to natural seasonal variation in GSM activity. Previous studies conducted by Rowell (2012) and Ritcher (2013) on York Park found little variation with GSM densities over time, but detected moths in low abundance consistent with the present monitoring results. The variation observed in three years of monitoring observed lies consistently in the low to moderate activity range, and is consistent with previous reporting of little variation. It is likely that the variation observed is due to natural seasonal variation in GSM activity. This observation is consistent with evidence that GSM activity levels may be highly variable even when conditions are favourable (Hogg 2010).

Notable differences in conditions between years include exceptionally high rainfall in September and November 2013, and in December 2014 (Figure 2). Rainfall in 2015 was generally lower than in previous years be in September but increased in November. Average daily maxima were higher during September and October compared to 2014 in which the average maximum air temperatures were higher in October and November. 2015 had a greater average daily minimum air temperature compared to 2013 and 2014. Average daily maximum and minimum air temperatures were consistent in December from 2013 to2015 (Figure 3). Soil temperatures leading up to the GSM flying season were similar from 2013 to 2015 (Figure 4), however there is missing BoM data between mid-November and mid-December 2013, which limits comparison of these months between 2013 to 2015.

1.1.2 Pupae case surveys

The 2015 pupa case search result was the highest compared to 2014 and 2013 season (Figure 9), with six pupae cases recorded compared to five and two pupae cases recorded in 2014 and 2013 respectively. The detection rate is still very low and it is likely that the variation in pupae case detection between years, and between the control and impact sites is due to stochastic variation, despite the relatively high survey effort relative to the recommendations of Richter *et. al.* (2013). No conclusions can be drawn from the baseline data regarding the breeding success in the control and impact zones prior to any shading occurring using pupae case searches.

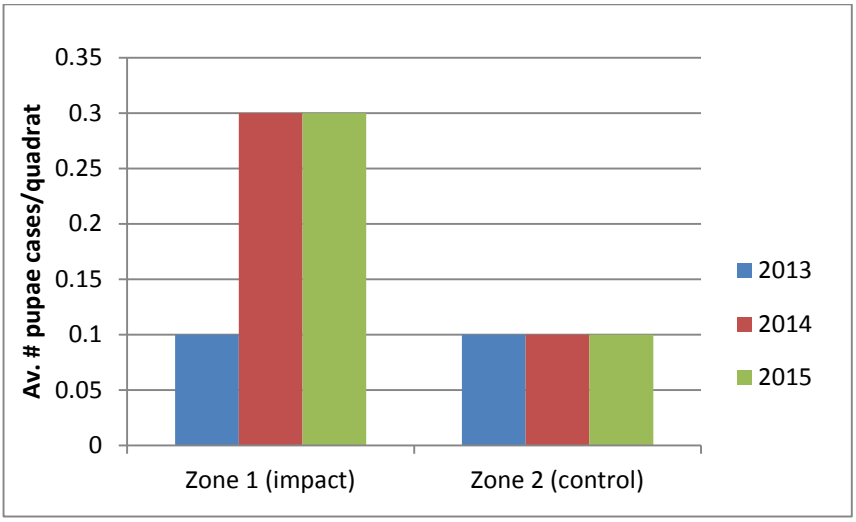

Figure 9. Average number of pupae cases observed by year.

1.1.3 Vegetation surveys

Figure 10 and Figure 11 show summarised vegetation survey results compared by year for the impact and control zones. The 2015 survey had lower average floristic value scores and lower native species diversity compared to either 2013 and 2014 vegetation assessment. This difference was more distinct in the control zone (Figure 11) than in the impact zone (Figure 10), and consequently cannot be attributed to shading impacts. The 2014 survey was conducted in October and consequently is likely to favour the detection of native forbs and exotic annuals relative to the surveys conducted in December for both the 2013 and 2015 season (RJPL 2014b).

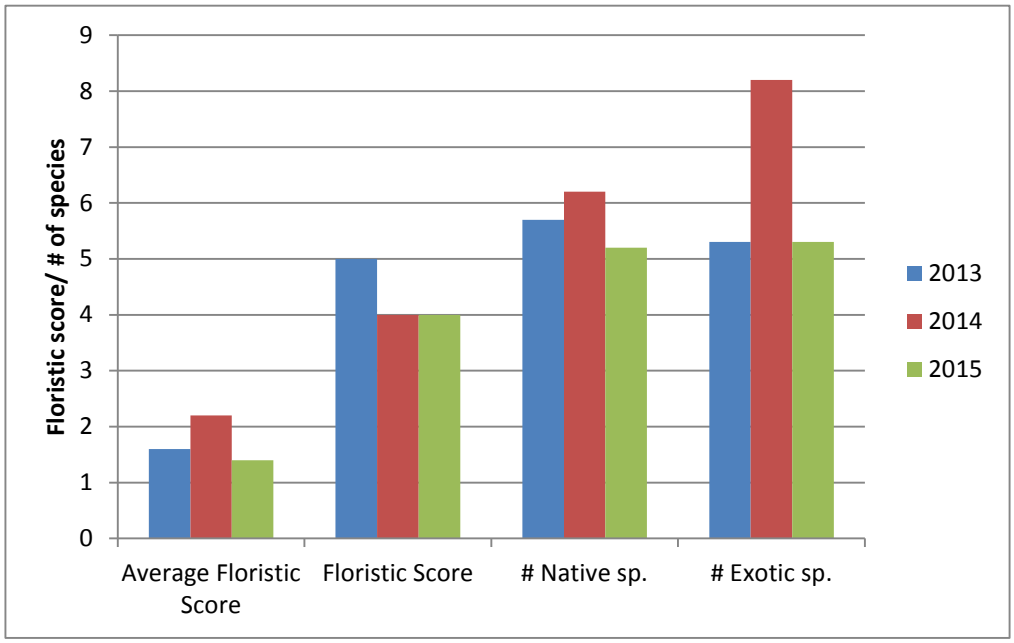

Figure 10. Comparison of impact zone vegetation statistics by year.

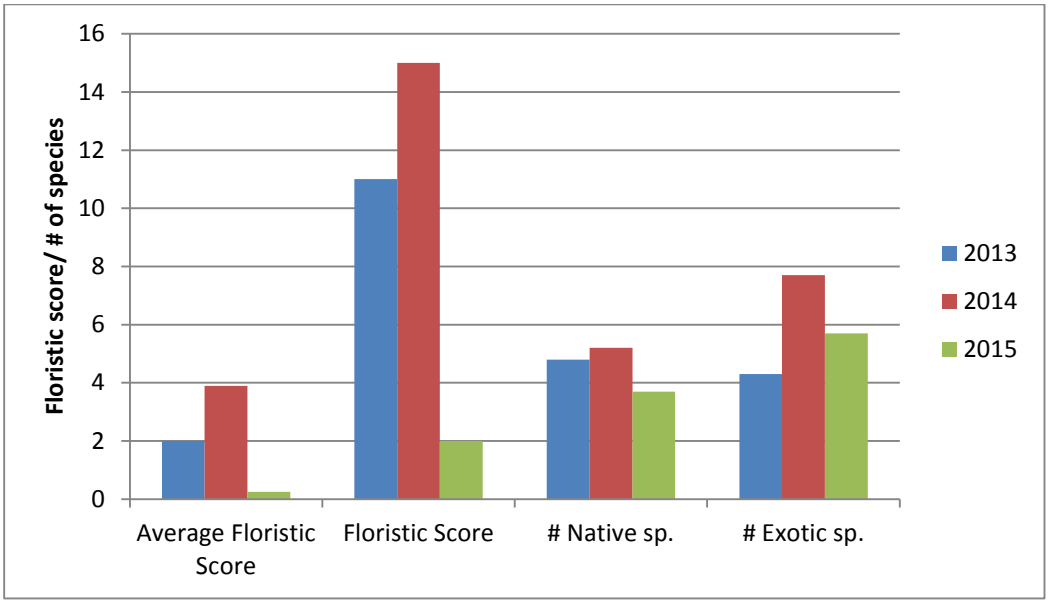

Figure 11. Comparison of control zone vegetation statistics by year.

Climate variability, in particular rainfall and seasonal variability, is an important factor in grassland composition and cover (Williams *et al*. 2015). In 2013, rainfall was 14% below the average (BOM 2013). In 2014, rainfall was still below average (BOM 2014). In 2015, rainfall was close to the average rainfall in comparison to previous years (BOM 2015). The increase in rainfall is likely to have affected the composition of native species and weeds. For exampling, in previous years, native species sensitive to climate variability, e.g. Bulbine Lily (*Bulbine bulbosa*) and Cut-leaf Goodenia (*Goodenia pinnatifida*), were identified but not in 2015. The absence of these species from the 2015 surveys does not suggest that these species no longer occur at the site, but most likely reflects very dry conditions and the late survey timing in 2015.

Variations in vegetation composition between the years may have occurred as precise quadrat locations are not been permanently marked out. Quadrats are marked by a GPS co-ordinate, resulting in a potential ±5 m error, and consequently quadrats may be located in slightly different positions each year. This has the potential to influence plant diversity recorded within each individual quadrat. The impact on analysis is anticipated to be minimal, as survey design does not require sampling of the same location and incorporates sampling of multiple quadrats within both the impact and control zones.

5. COMPLIANCE WITH THE GSM MONITORING PLAN

5.1 Survey Requirements

Transect surveys, pupae case surveys and vegetation surveys were conducted according to the methods specified in the monitoring plan (RJPL 2014a). Soil temperature loggers were successfully recovered from York Park; however, data was successfully recovered from only two of the four units.

As described in Section 3.5, the soil temperature loggers located in Zone 1a and Zone 2a failed due to password protection issues caused by a manufacturer's software update. Data could not be recovered from the devices. All the soil temperature loggers will need replacing. Comparison of soil temperature data from the two functioning loggers indicates that there was minimal soil temperature variation in York Park, with average daily variation typically within the 0.5˚C error of the loggers.

5.2 Reporting Requirements

The GSM monitoring plan (RJPL 2014a) requires that annual monitoring reports meet the following specifications:

- Annual monitoring and compliance reports would be prepared in a timely manner each year meeting the *EPBC Act* approval requirements (Conditions 3, 8) by:
    - providing and assessing the monitoring data for the previous twelve months against the baseline conditions
    - concluding whether or not there has been a decline in the GSM population in the area of York Park shaded as a result of the action, taking into account regional population trends and local ecological conditions
    - reviewing the GSMMP's applicability in achieving its objectives (Condition 8) to determine whether, under *EPBC Act* approval Condition 10, the GSMMP should be revised in consultation with the Commonwealth.
- When preparing the report, reference would be made to the current NTGMP and any relevant management and monitoring changes relevant to a review of this GSMMP.

The current report represents the third baseline data monitoring report. The above requirements for analysis against the baseline conditions and assessment of whether there has been a decline in the population of GSM at York Park can only be qualitatively assessed as additional data is required.

The preparation of this report fulfils the reporting requirements for year 3 baseline surveys as specified in the monitoring plan (RJPL 2014a).

5.3 Potential Compliance Issues

Data could not be recovered from two soil temperature loggers due to a software fault resulting from a manufacturer's upgrade. Comparable data is available to be used in place of the lost data, and, while DoE should be notified of this issue, SMEC does not consider that the logger fault represents a compliance issue in relation to the approval. Due to the failure of these two data loggers, and similar issues with failure of one data logger in 2014, SMEC recommends that a new, more reliable, model of soil temperature data logger be sourced and installed before winter.

5.4 GSM Monitoring Plan Review

Monitoring of flying moth numbers and vegetation condition is progressing according to the GSM monitoring plan, and the data collected is appropriate for the analyses proposed to commence after the fifth flying season. In contrast, the current monitoring results suggest that the effectiveness of pupae case surveys and ongoing soil temperature monitoring may be limited, and requires reconsideration in consultation with DoE. These issues and the proposed responses are summarised in Table 5-1.

Pupae cases have consistently been detected at very low rates in the quadrats, despite the substantially higher survey effort implemented relative to the recommendations of Richter *et. al.* (2013). The very low detection rate is such that it is highly unlikely that any trends in pupae case numbers will be detected, and no meaningful BACI analysis of changes in pupae case numbers can be applied. Due to the uninformative nature of this data, the BACI analysis of pupae case numbers proposed in the GSM monitoring plan is not feasible and we propose that pupae case sampling be discontinued and that monitoring focuses on flying GSM and the comparison of vegetation condition in the control and impact zones.

While there have been some difficulties with soil temperature monitoring, preliminary results indicate that there is negligible difference in soil temperature during the shading period between the control and impact areas. If this is the case, ongoing collection of soil temperature data will not be informative to future analyses. We recommend that this be confirmed through one more complete season of monitoring, and, if verified soil temperature monitoring can then be discontinued.

Table 5-1. Recommended changes to the GSM monitoring plan.

	Issue	Proposed response
Pupae Case Counts	The detection of moth pupae cases is insufficient for comparison of trends in shaded or non-shaded areas	End pupae case sampling in quadrats. Monitoring should focus on general trends in flying GSM numbers across York Park and a comparison of vegetation condition in the control and impact zones.
Soil Temperature Monitoring	Difference in soil temperature during the winter shading period between control and impact sites is less than the ±0.5˚C recording error of the loggers, indicating that shading impacts on soil temperature are negligible. This result is unlikely to change over time as the impact site was fully shaded in winter 2015.	Continue soil temperature monitoring for one more complete season. If there is no substantial difference (i.e. >1˚C) between impact and control zone soil temperatures during the winter shading period after one more complete monitoring period, we recommend that the soil temperature monitoring component be discontinued.

SMEC recommends that discussions with DoE be held prior to winter 2016 and the GSM flying season to determine the best approach to the issues identified in Table 5-1, and to reach agreement on any amendments to the GSM monitoring plan.

6. CONCLUSION

This report provides baseline results of flying moth surveys, pupae case surveys and vegetation surveys for 2015 in accordance with the *Potential shading impacts on York Park golden sun monitoring plan* (RJPL 2014a, the monitoring plan). Data is provided in summarised form suitable for incorporation into future analyses of potential impacts. Appendices A to D present all survey data.

The surveys confirmed the presence of GSM at low to moderate activity levels in the York Park GSM site, confirmed the low pupae case detection rates and confirmed the vegetation classification in the York Park GSM site as natural temperate grassland. Vegetation condition was generally consistent between the control and impact zones although variation was present between quadrats.

Soil temperature loggers were recovered and data downloaded from two of the four zones. The loggers located in Zone 1a and Zone 2a were faulty and due to the issue with the software, all the data loggers need to be replaced. Analysis of data from the two working data loggers indicates a low level of variation between loggers.

2015 represents the third year of data collection. Winter shading of the impact zone of the York Park GSM site commenced in 2015. Basic comparison of results of flying moth surveys and vegetation condition surveys with the first year and second year of baseline data (RJPL 2014b) did not identify any dramatic changes potentially resulting from winter shading of the site, but is consistent with the high level of seasonal variability in the levels of GSM activity detected and a moderate level of variability in vegetation condition. Consistent with the three earlier seasons, pupae case detection rates are too low to enable the proposed BACI analysis to be meaningfully undertaken after the fifth survey season. Despite shading occurring during the winter period of 2015, negligible difference in soil temperatures between the impact and control areas was recorded.

Surveys were conducted in a manner consistent with the survey requirements outlined in the monitoring plan (RJPL 2014a). This report also fulfils requirements for reporting the year 3 baseline monitoring data outlined in the monitoring plan (RJPL 2014a).

SMEC recommends that data loggers be replaced with a more reliable model prior to winter 2016. In addition, discussions with the DoE should be undertaken to review the following recommended amendments to the GSM monitoring plan:

- the pupae case surveys and associated analyses should be removed from the monitoring plan as detection of pupae cases is insufficient for meaningful analysis
- the importance of monitoring soil temperatures should be reviewed after one additional full season of monitoring, and, if there is no substantial difference in soil temperatures within shaded and unshaded areas after this period, temperature monitoring be removed from the monitoring plan.

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APPENDIX A: FLYING MOTH SURVEY 2014 AND 2015

Appendix A - Table 1: Flying moth surveys 2015 – transects.

Date	Transect	Moth numbers / Survey time			Moth numbers
		1130	1200	1230	Average (1dp)
19/11/2015	Transect 1	6	14	22	10.6
25/11/2015	Transect 1	7	12	10	9.723
112/2015	Transect 1	1	7	23	10.3
19/11/2015	Transect 2	11	12	23	15.3
25/11/2015	Transect 2	3	3	4	3.3
1/12/2015	Transect 2	4	8	10	7.3

Appendix A - Table 2: Flying moth surveys 2015 – point observations.

Date	Time	Point	Moth numbers	
			Average (1dp)	Range
19/11/2015	11:30	North	1.1	0-3
25/11/2015	11:40	North	2.1	0-5
1/12/2015	11:50	North	1.1	1-2
19/11/2015	11:43	Centre	2.8	0-8
25/11/2015	11:36	Centre	1.8	0-5
1/12/2015	11:38	Centre	1.2	0-2
19/11/2015	12:15	Centre	4.7	1-12
25/11/2015	12:36	Centre	-	-
1/12/2015	12:09	Centre	1.4	0-5
19/11/2015	11:55	South	2.1	0-7
25/11/2015	12:05	South	2.1	0-5
1/12/2015	12:20	South	1.9	0-4

APPENDIX B: PUPAE CASE SURVEY 2015

Date	Survey	Quadrat	Control or Impact site	Zone	Pupae case numbers	Notes
25/11/2015	1	1	Impact	1a	0	
25/11/2015	1	2	Impact	1a	0	
25/11/2015	1	3	Impact	1a	0	
25/11/2015	1	4	Impact	1a	0	
25/11/2015	1	5	Impact	1a	0	
25/11/2015	1	6	Impact	1a	2	
25/11/2015	1	7	Impact	1a	0	
25/11/2015	1	8	Impact	1a	0	
25/11/2015	1	9	Impact	1a	1	
25/11/2015	1	10	Impact	1b	0	
25/11/2015	1	11	Impact	1b	0	
25/11/2015	1	12	Impact	1b	0	
25/11/2015	1	13	Control	2b	0	
25/11/2015	1	14	Control	2b	0	
25/11/2015	1	15	Control	2a	0	
25/11/2015	1	16	Control	2a	0	
25/11/2015	1	17	Control	2a	1	
25/11/2015	1	18	Control	2a	0	
25/11/2015	1	19	Control	2a	0	
25/11/2015	1	20	Control	2b	0	
25/11/2015	1	21	Control	2a	0	
25/11/2015	1	22	Control	2a	0	
25/11/2015	1	23	Control	2a	0	
25/11/2015	1	24	Control	2a	0	
01/12/2015	2	1	Impact	1a	0	
01/12/2015	2	2	Impact	1a	0	
01/12/2015	2	3	Impact	1a	0	
01/12/2015	2	4	Impact	1a	0	
01/12/2015	2	5	Impact	1a	0	
01/12/2015	2	6	Impact	1a	0	
01/12/2015	2	7	Impact	1a	0	
01/12/2015	2	8	Impact	1a	0	
01/12/2015	2	9	Impact	1a	0	
01/12/2015	2	10	Impact	1b	0	
01/12/2015	2	11	Impact	1b	0	
01/12/2015	2	12	Impact	1b	0	
01/12/2015	2	13	Control	2b	0	
01/12/2015	2	14	Control	2b	0	
01/12/2015	2	15	Control	2a	0	
01/12/2015	2	16	Control	2a	0	
01/12/2015	2	17	Control	2a	0	
01/12/2015	2	18	Control	2a	0	.

Date	Survey	Quadrat	Control or Impact site	Zone	Pupae case numbers	Notes
01/12/2015	2	19	Control	2a	0	
01/12/2015	2	20	Control	2b	0	
01/12/2015	2	21	Control	2a	0	
01/12/2015	2	22	Control	2a	1	
01/12/2015	2	23	Control	2a	0	
01/12/2015	2	24	Control	2a	0	
15/12/2015	3	1	Impact	1a	0	
15/12/2015	3	2	Impact	1a	0	
15/12/2015	3	3	Impact	1a	0	
15/12/2015	3	4	Impact	1a	0	
15/12/2015	3	5	Impact	1a	0	
15/12/2015	3	6	Impact	1a	0	
15/12/2015	3	7	Impact	1a	0	
15/12/2015	3	8	Impact	1a	0	
15/12/2015	3	9	Impact	1a	0	
15/12/2015	3	10	Impact	1b	0	
15/12/2015	3	11	Impact	1b	1	
15/12/2015	3	12	Impact	1b	0	
15/12/2015	3	13	Control	2b	0	
15/12/2015	3	14	Control	2b	0	
15/12/2015	3	15	Control	2a	0	
15/12/2015	3	16	Control	2a	0	
15/12/2015	3	17	Control	2a	0	
15/12/2015	3	18	Control	2a	0	
15/12/2015	3	19	Control	2a	0	
15/12/2015	3	20	Control	2b	0	
15/12/2015	3	21	Control	2a	0	
15/12/2015	3	22	Control	2a	0	
15/12/2015	3	23	Control	2a	0	
15/12/2015	3	24	Control	2a	0	

APPENDIX C: VEGETATION SURVEY 2015

Date	Quadrat	Control or Impact site	Zone	Species (* - exotic species)		Cover (%)
				Dominant	Co-Dominant	
16/10/2014	1	Impact	1a	*Austrostipa bigeniculata*		70
16/10/2014	2	Impact	1a	*Austrostipa bigeniculata*		60
16/10/2014	3	Impact	1a	*Austrostipa bigeniculata*		50
16/10/2014	4	Impact	1a	*Austrostipa bigeniculata*	*Bothriochloa macra*	70
16/10/2014	5	Impact	1a	*Austrostipa bigeniculata*	*Bothriochloa macra*	85
16/10/2014	6	Impact	1a	*Austrostipa bigeniculata*	*Bothriochloa macra*	90
16/10/2014	7	Impact	1a	*Austrostipa bigeniculata*	*	80
16/10/2014	8	Impact	1a	*Themeda triandra*		70
16/10/2014	9	Impact	1a	*Bothriochloa macra*		80
16/10/2014	10	Impact	1b	*Austrostipa bigeniculata*	*Bothriochloa macra*	80
16/10/2014	11	Impact	1b	*Austrostipa bigeniculata*	*Bothriochloa macra*	75
16/10/2014	12	Impact	1b	*Austrostipa bigeniculata*	*Austrostipa scabra*	95
16/10/2014	13	Control	2b	*Austrostipa bigeniculata*		70
16/10/2014	14	Control	2b	*Austrostipa bigeniculata*		60
16/10/2014	15	Control	2a	*Austrostipa bigeniculata*	*Bothriochloa macra*	70
16/10/2014	16	Control	2a	*Austrostipa bigeniculata*	*Bothriochloa macra*	95
16/10/2014	17	Control	2a	*Austrostipa bigeniculata*	*Austrostipa scabra*	90
16/10/2014	18	Control	2a	*Bothriochloa macra*		80
16/10/2014	19	Control	2a	*Austrostipa bigeniculata*	*Bothriochloa macra*	95
16/10/2014	20	Control	2b	*Dactylis glomerata**	*Bothriochloa macra*	65
16/10/2014	21	Control	2a	*Austrostipa bigeniculata*		80
16/10/2014	22	Control	2a	*Austrostipa bigeniculata*	*Bothriochloa macra*	80
16/10/2014	23	Control	2a	*Austrostipa bigeniculata*		80
16/10/2014	24	Control	2a	*Austrostipa bigeniculata*		60

Scientific name	Common name	Quadrat number																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Native grasses																									
Aristida ramosa	Wiregrass						+																		
Austrodanthonia auriculata	Lobed Wallaby Grass																								
Austrodanthonia bipartita	A Wallaby Grass																								
Austrodanthonia caespitosa	Ringed Wallaby Grass																								
Austrodanthonia carphoides	Short Wallaby Grass																								
Austrodanthonia fulva	A Wallaby Grass																								
Austrodanthonia laevis	Smooth Wallaby Grass																								
Austrodanthonia spp.	Wallaby Grasses		+			+	+	+	1		+			r		2	+	2	2			+	2		
Austrostipa bigeniculata	Tall Speargrass	4	3	3	3	4	+	5			4	3	4	4	4	3	4	4		4	2	5	2	5	4
Austrostipa densiflora	A Speargrass																								
Austrostipa scabra	Rough Speargrass			+			4		1		+		2		2		3	r							
Bothriochloa macra	Redleg Grass	r	2		3	2	3	2		4	2	2	2	r	2	3	3	2	5	3	3	2	4	2	
Chloris truncata	Windmill Grass																							r	
Elymus scaber	Wheatgrass					+		r					r												
Eragrostis brownii	A Lovegrass																								
Eragrostis trachycarpa	A Lovegrass																								
Microlaena stipoides	Weeping Grass	r																							
Panicum effusum	Hairy Panic Grass			r			+		r				+	r	+		+	+		r		2	2		
Poa labillardieri	Tussock Grass																								
Themeda triandra	Kangaroo Grass								4																
Native forbs																									
Acaena ovina	Sheeps Burr																								
Asperula conferta[2]	Common Woodruff																								
Bulbine bulbosa[2]	Golden Lily																								
Calocephalus citreus[2]	Lemon Beauty Heads																								
Chamaesyce drummondii	Caustic Weed																								

Scientific name	Common name	Quadrat number																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Cheilanthes sp.[2]																r									
Cheilanthes sieberi[2]	Rock Fern																								
Cheilanthes tenuifolia[2]																									
Chenopodium pumilio	Small Crumbweed																								
Chrysocephalum apiculatum[1]	Yellow Buttons	+	2			1	2		+	r	r	+	+			2									
Chrysocephalum semipapposum	Clustered Everlasting												+												
Convolvulus angustissimus	Australian Bindweed									r		r													
Crassula sieberiana	Australian Stonecrop																								
Cymbonotus lawsonianus	Bear's Ears																								
Drosera peltata	Sundew																								
Eryngium rostratum[2]	Blue Devil																								
Euchiton sp.	A Cudweed																								
Euchiton gymnocephalus	A Cudweed																								
Euchiton sphaericus	A Cudweed																								
Glycine tabacina[2]	Vanilla Glycine																								
Gonocarpus tetragynus[1]	Raspwort																								
Goodenia pinnatifida[2]	Scrambled Eggs	r																							
Hypericum gramineum[2]	Small St John's Wort																								
Juncus sp.	A Rush																								
Lomandra bracteata[1]	A Matrush																			r					
Lomandra filiformis[1]	A Matrush																								
Lomandra multiflora[2]	A Matrush																								
Lomandra sp.[1]	A Matrush			r																					
Microtis unifolia[2]	Common Onion Orchid																								
Oxalis perennans	Soursob																								
Pimelea curviflora[2]	Curved Rice-flower																								
Plantago varia[2]	Variable Plantain																								
Rumex brownii	Swamp Dock																								
Schoenus apogon	Bog-rush		r	r	r																				

Scientific name	Common name	Quadrat number																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Sebaea ovata[2]																									
Senecio quadridentatus	Cotton Fireweed																								
Solenogyne dominii	Smooth Solenogyne																								
Stackhousia monogyna[2]	Creamy Candles														r										
Tricoryne elatior[2]	Yellow Rush Lily						+																		
Triptilodiscus pygmaeus[2]	Austral Sunray																								
Vittadinia muelleri	Fuzzweed																								
Wahlenbergia sp.	A Bluebell																								
Wahlenbergia communis	Tufted Bluebell																								
Wahlenbergia luteola	A Bluebell																								
Wahlenbergia stricta	Tall Bluebell																								
Wurmbea dioica[2]	Early Nancy																								
Xerochrysum viscosum[2]	Sticky Everlasting																								
Exotic grasses																									
Aira sp.	A Hairgrass											+												+	
Aira elegantissima	A Hairgrass																								
Avena sp.	Wild Oats	r			+	r						r	r	r			+	r						r	r
Avena barbata	Bearded Oats																								
Briza maxima	Blowfly Grass	r	+	r	1	1	+	+	+	1	+	1	+	r	+	r	1	1	+	+	+	1	+	1	+
Briza minor	Shivery Grass																								
Bromus sp.	A Brome Grass																								
Bromus catharticus	A Brome Grass																								
Bromus diandrus	A Brome Grass																								
Bromus hordeaceus	A Brome Grass																								
Bromus mollis	Soft Brome																								
Cynodon dactylon	Couch		r		+										r		+								
Dactylis glomerata	Cocksfoot	2		r										2		r									
Eleusine tristachya	Goose Grass																								
Eragrostis curvula	African Lovegrass																								

Scientific name	Common name	Quadrat number																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Festuca sp.	A Fine-leaved Fescue																								
Festuca arundinacea	Tall Fescue																								
Lolium perenne	Perennial Ryegrass																								
Lolium rigidum	Ryegrass																								
Lophochloa cristata	Annual Cat's Tail																								
Nassella neesiana	Chilean Needlegrass																								
Nassella trichotoma	Serrated Tussock																								
Paspalum dilatatum	Paspalum																								
Phalaris aquatica	Phalaris																								
Poa bulbosa	Bulbous bluegrass																								
Vulpia sp.	Rat's-tail Fescue	r	r										r	r	r										r
Exotic forbs																									
Acetosella vulgaris	Sorrel																								
Anagallis arvensis	Scarlet Pimpernel																								
Arctotheca calendula	Capeweed																								
Centaurium erythraea	Pink Stars		r	r		+	r	r	+	r	r	+			r	r		+	r	r	+	r	r	+	
Centaurium tenuiflorum	*Branched Centaury*		*r*	*r*	+	+	+		*r*				+		*r*	*r*	+	+	+		*r*				+
Cerastium glomeratum	Chickweed																								
Cirsium vulgare	Spear Thistle																								
Conyza bonariensis	Flax-leaf Fleabane																								
Echium plantagineum	Paterson's Curse																								
Erodium cicutarium	Common Crowfoot																								
Galium divaricatum	A Bedstraw																								
Gamochaeta purpurea	A Cudweed																								
Gnaphalium sp.	A Cudweed																								
Hirschfeldia incana	Hoary Mustard																								
Hypericum perforatum	St John's Wort				+		r	r					r				+		r	r					r
Hypochaeris glabra	Smooth Catsear																								
Hypochaeris radicata	Catsear		1		+	+	+	+			+		r		1		+	+	+	+			+		r

Scientific name	Common name	Quadrat number																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Lactuca serriola	Prickly Lettuce																								
Lepidium africanum	A Peppercress																								
Parentucellia latifolia	Common Bartsia																								
Petrorhagia nanteulii	Proliferous Pink																								
Plantago lanceolata	Ribwort Plantain	+		r	r		+	r	+	r	r	+	r	+		r	r		+	r	+	r	r	+	r
Romulea rosea	Onion Grass																								
Salvia verbenaca	Wild Sage																								
Silene gallica	French Catchfly																								
Sonchus oleraceus	Common Sow-thistle																								
Tragopogon porrifolius	Salsify																								
Trifolium angustifolium	Narrow leaf Clover																								
Trifolium arvense	Haresfoot Clover			r					r	2						r					r	2			
Trifolium campestre	Hop Clover																								
Trifolium dubium								r												r					
Trifolium glomeratum	Clustered Clover																								
Trifolium striatum																									
Trifolium spp.	Clovers																								
Exotic shrubs and trees																									
Cotoneaster sp.	Cotoneaster																								
Crataegus monogyna	Hawthorn																								
Ligustrum sinense	Small-leaved Privet																								
Populus nigra var. *italica*	Lombardy Poplar																								
Prunus sp.	Plum																								
Sorbus domestica	Service Tree																								

Indicator	Quadrat number																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Number of Common Species	3	5	4	4	4	6	5	3	2	4	3	6	4	4	3	5	5	2	3	2	4	4	3	1
Number of indicator level 1 species	1	1	0	0	1	1	0	1	1	1	1	1	0	0	1	0	0	0	1	0	0	0	0	0
Number of indicator level 2 species	1	0	0	0	0	1	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0
Total number of native species	5	6	4	4	5	8	5	5	3	5	4	9	4	5	5	5	5	2	4	2	4	4	3	1
Number of exotic species	5	4	6	6	5	6	7	5	4	4	5	6	5	7	4	8	8	7	4	4	5	6	2	6
Number of significant weed species	0	0	0	1	0	1	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0
Site value score	2	**1**	**0**	0	1	**4**	**0**	4	0	**0**	**1**	**4**	0	**1**	**2**	0	0	**0**	0	0	0	0	**0**	**0**

APPENDIX D: DAILY MAXIMUM AND MINIMUM SOIL TEMPERATURES

No data is provided for Zone 1a or 2a as the loggers was faulty and no data could be recovered. Discussion from the wholesaler identified that since the last download, an update in the software has caused some data loggers to be locked with a password and retrieving data from these temperature loggers is not possible. As the definition of Zones 1b and 2b is based on potential shading from development on Block 3 Section 22 Barton, which has not occurred to date, data monitors in these zones can be considered to have been subjected to the same shading treatments as Zones 1a and 2a respectively.

Date	Zone 1b Daily Min (˚C)	Zone 1b Daily Max (˚C)	Zone 2b Daily Min (˚C)	Zone 2b Daily Max (˚C)
20-Oct-14	12.12	22.64	12.09	22.61
21-Oct-14	11.12	19.13	11.09	19.11
22-Oct-14	14.63	22.64	15.6	24.11
23-Oct-14	15.63	21.14	16.6	22.61
24-Oct-14	15.63	22.64	16.6	24.11
25-Oct-14	16.13	24.14	16.6	25.61
26-Oct-14	17.13	25.14	17.6	26.61
27-Oct-14	16.63	20.64	17.6	22.11
28-Oct-14	14.63	23.14	15.6	25.11
29-Oct-14	15.13	24.64	16.6	26.61
30-Oct-14	15.63	24.64	16.6	26.61
31-Oct-14	15.63	25.14	17.1	27.11
1-Nov-14	17.13	22.14	18.61	24.11
2-Nov-14	14.13	24.14	15.6	26.11
3-Nov-14	14.63	25.14	16.1	26.61
4-Nov-14	17.63	26.14	19.11	28.11
5-Nov-14	17.63	23.64	19.11	25.61
6-Nov-14	18.13	25.64	19.61	27.11
7-Nov-14	17.13	27.14	18.61	29.11
8-Nov-14	17.63	28.14	19.11	30.11
9-Nov-14	18.13	28.64	19.61	30.61
10-Nov-14	20.64	29.64	22.11	31.61
11-Nov-14	20.14	29.14	21.61	31.11
12-Nov-14	20.14	29.14	22.11	31.11
13-Nov-14	20.64	29.64	22.61	31.61
14-Nov-14	20.14	30.14	22.11	32.6
15-Nov-14	20.64	24.64	22.61	26.11
16-Nov-14	18.13	21.14	18.61	23.11
17-Nov-14	16.13	24.64	17.1	27.61
18-Nov-14	16.63	26.14	18.1	28.11
19-Nov-14	19.13	28.14	20.11	30.11
20-Nov-14	18.13	27.64	19.61	29.11
21-Nov-14	20.14	28.14	21.61	30.11
22-Nov-14	21.14	30.14	22.11	32.1

Date	Zone 1b Daily Min (˚C)	Zone 1b Daily Max (˚C)	Zone 2b Daily Min (˚C)	Zone 2b Daily Max (˚C)
23-Nov-14	20.64	31.63	22.11	33.6
24-Nov-14	21.64	25.14	22.61	26.61
25-Nov-14	19.64	28.64	21.11	30.61
26-Nov-14	18.63	29.14	19.61	30.61
27-Nov-14	21.14	30.14	22.11	31.11
28-Nov-14	19.64	30.64	21.11	32.1
29-Nov-14	20.64	29.64	22.11	30.61
30-Nov-14	21.64	26.64	22.61	27.61
1-Dec-14	19.64	30.64	20.61	31.61
2-Dec-14	21.14	30.14	22.61	31.61
3-Dec-14	21.64	26.64	22.11	27.61
4-Dec-14	20.64	26.64	21.61	27.61
5-Dec-14	20.64	28.14	21.11	29.11
6-Dec-14	20.14	22.64	20.61	23.61
7-Dec-14	18.63	26.64	19.11	28.11
8-Dec-14	19.64	26.64	20.11	28.11
9-Dec-14	21.14	30.14	21.61	30.61
10-Dec-14	22.14	28.14	22.61	29.11
11-Dec-14	20.14	23.64	20.61	24.11
12-Dec-14	18.13	24.64	19.11	25.61
13-Dec-14	19.13	27.14	20.11	28.11
14-Dec-14	18.63	27.64	19.61	28.11
15-Dec-14	19.64	29.64	20.11	30.11
16-Dec-14	21.64	29.14	22.61	30.11
17-Dec-14	20.14	29.64	21.11	30.11
18-Dec-14	21.14	30.64	22.11	31.11
19-Dec-14	20.14	30.14	21.11	31.11
20-Dec-14	21.64	31.14	22.61	32.1
21-Dec-14	22.64	32.13	23.61	32.6
22-Dec-14	23.14	29.14	24.11	30.11
23-Dec-14	22.14	29.64	23.11	30.61
24-Dec-14	22.64	26.64	23.61	26.61
25-Dec-14	22.14	26.64	22.61	27.11
26-Dec-14	21.14	29.14	21.61	30.61
27-Dec-14	20.14	28.64	21.11	29.11
28-Dec-14	20.14	28.64	21.11	28.61
29-Dec-14	20.64	27.64	21.61	28.61
30-Dec-14	19.64	30.14	20.61	30.61
31-Dec-14	20.14	31.63	21.11	32.1
1-Jan-15	23.64	33.13	24.11	33.6
2-Jan-15	22.64	34.63	23.61	34.6
3-Jan-15	24.64	35.13	25.61	35.6
4-Jan-15	25.14	31.14	26.11	31.61
5-Jan-15	22.64	32.63	23.61	32.6

Date	Zone 1b Daily Min (˚C)	Zone 1b Daily Max (˚C)	Zone 2b Daily Min (˚C)	Zone 2b Daily Max (˚C)
6-Jan-15	23.14	29.64	24.11	30.11
7-Jan-15	22.14	29.64	22.61	30.11
8-Jan-15	22.14	31.63	23.11	32.1
9-Jan-15	24.14	30.64	24.61	31.11
10-Jan-15	23.14	27.14	23.61	27.11
11-Jan-15	21.64	24.64	22.11	25.11
12-Jan-15	21.14	27.64	21.61	28.11
13-Jan-15	21.64	24.64	22.11	25.11
14-Jan-15	21.64	27.64	21.61	28.11
15-Jan-15	20.64	28.64	21.11	29.61
16-Jan-15	21.14	29.14	21.61	29.61
17-Jan-15	20.64	29.14	21.11	29.61
18-Jan-15	20.14	29.14	20.61	29.11
19-Jan-15	22.14	28.64	22.11	28.61
20-Jan-15	22.14	26.64	22.11	26.11
21-Jan-15	22.14	27.64	22.11	27.61
22-Jan-15	21.64	29.64	21.61	29.61
23-Jan-15	22.64	30.64	23.11	31.11
24-Jan-15	23.64	29.64	24.11	30.11
25-Jan-15	22.64	29.64	23.11	30.61
26-Jan-15	22.14	27.14	22.61	27.11
27-Jan-15	20.64	22.14	21.11	22.61
28-Jan-15	19.64	25.14	20.11	25.11
29-Jan-15	19.13	25.64	19.11	25.61
30-Jan-15	18.63	23.14	18.61	23.61
31-Jan-15	18.13	26.14	18.61	26.11
1-Feb-15	19.64	26.14	20.11	26.11
2-Feb-15	19.13	24.64	19.61	25.11
3-Feb-15	18.13	26.64	18.61	27.11
4-Feb-15	19.64	22.64	19.61	23.11
5-Feb-15	18.63	27.14	19.11	27.11
6-Feb-15	19.64	28.64	20.11	28.61
7-Feb-15	20.64	29.64	21.11	29.11
8-Feb-15	21.64	29.14	22.11	29.11
9-Feb-15	22.14	25.14	22.61	25.61
10-Feb-15	21.64	29.64	22.11	29.61
11-Feb-15	23.14	30.64	23.61	31.11
12-Feb-15	23.64	27.64	24.11	28.11
13-Feb-15	22.64	28.14	23.11	29.11
14-Feb-15	21.64	25.14	22.11	25.61
15-Feb-15	21.14	27.64	21.61	28.11
16-Feb-15	21.14	28.64	21.61	29.11
17-Feb-15	22.64	31.63	23.11	31.61
18-Feb-15	23.14	30.64	23.61	31.11

Date	Zone 1b Daily Min (˚C)	Zone 1b Daily Max (˚C)	Zone 2b Daily Min (˚C)	Zone 2b Daily Max (˚C)
19-Feb-15	23.14	30.14	23.61	30.11
20-Feb-15	23.14	29.64	23.61	30.11
21-Feb-15	22.64	29.14	23.11	29.61
22-Feb-15	22.64	30.14	23.11	30.61
23-Feb-15	23.64	32.63	23.61	32.6
24-Feb-15	22.64	26.64	23.11	27.61
25-Feb-15	21.64	23.64	21.61	24.11
26-Feb-15	20.64	25.14	20.61	25.61
27-Feb-15	20.64	27.64	20.61	28.11
28-Feb-15	21.64	28.14	21.61	28.61
1-Mar-15	21.14	26.64	21.11	27.11
2-Mar-15	19.13	27.64	19.11	27.61
3-Mar-15	21.14	26.14	21.11	26.61
4-Mar-15	21.64	28.14	22.11	28.61
5-Mar-15	20.14	28.14	20.11	28.11
6-Mar-15	19.13	27.14	19.61	27.61
7-Mar-15	19.13	27.64	19.61	27.61
8-Mar-15	20.64	29.14	21.11	29.61
9-Mar-15	20.14	29.14	20.61	29.11
10-Mar-15	20.64	29.64	21.11	29.61
11-Mar-15	22.64	30.64	23.11	30.61
12-Mar-15	21.64	30.14	22.11	30.11
13-Mar-15	21.64	25.64	22.11	26.11
14-Mar-15	19.13	27.64	20.11	27.61
15-Mar-15	20.64	28.64	21.11	28.61
16-Mar-15	19.13	28.14	19.61	27.61
17-Mar-15	20.14	25.64	20.61	25.61
18-Mar-15	20.14	27.14	20.61	28.11
19-Mar-15	18.63	27.64	19.11	28.11
20-Mar-15	19.64	28.64	20.11	28.61
21-Mar-15	19.64	27.14	20.11	27.11
22-Mar-15	20.64	24.14	21.11	24.11
23-Mar-15	19.13	25.64	19.11	26.11
24-Mar-15	19.13	24.64	19.11	25.11
25-Mar-15	16.63	23.14	16.6	23.61
26-Mar-15	16.13	23.14	16.6	24.11
27-Mar-15	15.13	22.64	15.6	23.61
28-Mar-15	14.63	23.14	15.1	23.61
29-Mar-15	15.63	23.14	16.1	23.11
30-Mar-15	16.13	20.14	16.1	20.11
31-Mar-15	15.13	23.14	15.6	23.11
1-Apr-15	16.63	24.64	17.1	24.61
2-Apr-15	18.13	21.64	18.61	21.61
3-Apr-15	18.13	20.14	18.1	20.61

Date	Zone 1b Daily Min (˚C)	Zone 1b Daily Max (˚C)	Zone 2b Daily Min (˚C)	Zone 2b Daily Max (˚C)
4-Apr-15	17.63	19.13	18.1	19.11
5-Apr-15	16.63	22.14	17.1	22.11
6-Apr-15	15.63	18.63	15.6	19.11
7-Apr-15	12.62	17.13	11.59	17.6
8-Apr-15	11.12	15.13	10.59	15.1
9-Apr-15	12.62	18.63	12.09	18.61
10-Apr-15	14.63	18.13	14.1	18.61
11-Apr-15	13.62	19.13	13.6	19.61
12-Apr-15	14.13	19.64	14.1	19.61
13-Apr-15	14.63	19.64	14.6	19.61
14-Apr-15	14.63	18.13	14.6	18.61
15-Apr-15	14.63	18.13	15.1	18.61
16-Apr-15	14.63	20.64	14.6	21.11
17-Apr-15	16.63	17.63	16.6	18.1
18-Apr-15	16.63	19.64	16.6	20.11
19-Apr-15	14.63	17.13	14.6	17.1
20-Apr-15	13.12	15.13	13.09	15.6
21-Apr-15	12.62	13.62	12.59	13.6
22-Apr-15	12.12	16.13	12.09	16.1
23-Apr-15	13.62	17.63	13.6	18.1
24-Apr-15	15.13	17.13	15.1	17.6
25-Apr-15	13.12	15.63	13.09	16.1
26-Apr-15	12.62	16.13	12.59	16.1
27-Apr-15	10.62	16.13	10.59	16.1
28-Apr-15	11.12	16.63	11.09	16.6
29-Apr-15	10.62	15.63	10.59	15.6
30-Apr-15	12.12	15.13	12.09	15.1
1-May-15	12.62	15.13	12.59	15.6
2-May-15	13.62	16.63	13.6	17.1
3-May-15	13.62	18.13	13.6	18.1
4-May-15	13.12	18.13	13.09	18.1
5-May-15	12.62	16.63	12.59	17.1
6-May-15	11.62	15.13	11.59	15.6
7-May-15	11.12	14.63	11.09	15.1
8-May-15	10.62	15.13	10.59	15.1
9-May-15	10.62	14.13	10.59	14.1
10-May-15	11.62	14.13	11.59	14.6
11-May-15	11.12	14.63	11.09	15.1
12-May-15	11.62	14.13	11.59	14.6
13-May-15	9.61	12.12	9.58	12.59
14-May-15	7.6	12.62	7.58	12.59
15-May-15	8.11	13.12	8.08	13.09
16-May-15	9.11	13.62	9.08	13.6
17-May-15	8.11	13.12	8.08	13.09

Date	Zone 1b Daily Min (˚C)	Zone 1b Daily Max (˚C)	Zone 2b Daily Min (˚C)	Zone 2b Daily Max (˚C)
18-May-15	7.6	12.62	7.58	12.59
19-May-15	9.61	12.12	10.09	12.09
20-May-15	10.62	14.63	10.59	14.6
21-May-15	9.61	13.62	10.09	13.6
22-May-15	10.62	13.62	11.09	13.6
23-May-15	8.61	12.62	8.58	12.59
24-May-15	6.6	11.12	7.08	11.09
25-May-15	7.6	10.62	7.58	10.59
26-May-15	6.1	10.62	6.07	10.59
27-May-15	7.6	11.12	7.58	11.59
28-May-15	7.6	11.12	8.08	11.09
29-May-15	9.61	13.12	10.09	13.09
30-May-15	7.6	11.12	7.58	11.59
31-May-15	7.6	10.62	7.58	11.09
1-Jun-15	7.1	10.62	7.58	11.09
2-Jun-15	5.09	9.11	5.57	9.58
3-Jun-15	4.59	8.61	5.07	9.08
4-Jun-15	4.09	8.11	4.57	8.58
5-Jun-15	6.6	9.61	7.08	10.59
6-Jun-15	5.09	8.61	5.07	9.58
7-Jun-15	4.59	9.11	5.07	10.09
8-Jun-15	6.1	10.11	6.57	10.59
9-Jun-15	7.6	11.62	8.08	12.09
10-Jun-15	6.1	9.61	6.07	10.09
11-Jun-15	5.09	8.61	5.57	9.58
12-Jun-15	4.59	8.61	5.07	9.58
13-Jun-15	5.09	9.11	5.57	9.58
14-Jun-15	5.59	9.11	6.07	10.09
15-Jun-15	6.6	10.11	7.08	10.59
16-Jun-15	9.61	10.62	10.09	11.09
17-Jun-15	10.62	11.12	10.59	11.09
18-Jun-15	9.61	11.12	9.58	11.09
19-Jun-15	8.11	10.62	8.08	10.59
20-Jun-15	6.1	9.11	6.57	9.58
21-Jun-15	5.59	8.61	5.57	9.08
22-Jun-15	4.59	8.11	4.57	8.08
23-Jun-15	5.09	8.11	5.07	8.58
24-Jun-15	7.1	9.61	7.08	10.09
25-Jun-15	7.1	10.11	7.58	10.59
26-Jun-15	6.6	9.61	7.08	10.09
27-Jun-15	5.59	8.11	6.07	8.58
28-Jun-15	6.6	9.11	7.08	9.58
29-Jun-15	5.59	8.61	5.57	9.08
30-Jun-15	5.59	8.61	6.07	9.08

Date	Zone 1b Daily Min (˚C)	Zone 1b Daily Max (˚C)	Zone 2b Daily Min (˚C)	Zone 2b Daily Max (˚C)
1-Jul-15	5.09	7.6	5.57	8.58
2-Jul-15	4.59	7.1	5.07	7.58
3-Jul-15	3.08	6.1	3.56	7.08
4-Jul-15	3.59	6.1	3.56	6.57
5-Jul-15	3.59	5.59	3.56	6.07
6-Jul-15	5.09	7.6	5.07	8.08
7-Jul-15	4.09	7.6	4.06	7.58
8-Jul-15	4.59	8.11	5.07	8.58
9-Jul-15	5.09	8.61	5.57	9.08
10-Jul-15	5.59	7.6	6.07	7.58
11-Jul-15	6.6	9.11	7.08	9.08
12-Jul-15	6.6	8.11	7.08	8.58
13-Jul-15	6.6	9.11	6.57	9.58
14-Jul-15	6.6	9.11	6.57	9.58
15-Jul-15	6.1	8.11	6.57	8.08
16-Jul-15	5.59	8.61	5.57	8.58
17-Jul-15	6.1	9.11	6.57	9.08
18-Jul-15	5.09	8.61	5.07	8.58
19-Jul-15	4.09	8.61	4.06	8.58
20-Jul-15	4.09	8.61	4.06	8.08
21-Jul-15	4.09	8.61	4.06	8.58
22-Jul-15	5.59	7.6	5.57	7.58
23-Jul-15	7.1	9.11	7.08	9.08
24-Jul-15	7.1	9.11	7.08	9.58
25-Jul-15	7.6	9.61	7.58	9.58
26-Jul-15	7.1	9.61	7.08	10.09
27-Jul-15	5.09	9.11	5.57	9.08
28-Jul-15	4.59	9.11	4.57	9.08
29-Jul-15	5.09	9.61	5.07	9.08
30-Jul-15	5.09	9.11	5.07	9.08
31-Jul-15	6.1	10.62	6.07	10.09
1-Aug-15	7.1	10.11	7.08	10.09
2-Aug-15	7.6	10.62	8.08	11.09
3-Aug-15	7.1	10.11	7.08	10.09
4-Aug-15	4.59	9.11	4.57	9.08
5-Aug-15	5.09	8.61	5.57	9.08
6-Aug-15	4.59	9.11	5.07	9.58
7-Aug-15	5.09	9.61	5.57	9.58
8-Aug-15	5.59	10.11	5.57	10.09
9-Aug-15	4.59	9.61	5.07	9.58
10-Aug-15	6.6	10.62	6.57	10.59
11-Aug-15	6.6	11.12	6.57	11.09
12-Aug-15	5.59	7.6	5.57	7.58
13-Aug-15	5.09	10.11	5.07	10.09

Date	Zone 1b Daily Min (˚C)	Zone 1b Daily Max (˚C)	Zone 2b Daily Min (˚C)	Zone 2b Daily Max (˚C)
14-Aug-15	5.09	10.62	5.07	10.59
15-Aug-15	6.1	10.62	6.07	10.59
16-Aug-15	7.6	12.12	7.58	12.09
17-Aug-15	7.1	11.12	7.08	11.09
18-Aug-15	6.1	11.12	6.07	11.09
19-Aug-15	5.59	10.62	6.07	10.59
20-Aug-15	6.6	11.62	6.57	11.59
21-Aug-15	6.1	11.62	6.07	11.59
22-Aug-15	8.11	13.62	8.08	13.6
23-Aug-15	10.11	12.62	10.09	13.09
24-Aug-15	9.61	11.12	10.09	11.09
25-Aug-15	9.11	10.62	9.08	10.59
26-Aug-15	8.61	11.62	8.58	12.09
27-Aug-15	10.11	13.12	10.09	13.6
28-Aug-15	9.11	13.12	9.58	13.09
29-Aug-15	9.11	13.62	9.08	14.1
30-Aug-15	7.6	13.12	8.08	13.09
31-Aug-15	7.6	13.62	8.08	13.6
1-Sep-15	7.6	13.62	8.08	13.6
2-Sep-15	7.6	13.62	7.58	13.6
3-Sep-15	10.11	12.12	10.09	12.59
4-Sep-15	8.11	14.13	8.58	14.6
5-Sep-15	8.61	14.63	8.58	14.6
6-Sep-15	10.11	13.12	10.09	13.09
7-Sep-15	9.11	14.13	9.58	14.6
8-Sep-15	8.61	13.12	9.08	13.6
9-Sep-15	7.6	14.13	8.08	14.6
10-Sep-15	9.61	15.63	10.09	15.6
11-Sep-15	9.11	15.63	9.58	16.1
12-Sep-15	9.61	16.13	10.09	16.6
13-Sep-15	10.11	17.13	10.59	17.1
14-Sep-15	10.62	17.63	10.59	17.6
15-Sep-15	11.62	17.13	11.59	17.6
16-Sep-15	10.11	16.63	10.59	17.1
17-Sep-15	10.11	16.63	10.09	16.6
18-Sep-15	11.62	17.63	11.59	17.6
19-Sep-15	11.12	14.63	11.59	15.1
20-Sep-15	11.62	18.13	11.59	18.1
21-Sep-15	11.12	17.63	11.59	17.6
22-Sep-15	10.62	15.13	11.59	15.6
23-Sep-15	9.11	15.13	9.58	15.6
24-Sep-15	9.11	15.13	9.58	15.6
25-Sep-15	9.61	15.13	10.09	15.6
26-Sep-15	9.61	15.13	10.09	15.6

Date	Zone 1b Daily Min (˚C)	Zone 1b Daily Max (˚C)	Zone 2b Daily Min (˚C)	Zone 2b Daily Max (˚C)
27-Sep-15	10.62	18.13	10.59	18.61
28-Sep-15	11.62	19.13	11.59	19.61
29-Sep-15	11.62	19.13	12.09	20.11
30-Sep-15	11.62	19.64	12.09	20.11
1-Oct-15	14.63	21.64	15.1	22.11
2-Oct-15	13.12	21.64	13.09	22.11
3-Oct-15	13.62	22.14	13.6	22.61
4-Oct-15	14.13	21.14	14.6	21.61
5-Oct-15	15.13	23.14	15.6	24.11
6-Oct-15	15.13	24.14	15.6	24.61
7-Oct-15	15.63	19.13	16.1	19.61
8-Oct-15	14.63	20.64	15.6	21.11
9-Oct-15	15.13	23.64	15.6	24.61
10-Oct-15	15.63	23.64	16.1	24.11
11-Oct-15	15.13	19.64	15.6	20.61
12-Oct-15	15.13	23.64	16.1	25.11
13-Oct-15	16.63	21.14	17.6	22.11
14-Oct-15	16.63	24.14	17.1	24.61
15-Oct-15	16.63	25.64	17.1	26.61
16-Oct-15	16.63	26.14	17.6	27.61
17-Oct-15	18.63	23.64	19.61	24.11
18-Oct-15	17.63	22.14	18.61	23.11
19-Oct-15	17.63	26.14	18.61	27.11
20-Oct-15	18.13	26.64	18.61	28.11
21-Oct-15	19.64	22.64	20.11	23.61
22-Oct-15	18.13	21.14	18.61	22.11
23-Oct-15	16.63	20.14	17.1	21.61
24-Oct-15	15.63	22.64	16.6	24.11
25-Oct-15	15.13	24.14	15.6	26.11
26-Oct-15	16.63	23.64	17.6	25.11
27-Oct-15	17.13	24.64	18.1	26.61
28-Oct-15	16.63	25.64	18.1	27.11
29-Oct-15	16.63	26.14	17.6	27.61
30-Oct-15	17.63	25.64	18.61	27.61
31-Oct-15	17.63	21.64	18.61	22.61
1-Nov-15	16.63	21.64	17.6	22.61
2-Nov-15	17.63	23.64	18.1	25.11
3-Nov-15	18.63	21.64	19.11	23.11
4-Nov-15	18.13	19.64	18.61	20.61
5-Nov-15	17.13	19.13	18.1	20.11
6-Nov-15	17.63	22.64	18.1	24.11
7-Nov-15	17.63	24.64	18.1	26.61
8-Nov-15	18.63	23.64	19.11	25.11
9-Nov-15	18.13	25.14	18.61	26.61

Date	Zone 1b Daily Min (˚C)	Zone 1b Daily Max (˚C)	Zone 2b Daily Min (˚C)	Zone 2b Daily Max (˚C)
10-Nov-15	18.63	26.14	19.11	27.11
11-Nov-15	19.13	21.14	19.61	21.61
12-Nov-15	18.63	21.14	19.11	21.61
13-Nov-15	18.13	22.64	18.61	23.11
14-Nov-15	17.63	19.64	18.1	20.11
15-Nov-15	17.13	21.64	17.1	22.61
16-Nov-15	16.63	24.14	16.6	25.61
17-Nov-15	17.63	25.14	18.1	26.61
18-Nov-15	18.13	25.64	19.11	27.61
19-Nov-15	19.13	26.14	19.61	27.61
20-Nov-15	20.14	27.64	20.61	29.61
21-Nov-15	21.14	28.14	21.61	29.61
22-Nov-15	21.14	27.14	21.61	28.11
23-Nov-15	19.64	27.64	20.11	29.61
24-Nov-15	19.64	28.14	20.11	30.11
25-Nov-15	19.13	28.14	19.61	30.11
26-Nov-15	21.14	27.64	22.11	30.11
27-Nov-15	17.63	27.14	19.11	29.61
28-Nov-15	19.64	27.14	21.11	29.11
29-Nov-15	21.64	29.14	22.61	31.61
30-Nov-15	20.14	29.64	21.61	32.1
1-Dec-15	20.64	28.14	22.11	30.11
2-Dec-15	21.14	29.14	22.61	31.61
3-Dec-15	20.14	29.64	21.61	31.61
4-Dec-15	21.14	30.14	22.61	32.6
5-Dec-15	21.14	31.14	22.61	33.1
6-Dec-15	21.64	31.63	23.11	33.6
7-Dec-15	23.14	27.64	24.61	29.11
8-Dec-15	22.64	25.64	24.11	27.11
9-Dec-15	22.14	31.14	23.11	33.1
10-Dec-15	22.14	32.13	23.61	33.6
11-Dec-15	22.64	31.63	24.11	34.1
12-Dec-15	21.14	31.14	22.61	33.6
13-Dec-15	22.14	30.64	23.61	32.6
14-Dec-15	21.14	32.13	22.61	34.6
15-Dec-15	22.64	28.64	24.11	29.61
16-Dec-15	22.14	29.64	23.61	31.11
17-Dec-15	19.64	29.64	20.61	32.1
18-Dec-15	21.64	35.63	22.61	33.1
19-Dec-15	23.64	26.64	24.11	33.1
20-Dec-15	25.14	27.64	25.11	35.6
21-Dec-15	22.14	26.64	26.11	30.61
22-Dec-15	22.64	24.14	24.11	31.61
23-Dec-15	23.14	23.64	24.11	32.6

Date	Zone 1b Daily Min (˚C)	Zone 1b Daily Max (˚C)	Zone 2b Daily Min (˚C)	Zone 2b Daily Max (˚C)
24-Dec-15	22.14	23.64	22.11	30.61
25-Dec-15	22.64	24.14	22.11	32.1
26-Dec-15	23.14	24.14	22.61	24.61
27-Dec-15	23.14	24.14	20.11	29.11
28-Dec-15	22.64	23.64	19.61	29.11
29-Dec-15	22.14	23.14	20.61	31.11
30-Dec-15	21.64	23.14	21.61	32.6
31-Dec-15	21.64	23.14	22.61	33.6
1-Jan-16	23.14	25.14	24.61	34.1
2-Jan-16	24.64	25.64	24.11	28.61
3-Jan-16	24.64	25.64	22.11	28.61
4-Jan-16	23.64	24.64	21.61	24.11
5-Jan-16	23.14	24.14	20.11	22.61
6-Jan-16	22.64	24.14	20.11	23.11
7-Jan-16	22.14	23.64	18.1	26.11
8-Jan-16	22.64	24.14	19.11	29.11
9-Jan-16	23.14	24.64	21.61	30.61
10-Jan-16	24.14	26.14	22.61	32.6
11-Jan-16	22.64	25.64	23.61	32.1
12-Jan-16	22.64	24.64	24.11	32.6
13-Jan-16	22.64	25.14	24.11	34.6
14-Jan-16	23.14	25.14	25.11	30.61
15-Jan-16	22.64	24.14	21.61	29.11
16-Jan-16	22.64	24.14	20.61	28.61
17-Jan-16	23.14	24.64	21.11	31.61
18-Jan-16	23.14	24.64	23.11	33.6
19-Jan-16	23.14	24.64	24.11	34.6
20-Jan-16	23.64	25.14	25.11	31.11
21-Jan-16	23.64	25.14	24.61	31.11
22-Jan-16	23.64	24.64	24.11	26.61
23-Jan-16	23.64	25.14	22.61	29.61
24-Jan-16	24.14	25.64	23.11	29.11
25-Jan-16	23.14	24.64	23.11	27.61
26-Jan-16	23.64	25.14	22.61	29.11
27-Jan-16	22.64	24.14	22.61	25.61
28-Jan-16	23.64	24.64	21.61	30.11
29-Jan-16	23.64	24.64	22.61	25.11
30-Jan-16	23.14	24.64	20.11	26.61
31-Jan-16	23.14	24.14	20.11	25.61
1-Feb-16	22.64	23.64	20.11	24.11
2-Feb-16	22.64	24.14	22.11	24.61
3-Feb-16	23.14	23.64	23.11	23.61

APPENDIX E – SUMMARISED METEOROLOGICAL DATA 2013 - 2015

Year	Month	Monthly Precipitation (mm)	Average Maximum Daily Air Temperature (ºC)	Average Minimum Daily Air Temperature (ºC)	Average Maximum Daily Soil Temperature (ºC at 10 cm depth)	Average Minimum Daily Soil Temperature (ºC at 10 cm depth)
2013	January	72.6	32.3	13.9	33.2	23.8
2013	February	30	27.4	12.8	30.0	21.4
2013	March	197.2	25.7	9.6		
2013	April	9.8	22.1	5.5		
2013	May	19.8	17.4	1.3		
2013	June	85.2	13.9	1.6		
2013	July	42.8	13.4	1.7	10.5	6.2
2013	August	27	14.8	2.4	12.1	6.6
2013	September	91	19.9	4.0	17.8	10.8
2013	October	13.4	21.9	3.8	21.7	13.3
2013	November	105.6	23.8	6.7	25.3	16.3
2013	December	23.2	28.5	11.5	33.7	23.6
2014	January	4.8	31.6	12.1	35.7	24.8
2014	February	83.6	29.4	13.5	33.2	23.8
2014	March	88	24.2	12.2	25.0	18.7
2014	April	16.9	19.7	7.4	19.3	13.9
2014	May	14.4	17.6	2.7	14.7	9.5
2014	June	57.2	13.2	2.8	10.7	7.3
2014	July	34.9	12.2	0.0	9.1	4.9
2014	August	26.8	14.3	-0.8	11.8	5.7
2014	September	36.2	17.9	2.7	16.9	9.5
2014	October	53.4	22.5	5.4	22.5	13.9
2014	November	29	27.9	10.2	29.5	19.9
2014	December	102	27.7	12.7	29.5	20.4
2015	January	34.8	27.2	13.9	29.6	21.4
2015	February	30.2	28.3	13.0	30.0	21.4
2015	March	12.4	26.1	9.0	27.1	18.6
2015	April	91.8	19.1	7.1	17.7	12.6
2015	May	12.2	16.0	2.8	14.0	8.8
2015	June	55.2	13.7	-0.8	10.6	5.7
2015	July	37.2	11.6	-0.7	8.6	3.9
2015	August	66.8	13.7	1.0	10.7	5.3
2015	September	13.6	17.7	1.5	17.3	8.7
2015	October	26.6	24.8	8.3	24.6	16.2
2015	November	67.6	25.6	10.9	26.1	17.9
2015	December	34.8	29.3	11.4	32.3	21.9