



Your ref:

Our ref: 29446/002/01/CBH/JGO

4 March 2014

Mrs C Rodway  
Planning Services  
Arun District Council  
Arun Civic Centre  
Maltravers Road  
Littlehampton  
West Sussex  
BN17 5LF

Peter Brett Associates LLP  
Caversham Bridge House  
Waterman Place, Reading  
Berkshire RG1 8DN

Attn: C Rodway

By Email Only

Dear Sirs

**Windroos Nursery, Worthing Road, Littlehampton, BN17 6LY: Discharging Condition 8, 9 & 10 of Planning Consent LU/229/10**

We have been commissioned by Mr Stuart Lyons of Windroos Nursery to review the Planning Conditions 8, 9 and 10 and provide information to the Arun District Council in order to deal with and discharge the planning conditions 8, 9, and 10 of planning consent LU/229/10.

#### Condition 10

*Condition 10: Infiltration rates for soakaways and SuDS systems are to be based on tests undertaken over the wetter winter period. The design should be based on BRE 365, and cater for the 1 in 10 year storm between the invert of the entry pipe to the soakaway, and the highest recorded groundwater table. It must also have provision to ensure that there is capacity in the system to contain below the lowest ground level the 1 in 100 year event plus 20% rainwater volumes.*

*Any sustainable Urban Drainage Scheme (SuDS) or soakaway design must include 12 months of groundwater table monitoring data to determine the typical highest annual groundwater table in support of the design.*

We have been provided with the two geotechnical and geo-environmental site investigation report and preliminary contamination assessment reports. In addition to these Peter Brett Associates has recently undertaken groundwater monitoring at the site. These latter readings are included with this letter.

We have reviewed these reports to assess whether infiltration methods can be used as a SuDS based on the tests undertaken, and to evaluate the information provided for groundwater level.

1. Geotechnical and Geo-Environmental Site Investigation Report (Eastwood & Partners, June 2013, Report Ref:35747-001R(12).

The Eastwood & Partners Geotechnical and Geo-Environmental Site Investigation Report comprises ten trial pits, the boring of six window sample holes and excavation of one hole by hand

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auger. In addition fifteen hand dug pits and four soakaway tests were undertaken as part of this study. The report provides information based on groundwater monitoring wells up to 4metres deep.

2. Site Investigation Report (RLT, 11<sup>th</sup> December 2012, Report number:121013) including Geo-Environmental Desk Study and Site Investigation Report (Brown2Green, November 2012, Ref number:1023/Rpt1v1)

The RTL Site Investigation Report includes 8 No window sample boreholes together with monitoring points. The depths of these boreholes are between 4m to 4.5m.

3. Post Fieldwork Monitoring Record (PBA 1- 21<sup>st</sup> February 2014)

The Monitoring Record consists of groundwater level readings at 6 No boreholes. The boreholes are installed as part of the previous investigations by Eastwood Partners and RLT. The readings are attached.

The following information is summarised from the reports provided.

### **Soil Types**

The report shows that the ground is consist of made ground averaging 0.5m deep. The made ground is predominantly granular. The natural ground generally comprises brown silty sand/clay with occasional inclusion of flint gravel to the depths of between 0.8m and 3m below ground level (bgl). Below this orange brown slightly silty/clayey gravelly coarse grained sand with occasional flint and chalk gravel is identified. Weathered chalk was encountered in six of ten trial pits and five of the six window sample holes, at depth of between 2m to 3.8m bgl.

### **Groundwater**

The E&P's showed that the groundwater has not been observed in any of the explanatory holes during the investigation. The 4m deep monitoring wells were dry at the time of the investigation.

The groundwater monitoring for five positions (at adjacent site) to the north and west of this site has been undertaken in 2005. Initial water level recordings were made on 30 August 2005. Ground water level monitoring was then subsequently undertaken over a four month period starting in December 2005, with two visits per month. The groundwater depths ranged between 3.17m and 5.35m. There was relatively little variation in the groundwater level at each position and depths in the closest well to the site, which is 75m to the north of the site, were recorded at 4m to 4.5m.

The RTL Site Investigation Report also stated that 8 No window sample boreholes were dry at time of inspections at 4m-4.5m depths.

Peter Brett Associates has recently undertaken groundwater monitoring readings at 6 No boreholes as shown on the attached drawings (E&P and Brown2Green Borehole Location Plans). It is believed that the groundwater would be at its highest level due to the recent wettest season. The readings indicated that the groundwater levels fluctuate between 3.28m to 3.93m bgl at 5No boreholes and show some level of consistency compared to the previous readings apart from the bore hole RLT WS4. The reading at this point shows that the groundwater level is at 2.25m bgl. This is likely to be due to the perched water table at this location.

## Infiltration

The Eastwood & Partners Geotechnical and Geo-Environmental Site Investigation Report includes 4 No soakaway tests at the site on 26<sup>th</sup> of March 2013. The results of these tests are given in Table 1.

| Test | Depth (m bgl) | Strata                                                             | Comments                                                                                      | Infiltration Rate ( $\times 10^{-06}$ m/sec) |
|------|---------------|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------|
| TP2  | 2.42 to 3.48  | Very sandy SILT/CLAY (RTD) over slightly silty gravelly SAND (RBD) | Water level dropped 80 mm in 2.4 hours and then remained at this level for the next 2.6 hours | 1.4 ✓                                        |
| WS7  | 2.63 to 3.55  | Slightly silty SAND (RBD) over CHALK                               | Water level dropped 160 mm in just over 1 hour                                                | 7.1 ✓                                        |
| TP5  | 2.4 to 3.22   | Slightly silty gravelly SAND (RBD) over CHALK                      | Water level dropped 380 mm in just over 2 hours                                               | 12 ✓                                         |
| TP9  | 2.25 to 3.34  | Very silty slightly clayey slightly gravelly SAND                  | Water level dropped 30 mm in 2.6 hours                                                        | 0.48 ✓                                       |

**Table 1: Soakage Test Results (March 2013)**

The report also includes the results of the previously (August/early September 2005) undertaken soakaway tests to the north and west of this site. The results of these tests are given in Table 2.

| Location                                        | Depth (mbgl) | Infiltration Rate ( $\times 10^{-06}$ m/sec) |
|-------------------------------------------------|--------------|----------------------------------------------|
| SAA (Around 270 m north-north-west of the site) | 1.54 to 2.63 | 8.9                                          |
| SAB (Around 300 m north-west of the site)       | 1.93 to 2.53 | 7.2                                          |
| SAC (Around 15 m north of the site)             | 1.09 to 1.74 | 3                                            |

**Table 2: Soakage Test Results (September 2005)**

The report provides further soakaway test results which were undertaken by Ashdown Site Investigation Ltd in 2004 at adjacent site to the north and west. The results of these tests are given in Table 3.

| Test   | Infiltration Rate ( $\times 10^{-06}$ m/sec) |
|--------|----------------------------------------------|
| Test 1 | 1.2                                          |
| Test 2 | 6.9                                          |
| Test 3 | 16                                           |
| Test 4 | 21                                           |

**Table 3: Soakage Test Results (2004)**

The reports provide comprehensive information regarding the groundwater level and potential soil infiltration. The Eastwood & Partners Geotechnical and Geo-Environmental Site Investigation Report includes the 2005 study (4months monitoring) at the adjacent site during the wettest period of the year which shows that the groundwater depths ranged between 3.17m and 5.35m bgl. The recent groundwater readings by PBA at the site also indicates similar levels, therefore we believe that the information provided is sufficient to assess the groundwater levels and hence there is no requirement to monitor groundwater levels for 12 months period.

#### **Condition 9**

*Condition 9: Development shall not commence until a surface water drainage scheme for the site, based on sustainable drainage principles and including an assessment of the hydrological and hydro geological context of the development, has been submitted to and approved in writing by the Local Planning Authority, in consultation with Southern Water and the Environment Agency. The scheme shall also include:*

- a "Surface water Management Statement, or a SUDS Design Statement detailing the management train processes;
- details of how the scheme shall be maintained and managed after completion;- details of how the scheme relates to any identified contamination and risk assessment;
- information of pollution prevention.

*The scheme shall subsequently be implemented in accordance with the approved details before the development is completed.*

The proposed solution for the surface water drainage is to provide shallow infiltration systems for roof areas and attenuated discharge to public sewer for the impermeable infrastructure areas. This will need further discussion with Southern Water to establish capacity within the public sewer and further investigation of BRE 365 infiltration test to validate.

Once we acquire all information we will then detail the SuDS drainage strategy for the proposed site. The strategy will also depend on the capacity in the Southern Water public sewer system.

#### **Condition 8**

*Condition 8: No infiltration of surface water drainage into the ground is permitted other than with the express written consent of the local planning authority, which may be given for those parts of the site where it has been demonstrated that there is no resultant unacceptable risk to controlled waters. The Development shall be carried out in accordance with the approved details.*

The infiltration tests have not been undertaken according to BRE 365 and it appears that the tests were undertaken more in the lower gravelly strata. If they were placed higher up, the infiltration will be lower as the material is sandy clay, however the results indicates that the soil has some potential for the infiltration SuDS systems. It is also known that the surface water is currently drained via soakaways.

More targeted specific soakaway tests according to BRE 365 will be undertaken where the proposed houses are located.

The available ground condition data shows that there is no gross site wide contamination, however, there are data gaps and associated uncertainty and as such further investigation is likely to be required to fully characterise the ground conditions. It is considered that the use of infiltration drainage should not be eliminated as an option due to contamination, however, targeted investigation of proposed soakaway locations will be required to confirm the uncontaminated nature of the ground at the specific locations.

## **Conclusion**

The previously undertaken studies as part the proposed scheme provide sufficient information to assess the groundwater level appropriately.

The infiltration rates vary across the site, therefore more targeted soakaway tests according to BRE 365 will be undertaken at later detailed stage.

There is not gross site wide contamination, therefore the use of infiltration should not be eliminated.

Based on the above we believe that 12 months groundwater monitoring will not improve the robustness of the design strategy, therefore we recommend that ADC agree to vary Condition 10 and remove this requirement.

Yours faithfully

**J G OZKAN**

For and on behalf of

**PETER BRETT ASSOCIATES LLP**

C.C. Mark Luker – Environment Agency  
Stuart Lyons

Enc Post Fieldwork Monitoring Record (PBA 1) and E&P and Brown2Green Borehole Location Plans

# POST FIELDWORK MONITORING RECORD (PBA 1)

Page 1 of 2



|           |                                 |
|-----------|---------------------------------|
| Job Title | Windroos Nursery, Littlehampton |
| Job No    | 29446/3501                      |
| Date      | 21/02/2014                      |
| Operator  | JWG                             |

| CALIBRATION |            |                    |                |
|-------------|------------|--------------------|----------------|
|             | Limits (%) | Cal Gas Start/ End | Air Start/ End |
| CH4 (5%)    | 4.5 - 5.5  | 4.5 / 4.7          | 0.0 / 0.0      |
| CO2 (5%)    | 4.5 - 5.5  | 6.1 / 5.4          | 0.0 / 0.0      |
| O2 (5%)     | 5.0 - 7.0  | 5.4 / 5.5          | 20.5 / 20.9    |

|                                                                    |  |
|--------------------------------------------------------------------|--|
| Instrument (type/serial no) and date of last manufacturers service |  |
|--------------------------------------------------------------------|--|

| Atmospheric Pressure | Time | - 48 hrs | - 24 hrs | 0    | + 24 hrs | + 48 hrs | Comment |
|----------------------|------|----------|----------|------|----------|----------|---------|
|                      | mbar | 1013     | 1001     | 1006 | 1013     | 1012     | Rising  |

|                   |                                                                    |
|-------------------|--------------------------------------------------------------------|
| Ground conditions | Mostly dry underfoot with some areas flooded due to failing drains |
|-------------------|--------------------------------------------------------------------|

|         |                        |
|---------|------------------------|
| Weather | Sunny, warm and windy. |
|---------|------------------------|

| Borehole identification and construction |             |                                 |             | E&P WS2     |             | Square flush cover with allen key opening |             |                          |                      |
|------------------------------------------|-------------|---------------------------------|-------------|-------------|-------------|-------------------------------------------|-------------|--------------------------|----------------------|
| Comment/Condition                        |             | Good, slightly stiff and rusty. |             |             |             |                                           |             |                          |                      |
| Start time with pump time (minutes)      | Flow (l/hr) | Pressure (mb)                   | CH4 (%v/v)  | CO2 (%v/v)  | O2 (%v/v)   | CH4 (%LEL)                                | H2S (ppm)   | Groundwater Level (mBGL) | Depth to base (mBGL) |
|                                          | Peak/Steady | Peak/Steady                     | Peak/Steady | Peak/Steady | Peak/Steady | Peak/Steady                               | Peak/Steady |                          |                      |
| 0 to 1                                   | -3.0 / 0.0  | 1006                            | 2.4 / 0.0*  | 0.8         | 17.8        | 0.0*                                      | 0.0*        | 3.80                     | 3.90                 |
| 1 to 2                                   |             |                                 | 0.0*        | 1.5         | 16.2        | 0.0*                                      | 0.0*        |                          |                      |
| 2 to 3                                   |             |                                 | 0.0*        | 1.9         | 15.1        | 0.0*                                      | 0.0*        |                          |                      |

| Borehole identification and construction |             |                      | RLT WS1     |             | Circular flush cover with 2 bolts |             |             |                          |                      |
|------------------------------------------|-------------|----------------------|-------------|-------------|-----------------------------------|-------------|-------------|--------------------------|----------------------|
| Comment/Condition                        |             | Good, slightly rusty |             |             |                                   |             |             |                          |                      |
| Start time with pump time (minutes)      | Flow (l/hr) | Pressure (mb)        | CH4 (%v/v)  | CO2 (%v/v)  | O2 (%v/v)                         | CH4 (%LEL)  | H2S (ppm)   | Groundwater Level (mBGL) | Depth to base (mBGL) |
|                                          | Peak/Steady | Peak/Steady          | Peak/Steady | Peak/Steady | Peak/Steady                       | Peak/Steady | Peak/Steady |                          |                      |
| 0 to 1                                   | -3.9 / 0.0  | 1006                 | 0.0*        | 5.9         | 18.7                              | 0.0*        | 0.0*        | 3.93                     | 4.00                 |
| 1 to 2                                   |             |                      | 0.0*        | 5.6         | 11.0                              | 0.0*        | 0.0*        |                          |                      |
| 2 to 3                                   |             |                      | 0.0*        | 5.5         | 11.2                              | 0.0*        | 0.0*        |                          |                      |

|                                          |             |                      |             |             |                                           |             |             |                          |                      |
|------------------------------------------|-------------|----------------------|-------------|-------------|-------------------------------------------|-------------|-------------|--------------------------|----------------------|
| Borehole identification and construction |             |                      | E&P WS1     |             | Square flush cover with allen key opening |             |             |                          |                      |
| Comment/Condition                        |             | Good, slightly rusty |             |             |                                           |             |             |                          |                      |
| Start time with pump time (minutes)      | Flow (l/hr) | Pressure (mb)        | CH4 (%v/v)  | CO2 (%v/v)  | O2 (%v/v)                                 | CH4 (%LEL)  | H2S (ppm)   | Groundwater Level (mBGL) | Depth to base (mBGL) |
|                                          | Peak/Steady | Peak/Steady          | Peak/Steady | Peak/Steady | Peak/Steady                               | Peak/Steady | Peak/Steady |                          |                      |
| 0 to 1                                   | 0.0         | 1006                 | 0.0*        | 1.1         | 18.0                                      | 0.0*        | 0.0*        | 3.69                     | 4.05                 |
| 1 to 2                                   |             |                      | 0.0*        | 1.1         | 18.5                                      | 0.0*        | 0.0*        |                          |                      |
| 2 to 3                                   |             |                      | 0.0*        | 1.3         | 18.5                                      | 0.0*        | 0.0*        |                          |                      |

| Borehole identification and construction |             |                              | RLT WS4     |             | Circular flush cover with 2 bolts |             |             |                          |                      |
|------------------------------------------|-------------|------------------------------|-------------|-------------|-----------------------------------|-------------|-------------|--------------------------|----------------------|
| Comment/Condition                        |             | Good, muddy underneath cover |             |             |                                   |             |             |                          |                      |
| Start time with pump time (minutes)      | Flow (l/hr) | Pressure (mb)                | CH4 (%v/v)  | CO2 (%v/v)  | O2 (%v/v)                         | CH4 (%LEL)  | H2S (ppm)   | Groundwater Level (mBGL) | Depth to base (mBGL) |
|                                          | Peak/Steady | Peak/Steady                  | Peak/Steady | Peak/Steady | Peak/Steady                       | Peak/Steady | Peak/Steady |                          |                      |
| 0 to 1                                   | 0.2 / 0.0   | 1006                         | 0.0*        | 4.1 / 1.8   | 14.6                              | 0.0*        | 0.0*        | 2.25                     | 3.40                 |
| 1 to 2                                   |             |                              | 0.0*        | 1.2         | 16.6                              | 0.0*        | 0.0*        |                          |                      |
| 2 to 3                                   |             |                              | 0.0*        | 1.0         | 17.1                              | 0.0*        | 0.0*        |                          |                      |

| Borehole identification and construction |             |               |             | E&P WS4     |             | Square flush cover with allen key opening |             |                          |                      |
|------------------------------------------|-------------|---------------|-------------|-------------|-------------|-------------------------------------------|-------------|--------------------------|----------------------|
| Comment/Condition                        |             | Good, muddy   |             |             |             |                                           |             |                          |                      |
| Start time with pump time (minutes)      | Flow (l/hr) | Pressure (mb) | CH4 (%v/v)  | CO2 (%v/v)  | O2 (%v/v)   | CH4 (%LEL)                                | H2S (ppm)   | Groundwater Level (mBGL) | Depth to base (mBGL) |
|                                          | Peak/Steady | Peak/Steady   | Peak/Steady | Peak/Steady | Peak/Steady | Peak/Steady                               | Peak/Steady |                          |                      |
| 0 to 1                                   | -2.7 / 0.0  | 1006          | 0.0*        | 4.5         | 10.9        | 0.0*                                      | 0.0*        | 3.28                     | 4.15                 |
| 1 to 2                                   |             |               | 0.0*        | 4.6         | 10.8        | 0.0*                                      | 0.0*        |                          |                      |
| 2 to 3                                   |             |               | 0.0*        | 4.6         | 10.8        | 0.0*                                      | 0.0*        |                          |                      |

|          |     |      |            |            |  |      |  |
|----------|-----|------|------------|------------|--|------|--|
| Typed By | JWG | Date | 24/02/2014 | Checked By |  | Date |  |
|----------|-----|------|------------|------------|--|------|--|

| Borehole identification and construction           |             |               |            |            |           |            |           |                          |                      |
|----------------------------------------------------|-------------|---------------|------------|------------|-----------|------------|-----------|--------------------------|----------------------|
| E&P WS10 Square flush cover with allen key opening |             |               |            |            |           |            |           |                          |                      |
| Comment/Condition                                  |             |               |            |            |           |            |           |                          |                      |
| Good                                               |             |               |            |            |           |            |           |                          |                      |
| Start time with pump time (minutes)                | Flow (l/hr) | Pressure (mb) | CH4 (%v/v) | CO2 (%v/v) | O2 (%v/v) | CH4 (%LEL) | H2S (ppm) | Groundwater Level (mBGL) | Depth to base (mBGL) |
| 0 to 1                                             | 0.0         | 1005          | 0.0*       | 2.3        | 18.3      | 0.0*       | 0.0*      | 3.60                     | 4.05                 |
| 1 to 2                                             |             |               | 0.0*       | 2.0        | 18.7      | 0.0*       | 0.0*      |                          |                      |
| 2 to 3                                             |             |               | 0.0*       | 1.7        | 19        | 0.0*       | 0.0*      |                          |                      |

| Borehole identification and construction                                                                                                   |             |               |            |            |           |            |           |                          |                      |
|--------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------|------------|------------|-----------|------------|-----------|--------------------------|----------------------|
| RLT WS2 Circular flush cover with 2 bolts                                                                                                  |             |               |            |            |           |            |           |                          |                      |
| Comment/Condition                                                                                                                          |             |               |            |            |           |            |           |                          |                      |
| Peak, wet and muddy. Cover buckled due to forays driving over it. Standpipe seemed intact. Could not get gas bang out to take water levels |             |               |            |            |           |            |           |                          |                      |
| Start time with pump time (minutes)                                                                                                        | Flow (l/hr) | Pressure (mb) | CH4 (%v/v) | CO2 (%v/v) | O2 (%v/v) | CH4 (%LEL) | H2S (ppm) | Groundwater Level (mBGL) | Depth to base (mBGL) |
| 0 to 1                                                                                                                                     | 0.0         | 1005          | 0.1        | 9.0        | 0.0       | 0.1        | 0.0*      |                          |                      |
| 1 to 2                                                                                                                                     |             |               | 0.1        | 9.0        | 0.0       | 0.0*       | 0.0*      |                          |                      |
| 2 to 3                                                                                                                                     |             |               | 0.1        | 9.0        | 0.0       | 0.8 / 0.5  | 0.0*      |                          |                      |

| Borehole identification and construction |             |               |            |            |           |            |           |                          |                      |
|------------------------------------------|-------------|---------------|------------|------------|-----------|------------|-----------|--------------------------|----------------------|
| Comment/Condition                        |             |               |            |            |           |            |           |                          |                      |
| Start time with pump time (minutes)      | Flow (l/hr) | Pressure (mb) | CH4 (%v/v) | CO2 (%v/v) | O2 (%v/v) | CH4 (%LEL) | H2S (ppm) | Groundwater Level (mBGL) | Depth to base (mBGL) |
| 0 to 1                                   |             |               |            |            |           |            |           |                          |                      |
| 1 to 2                                   |             |               |            |            |           |            |           |                          |                      |
| 2 to 3                                   |             |               |            |            |           |            |           |                          |                      |

| Borehole identification and construction |             |               |            |            |           |            |           |                          |                      |
|------------------------------------------|-------------|---------------|------------|------------|-----------|------------|-----------|--------------------------|----------------------|
| Comment/Condition                        |             |               |            |            |           |            |           |                          |                      |
| Start time with pump time (minutes)      | Flow (l/hr) | Pressure (mb) | CH4 (%v/v) | CO2 (%v/v) | O2 (%v/v) | CH4 (%LEL) | H2S (ppm) | Groundwater Level (mBGL) | Depth to base (mBGL) |
| 0 to 1                                   |             |               |            |            |           |            |           |                          |                      |
| 1 to 2                                   |             |               |            |            |           |            |           |                          |                      |
| 2 to 3                                   |             |               |            |            |           |            |           |                          |                      |

| Borehole identification and construction |             |               |            |            |           |            |           |                          |                      |
|------------------------------------------|-------------|---------------|------------|------------|-----------|------------|-----------|--------------------------|----------------------|
| Comment/Condition                        |             |               |            |            |           |            |           |                          |                      |
| Start time with pump time (minutes)      | Flow (l/hr) | Pressure (mb) | CH4 (%v/v) | CO2 (%v/v) | O2 (%v/v) | CH4 (%LEL) | H2S (ppm) | Groundwater Level (mBGL) | Depth to base (mBGL) |
| 0 to 1                                   |             |               |            |            |           |            |           |                          |                      |
| 1 to 2                                   |             |               |            |            |           |            |           |                          |                      |
| 2 to 3                                   |             |               |            |            |           |            |           |                          |                      |

| Borehole identification and construction |             |               |            |            |           |            |           |                          |                      |
|------------------------------------------|-------------|---------------|------------|------------|-----------|------------|-----------|--------------------------|----------------------|
| Comment/Condition                        |             |               |            |            |           |            |           |                          |                      |
| Start time with pump time (minutes)      | Flow (l/hr) | Pressure (mb) | CH4 (%v/v) | CO2 (%v/v) | O2 (%v/v) | CH4 (%LEL) | H2S (ppm) | Groundwater Level (mBGL) | Depth to base (mBGL) |
| 0 to 1                                   |             |               |            |            |           |            |           |                          |                      |
| 1 to 2                                   |             |               |            |            |           |            |           |                          |                      |
| 2 to 3                                   |             |               |            |            |           |            |           |                          |                      |

|           |     |      |            |             |  |      |  |
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| Typed By: | JWG | Date | 24/02/2014 | Checked By: |  | Date |  |
|-----------|-----|------|------------|-------------|--|------|--|

