Appendix 6.1 – Access Strategy Report

Heron Land Development; Taylor Wimpey; Persimmon Homes

Land at West Durrington

Access Strategy

Project Ref: 05969/T01

Doc Ref: RAS01/Rev C

July 2008

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1 Introduction and Background

1.1. The adopted Worthing Local Plan designated the two fields which lie within the application area closest to Titnore Lane as being within the settlement boundary. The adopted 2003 Development Brief confirms they are suitable for residential development. The plan in the Development Brief links them to each other and to the main areas of the development site to the east. Routes are shown crossing The Lag and going through South Lodge Rue. The Development Brief is a formal Supplementary Planning Guidance, having been through public consultation and consideration by statutory bodies and third parties. **Figure 1.1** shows the location of the site with regards to the surrounding area.

1.2. The housing supply assumptions made in the adopted and emerging development plans rely on these areas close to Titnore Lane coming forward. In making these allocations the Council followed due process and carefully considered the Local Plan Inspector's report which indicated that, on balance, it was reasonable for these areas to be included as part of the development site. The Inspector left the question of whether an access should be formed to Titnore Lane in the hands of the Council. He indicated that environmental appraisal and the aim of integration with the existing developed area should be key determining factors.

1.3. The Planning Officer's principal report to Development Control Committee in relation to the 2003 scheme concluded a new access was appropriate. The County Council, as highway authority, strongly shared that view. The Titnore Lane access was proposed to be in the form of a roundabout junction with some straightening of the road to its north at South Lodge. The authorities took account of sustainability and travel convenience, environmental issues both within the urban area and on Titnore Lane, accident records and the potential for increased vehicular linkages or increased use of proposed ones. The scheme would have required the loss of some 185 trees but it is very clear that this was taken into account in the balance of issues considered by the authorities.

1.4. Another significant factor was the opinion of the majority of respondents to the Consortium exhibition in 2003 that the main vehicular access to and from the site should be via Fulbeck Avenue and Titnore Lane rather than Tasman Way, Humber Avenue, Adur Avenue or other residential roads.

1.5. Nevertheless, there was strong objection to the loss of trees.

Retention of trees and planting of new trees

1.6. The Consortium has therefore reviewed the Titnore Lane access scheme with the highway authority. As a result the current submission by the Consortium includes a new type of access to the site from Titnore Lane, which takes the form of a T junction. The straightening at South Lodge has been replaced by speed management and hazard awareness measures without realigning or widening the existing carriageway.

1.7. The design is acceptable to the highway authority in highway safety terms and the number of trees to be removed at the junction and this part of Titnore Lane reduces from 185 trees under the original proposal to 6. Subject to site conditions during construction, it may be possible to reduce this figure even further to a loss of 3 low quality trees.

1.8. Tree loss for The Lag and South Lodge Rue crossings, because of a refined planning approach, is to be reduced from 57 to a maximum of 29. Similarly, the works at Titnore Way junction with Titnore Lane, which are essential whether or not there is direct access from the development to Titnore Lane, now involves 12-15 trees being lost as opposed to 25 shown within the 2003 scheme.

1.9. There is to be extensive new tree planting - estimated at approx 2,350 trees of varying sizes plus 13,000 shrubs, planted over an area of around 3 hectares. This work will be done in agreed locations and in accordance with species selection, sizing and a programme for planting to be submitted to and approved by the Council.

1.10. Against this background this report considers:

- Guidance on how to access large developments;
- Transport analysis of the options;
- Construction traffic;
- Road Safety;
- Impact Considerations:
  - The impact of the Titnore Lane access proposals on trees and hedgerows;
  - Air Quality; and
  - Noise.

1.11. The report provides a useful policy and factual context for the consideration of the proposals. The principal determining points, however, are that the new revised Access Strategy has produced an access scheme which meets the wishes of local residents on the routing of traffic, creates a safe access to Titnore Lane whilst improving safety for vehicles travelling along the lane, and minimises tree loss.

1.12. This report considers the most significant effects associated with creating an access onto Titnore Lane, as raised by Worthing Borough Council and local residents. For the full Environmental Impact Assessment please refer to the separate Environment Statement.

2 Guidance on How to Access Large Developments

2.1. The recently published Manual for Streets (MfS), which supersedes Design Bulletin 32 and its companion guide Places, Streets and Movement, provides guidance on the design and layout of residential developments. The aim of MfS is to put well-designed residential streets at the heart of sustainable communities.

2.2. A key consideration for achieving sustainable development is how the design can encourage people to choose sustainable travel modes. Designers and engineers need to respond to a wide range of polices aimed at making car use a matter of choice rather than habit or dependence. Local transport plans and movement strategies can directly inform the design process as part of the policy implementation process.

2.3. The main changes in the approach to street design that the MfS recommends include 'creating networks of streets that provide permeability and connectivity to main destinations and a choice of routes'.

2.4. The MfS states that 'Street networks should, in general, be connected. Connected or 'permeable', networks encourage walking and cycling and make places easier to navigate through. They also lead to a more even spread of motor traffic throughout the area and so avoid the need for distributor roads with no frontage development. Research shows that there is no significant difference in collision risk attributable to more permeable street layouts.'

2.5. With regard to pedestrian movement, MfS states 'pedestrians generally feel safe from crime where:

- Their routes are overlooked by buildings with habitable rooms;
- Other people are using the street;
- There is no sign of anti-social activity (e.g. litter, graffiti, vandalised street furniture);
- They can not be surprised (e.g. at blind corners);
- They cannot be trapped (e.g. people can feel nervous in places with few entry and exit points); and
- There is good lighting.

2.6 The exclusion of an access via Titnore Lane could lead to the provision of a number of cul-de-sacs or lightly trafficked (vehicles and pedestrians) links on the western side of the development that could result in an unsuitable and unattractive pedestrian and cycle environment. However, the provision of an additional access via Titnore Lane would open up the western end of the development to all traffic which would increase the use of these roads and provide a safer environment for all users.

2.7 The proposed access strategy provides three points of access into the development area. These access points are from:

- Fulbeck Avenue;

- Titnore Lane; and
- Tasman Way.

2.8 Vehicular access from Tasman Way would be limited to a maximum of 100 dwellings with the remaining two accesses being unrestricted. Providing access in this way gives a good sustainable connection into the heart of Durrington by restricting vehicle movements and encouraging walking, cycling and bus travel. The actual affects on reducing vehicle numbers is described in detail in Section 3.

2.9 Fulbeck Avenue and Titnore Lane accesses provide connection to the wider strategic highway network avoiding the densely populated areas of Durrington. This allows commuters travelling by car to avoid the local roads of Durrington without significantly adding to the existing capacity constraints in the area.

3 Impact of Traffic Flow Distribution

Capacity and Delay

3.1. This chapter analyses the impact that the distribution of development traffic will have on the local road network and community for the two scenarios of providing and not providing an additional site access from Titnore Lane.

Base Traffic Flows

3.2. Traffic surveys were completed at a number of local junctions on 17th January 2007 and the AM and PM peak hour traffic flow totals from these surveys are summarised on Figures 3.1 and 3.2 respectively, with the forecast year 2012 base traffic flows summarised on Figures 3.3 and 3.4.

Traffic Flow Distribution

3.3. The development trip distribution has been based on travel information contained within the Geographical Information System (GIS), which uses data from the 2001 census.

3.4. Travel to work information has been extracted for the existing residents of the properties enclosed by and including Fulbeck Avenue, Romany Road and Faraday Close. The data extracted from GIS provided details on the destination of commuter trips from this study area which has been used for forecasting travel distribution from the site.

Route Assignment

3.5. The distribution of traffic from the development site will be restricted to a maximum of 100 dwellings from Tasman Way in the scenario with access to Titnore Lane. In the scenario without direct access to Titnore Lane, Tasman Way together with Adur Avenue, Humber Avenue and Canberra Road could provide unrestricted access to give suitable connectivity without over saturating any single residential road.

Forecast Traffic Flows

3.6. The forecast AM and PM peak hour development traffic flows with and without the Titnore Lane access are illustrated on Figures 3.5 and 3.6 respectively, with the difference in development flow distribution across the network between these two scenarios illustrated on Figures 3.7 & 3.8 during the AM and PM peak hours.

3.7. From Figures 3.7 and 3.8 it can be seen that not providing an access into the site from Titnore Lane would result in higher traffic flow increases on:

- Titnore Way;
- New Road;
- Romany Road (Columbia Drive to Tasman Way)
- Tasman Way;
- Columbia Drive;
- Durrington Lane; and
- Durrington Hill.

Whereas with the access onto Titnore Lane the roads with higher traffic flow increases are:

- Romany Road (Titnore Way to Columbia Drive);
- Fulbeck Avenue;
- Yeoman Road; and
- Titnore Lane.

3.8. The most critical and beneficial change with the provision of the Titnore Lane access is the significant reduction of traffic on Tasman Way and the connecting roads.

3.9. These significant volumetric changes are considered both for capacity and delay impacts in the following paragraphs.

Junction Capacity

3.10. Junction capacity tests have been undertaken for all junctions considered in the study area, for ease of reference these include:

- Patching Junction;
- Titnore Lane/Site Access;
- Titnore Lane/Titnore Way;
- Goring Crossways;
- Yeoman Road/Littlehampton Road;
- Durrington Lane/Littlehampton Road;
- Durrington Lane/Columbia Drive;
- Durrington Lane/New Road/Durrington Hill;
- Fulbeck Avenue/Titnore Way;
- Romany Road/Yeoman Road; and
- Romany Road/Columbia Drive.

3.11. The capacity analysis was undertaken for both the morning and evening peak hours of 0800-0900 and 1700-1800 respectively. Transport Research Laboratory (TRL) software has been used which calculates the Ratio of Flow to Capacity (RFC) and the Maximum Queue lengths over the period modelled. The results in Table 3.1 show that that there are small increases in the RFC value on the residential roads of Durrington when the Titnore Lane access is removed. The most significant impacts are on the Titnore Way and Fulbeck Avenue Arms.

Junction		Arm	Year 2012 Do-Something PFDA 1225 + Tesco WITH TITNORE LANE ACCESS				Year 2012 Do-Something PFDA 1225 + Tesco NO TITNORE LANE SITE ACCESS			
			AM Peak		PM Peak		AM Peak		PM Peak	
			RFC	Queue	RFC	Queue	RFC	Queue	RFC	Queue
1a	A27 / A280 Long Furlong Roundabout	A27 Eastbound Off-Slip	0.49	1	0.31	0	0.48	1	0.30	0
		Arundel Road	0.11	0	0.06	0	0.11	0	0.06	0
		A280 Long Furlong	0.40	1	0.56	1	0.40	1	0.55	1
		A280 Northbound Approach	0.38	1	0.25	0	0.37	1	0.24	0
1b	A27 / Titnore Lane / Water Lane Roundabout	A280 Southbound Approach	0.54	1	0.69	2	0.53	1	0.67	2
		A27 Westbound Off-Slip	0.36	1	0.40	1	0.36	1	0.39	1
		Titnore Lane	0.39	1	0.47	1	0.37	1	0.46	1
		Water Lane	0.65	2	0.43	1	0.64	2	0.45	1
2	Titnore Lane / Titnore Way	Titnore Way	0.51	1	0.55	1	0.62	2	0.61	2
		Titnore Lane (S)	0.08	0	0.13	0	0.09	0	0.17	0
3	A2032 Littlehampton Road / Titnore Lane Roundabout	Littlehampton Road (W)	0.99	40	0.78	4	0.99	40	0.78	4
		Titnore Lane	0.90	7	0.62	2	0.87	6	0.62	2
		Littlehampton Road (E)	0.53	1	0.75	3	0.55	1	0.76	3
		Goring Street	0.77	3	0.87	6	0.77	3	0.87	6
4	A2032 Littlehampton Road / Yeoman Road Roundabout	Littlehampton Road (W)	0.64	2	0.55	1	0.64	2	0.55	1
		Yeoman Road	0.87	6	0.72	3	0.85	5	0.71	2
		Littlehampton Road (E)	0.53	1	0.59	1	0.52	1	0.58	1
		Palatine Road	0.48	1	0.55	1	0.48	1	0.52	1
5	A2032 Littlehampton Road / Durrington Lane Roundabout	Littlehampton Road (W)	0.80	4	0.79	4	0.78	4	0.80	4
		Durrington Lane	0.84	5	0.88	7	0.88	7	0.89	8
		Littlehampton Road (E)	0.77	3	0.73	3	0.78	4	0.74	3
		The Boulevard	0.83	5	0.88	7	0.83	5	0.89	8
6	Durrington Lane / Columbia Drive Roundabout	Columbia Drive	0.34	1	0.31	0	0.37	1	0.32	1
		Durrington Lane (N)	0.40	1	0.40	1	0.41	1	0.40	1
		Durrington Lane (S)	0.56	1	0.76	3	0.57	1	0.78	4
7	Romany Road / Columbia Drive Roundabout	Romany Road (W)	0.49	1	0.55	1	0.42	1	0.54	1
		Romany Road (N)	0.48	1	0.45	1	0.52	1	0.45	1
		Columbia Drive	0.63	2	0.68	2	0.63	2	0.70	2

8	Romany Road / New Road Roundabout	Tasman Way	0.08	0	0.05	0	0.20	0	0.11	0
		New Road	0.40	1	0.31	0	0.42	1	0.34	1
		Romany Road	0.35	1	0.54	1	0.34	1	0.59	2
		District Centre	0.22	0	0.58	1	0.21	0	0.63	2
9	Romany Road / Yeoman Road Roundabout	Romany Road (N)	0.63	2	0.36	1	0.55	1	0.33	1
		Romany Road (E)	0.52	1	0.49	1	0.49	1	0.43	1
		Yeoman Road	0.36	1	0.52	1	0.35	1	0.48	1
10	Titnore Way / Romany Road Roundabout	Titnore Way	0.36	1	0.28	0	0.37	1	0.32	1
		Fulbeck Avenue	0.42	1	0.21	0	0.37	1	0.19	0
		Romany Road	0.23	0	0.42	1	0.22	0	0.34	1
11	Durrington Lane / New Road Roundabout	New Road	0.54	1	0.42	1	0.56	1	0.43	1
		Durrington Hill	0.56	1	0.44	1	0.57	1	0.48	1
		Salvington Road	0.55	1	0.60	1	0.55	1	0.61	2
		Durrington Lane	0.55	1	0.51	1	0.56	1	0.52	1
12	Titnore lane Site Access	Site Access	0.29	1	0.10	0	-	-	-	-
		Titnore Lane (S)	0.02	0	0.06	0	-	-	-	-

Table 3.1 – Year 2012 Access Options Junction Assessment Result Summary

Junction Delay

3.12. Further to the reduction in highway capacity within the surrounding residential roads there are increases to network wide delays if an access via Titnore Lane is not provided. The results indicate that during the morning and evening period hours there will be additional delay as a result of not providing the Titnore Lane access. Further delay is also likely to take place outside of the peak hours, although this can not be quantified with the information available from the junction capacity and delay models used for this assessment.

4 Construction Traffic

Construction Phase

Potential impacts

4.1. Construction traffic associated with the development will comprise delivery of construction materials and plant, the export of surplus excavated material and other waste (for off-site disposal) and staff and operatives transport.

4.2. The daily volume of construction traffic will depend on the rate of construction which will fluctuate during the overall development programme. Overall, the period of construction will be in the order of 5 years.

4.3. It is envisaged that there will be three main stages of these works:

- Stage 1 will comprise the main access via Fulbeck Avenue and the main balancing pond;
- Stage 2 would be accessed from Titnore Lane; and
- Stage 3 would see the principal infrastructure extended into the northern part of the site.

4.4. Addressing first the export of surplus excavated material off-site, at this stage the estimation of quantities of surplus excavated material cannot be precise and so very broad assumptions have been made regarding the amount of topsoil and sub-soil that will be excavated.

4.5. The total estimated quantities of surplus excavated material to be transported from the site are in the order of 85,000 to 100,000 cubic metres. These quantities include for bulking of the material due to excavation in the order of 20 to 25%, so therefore the insitu volume of excavated material would be less than these figures.

4.6. Assuming standard 8 cubic metre capacity haulage lorries, these quantities approximate to 10,000 to 12,500 lorry loads.

4.7. Based on 250 working days per year, then the average number of loads per day over 5 years would be 8 to 10, so generating 16 to 20 two-way trips a day. But clearly the excavation operations will be more concentrated at some times rather than others, so there could be many more trips than this on any single day and conversely there may be days when there are no vehicle movements associated with excavated material.

4.8. A typically busy scenario occurring for the principal infrastructure might be 70 two-way trips per day, most of this traffic will occur during ‘off-peak’ periods.

4.9. The delivery of construction materials for roads and drainage – road construction materials, drainage pipes, etc, will lead to intermittent spells of from one or two up to a peak of say 40 to 60 two-way trips.

4.10. Delivery of materials for house construction is likely to be around 6 or 8 two-way trips a day. This would tend to be a more uniform rate over the development period.

4.11. Assuming that about 30 operatives would build 50 units per annum, that the maximum rate of construction would be around 200 units per annum and that there would be about 20 further additional site staff, it is estimated that there would be

approximately 150 construction workers on the site each day in connection with the house building during most of the construction period. The principal infrastructure works might require between 10 and 20 operatives depending on the rate of construction, but they would only be on site for a few periods when that work was in progress, possibly say three or four periods of about 20 weeks. Therefore there could be periods when there would be up to 170 operatives and site staff on site.

4.12. Considering a period when the possible maximum number of workers would be on site and assuming 70% of the workers' trips to and from the site occur during peak hours it is estimated that, as a likely worst case, there could be an additional 100 construction worker trips during peak hours. This assumes only a few vehicle sharing and non-car trips will be made. This level of traffic generation is considerably less than will occur once the scheme is fully occupied by new residents.

4.13. Large-scale waste disposal sites are currently generally located at some distance from the site entailing routing via the A27 and the A280. This will therefore mean that practically all the surplus excavated material trips will pass through Titnore Lane.

4.14. It is expected that most of the bulk construction materials will come from outside of the Worthing area. It is probable that concrete and aggregates will be supplied from Shoreham or Chichester. Bricks and timber are likely to be obtained through national supply chains. The majority of the construction material will therefore be transported to site via the County's strategic road network which includes the A27, the A280, the A258 and the A2032.

4.15. In summary, it is difficult to predict with certainty the construction traffic in terms of traffic flow rates, as noted above, and regarding traffic routes affected because of the variables to take into account including the rate and speed of building, which is dictated by prevailing market forces and by resource availability, and such factors as the location of suitable waste disposal sites and material sources at the time of construction.

4.16. The greatest impact of the construction traffic will be within the local neighbourhood. In this case this is primarily within the road network defined by Tasman Way, Romany Road, New Road, Columbia Drive, Durrington Lane, Yeoman Road, Fulbeck Avenue, Titnore Way and Titnore Lane.

4.17. Potential impacts of the construction traffic include noise nuisance, vehicle exhaust emissions, dust, mud and debris shed on the road, as well as potential road safety issues regarding the type of vehicles involved.

4.18. In the initial phases of the development, construction traffic will access and egress the site via Fulbeck Avenue and to a more limited extent via Tasman Way (this would be for the injection grouting operation at the very start of the development programme). However, as soon as the Titnore Lane access is provided, which will be before 350 dwellings are occupied, construction traffic in later phases will be routed via this access point.

4.19. Either by planning agreement or by planning conditions the Developers will undertake to control strictly the routes taken by construction traffic within the local road network. In the vicinity of the site it is proposed that construction traffic will only be permitted to use the following roads for access to the site: Tasman Way, Romany Road, Columbia Drive, Durrington Lane (south of Columbia Drive only), Yeoman Road, Fulbeck Avenue, Titnore Way and Titnore Lane. These roads will only be permitted for access to and from Titnore Lane north of the site. Use of Durrington Lane north of Columbia Drive will not be permitted. Effectively access to the A27 will only be via Titnore Lane.

5 Road Safety Analysis

Accident Forecasts

5.1. Formula contained within the Department for Transport COBA Manual has been used to forecast the annual level of accidents for links and junctions on the following study area:

- Titnore Lane (from Patching Junction to Littlehampton Road);
- Littlehampton Road (from Titnore Lane to Durrington Hill);
- Durrington Hill (from Littlehampton Road to New Road);
- Titnore Way – Romany Road – New Road;
- Yeoman Road; and
- Columbia Drive.

5.2. The accident predictions for the links has been calculated based on formula contained within Chapter 4 of Part 2 of the COBA manual with the accident predictions for junctions being calculated based on the Cross Product Rule, as explained in Chapter 5 'The Valuation of Accidents at Junctions' of Part 2 of the COBA manual.

5.3. Calculations of the level of accidents has been completed for the year 2012 for the base case scenario and then with the addition of the full development traffic including the Potential Future Development Area (PFDA) which has been taken as a total of 1,225 units for the with and without Titnore Lane access scenarios.

5.4. From the accident forecast summaries the existing road network for the forecast year 2012 base traffic flows has an annual rate of 31.8 accidents per year. The addition of the forecast development traffic without highway safety mitigation results in a small increase with forecasts of 35.5 and 34.9 for with and without the Titnore Lane access respectively.

Proposed Improvements to Titnore Lane

5.5. PBA have developed a number of speed management and hazard awareness measures along Titnore Lane, as illustrated on Drawing Numbers 5969/105/040 and 5969/105/041 contained within Appendix A of this report. These proposed measures will help reduce the annual accident rate of 35.5 for the area surrounding the development site and improve highway safety for all users.

6 Trees and Hedgerows

Landscape and Trees

6.1. The following text provides details of all trees that may need to be removed to accommodate the proposed access onto Titnore Lane. Maximum and minimum numbers are given: the maximum number is the worst case; the minimum number is achievable but subject to site conditions during construction (i.e. reduced working areas, appropriate tree protection, remedial crown reduction, etc.).

6.2. An arboricultural watching brief is proposed to ensure that tree removal is kept to an absolute minimum and that tree protection is implemented in accordance with BS5837: 2005. Although unlikely, the watching brief may even allow for the minimum tree loss figures to be reduced further. This of course will be subject to site conditions during the construction stage, where minor design modifications and special construction methods may allow for the retention of trees which at this stage appear not possible to keep.

6.3. Table 6.1 shows a comparison of tree loss between the original outline application and the current updated proposals. The total expected tree loss has been reduced from around 267 in December 2003 to as low as 43 now. This is a reduction of approximately 84%. The quality of these trees is mainly low: 70% are in BS5837: 2005 Category C, whilst 28% are moderate quality/value (Category B). It is likely that only one Category A tree will need to be removed.

6.4. Table 6.2 shows the category grades (quality/value) of trees for each area, whilst Appendix B includes full details of trees which may be affected by the development proposals.

6.5. A number of R Category trees are also recommended for removal. These trees are either dead, dying, in very poor condition or a potential hazard and, in accordance with BS5837: 2005, they should be removed as part of good tree or woodland management, regardless of the proposed development. For this reason they are not included in the figures for tree removal resulting from the proposed development. Refer to note 2 of Tables 6.1 and 6.2.

	Trees (Category Grades A-C) Proposed for Removal to Accommodate the Development Proposals (Titnore Lane, W8 and W10 only)			
	A (high quality/value)	B (moderate quality/value)	C (low quality/value)	Total A-C Grade Trees to be Removed
Titnore Lane – new T junction	0 (Max 1)	0 (Max 1)	3 (Max 4)	3 (Max 6)
Titnore Lane/Titnore Way junction	1 (Max 2)	7 (Max 9)	4	12 (Max 15)
Woodland W8	0	2	20	22
Woodland W10	0	5 (Max 6)	1	6 (Max 7)
TOTALS	1 (Max 3)	14 (Max 18)	28 (Max 29)	43 (Max 50)

Table 6.1 – Summary of Tree Loss Associated with Access onto Titnore Lane

Notes
1. The minimum number of tree loss can be achieved subject to detailed design, possible crown reduction/remedial action and checking structural condition of the trees.
2. Additional R category trees are recommended for removal on arboricultural grounds only, regardless of the development. These should be removed as part of good arboricultural management. R category trees to be removed include 8no in Woodland W8, 4no in Woodland W10, 1no adjacent to the proposed T junction on Titnore Lane and 4no adjacent to the widened Titnore Lane/Titnore Way junction.

	ORIGINAL OUTLINE APPLICATION DEC 2003	REVISED OUTLINE APPLICATION (Category A-C- ref BS 5837:2005) September 2006
Titnore Lane: new T-Junction	185	3 (Max 6)
Titnore Lane: new right turn junction into Titnore Way	25	12 (Max 15)
Woodlands W8 and W10	57	28 (Max 29)
Total	267	43 (Max 50)

Table 6.2 – Comparison of Tree Loss

Notes
1. The minimum number of tree loss can be achieved subject to detailed design, possible crown reduction/remedial action and checking structural condition of the trees.
2. Additional R category trees are recommended for removal on arboricultural grounds, regardless of the development. These should be removed as part of good arboricultural management. R category trees to be removed include 8no in Woodland W8, 4no in Woodland W10, 1no adjacent to the proposed T junction on Titnore Lane and 5no adjacent to the widened Titnore Lane/Titnore Way junction.

Titnore Lane - New Priority Controlled T-Junction

6.6. The proposed new T-junction results in the removal of a minimum 3no trees (two oak and one ash; all in Category C - low quality/value), up to maximum of 6no (1no in Category A; 1no B; 4no C). See Tables 6.1 and 6.2. Along the edge of Titnore Lane there is some thin scrub vegetation, the majority of which is dead or dying elm. This needs cutting back to accommodate the proposals.

6.7. This is a significant improvement on the original proposal (roundabout and realignment of Titnore Lane) which resulted in the loss of approximately 185 trees. Refer to Table 6.1. Subject to detailed design and the proposed watching brief, the total tree loss for the revised scheme may be reduced to 3 trees. Where drainage channels are to be cleared out within the woodland, this will be done by hand to avoid potential tree root damage.

6.8. On the east side of Titnore Lane 90m of hedgerow H14 will be coppiced, dug up and replanted along the new alignment. Gaps will be planted with similar native species. A small section of thin garden hedge next to South Lodge (35m, mainly garden species including Cotoneaster etc.) will be cut back to allow for visibility. It should be noted that over 1500m of new native hedgerow will be planted across the development site, plus over 30,000m² of woodland buffer/native shrub planting is proposed.

6.9. Refer also to Figures 6.1 and 6.5, Photosheet 6.1 and Appendix B.

Titnore Way/Titnore Lane Junction Highway Safety Improvements

6.10. The widening of this junction results in the removal of a minimum 12no trees, mostly oak and ash: 1no in Category A, 5no Category B and 6no Category C. If construction areas cannot be reduced sufficiently, a maximum of 15no trees may need to be removed (2no in Category A, 7no Category B and 6no Category C). It should be noted that these improvements will be provided as part of the Titnore Lane speed management and hazard awareness measures which will be implemented with or without the proposed access on Titnore Lane.

6.11. Refer also to Figures 6.2 and 6.5, Photosheet 6.2 and Appendix B.

Woodland W8

6.12. The access road through Woodland W8 results in the removal of 22no trees (just 2no in Category B; the rest in Category C). The majority are tall, thin Ash trees of low quality and value, growing close together. The two B Category trees are Scots pine: one has a heavy lean, the other shows signs of weak growth and has a sparse canopy; indeed both trees are B-C borderline category. The chosen route avoids the better quality trees to the north and south (e.g. oak to the north and sequoia to the south). There is little understorey or ground flora of note in this section. This is the least damaging route through Woodland W8.

6.13. Refer to Figures 6.3 and 6.5, Photosheet 6.3 and Appendix B.

Woodland W10

6.14. The access road through Woodland W10 (and over the stream known as the 'Lag') will result in the loss of a minimum 6no trees (oak, beech and hawthorn; 5no in Category B and 1no in Category C), up to a maximum total of 7no (6B; 1C).

6.15. At a meeting with Worthing BC on 12 September 2007 the retention of two of these trees (T140 and T145), by means of a raised carriageway, was discussed. This was investigated by the Consortium in some detail but considered not viable because of the likely harm to these trees, the need to bury the services and also the increased visual impact of a raised carriageway through this woodland. Even minor changes to the horizontal alignment would lead to damage or loss of adjacent trees currently proposed for retention.

6.16. Close inspection of this wood shows that the chosen route results in the least impact on higher quality, mature trees. None of the removed trees is in Category A. Visually, the impact will be minimal, as the canopies of retained trees either side of the road almost touch. Within a short time, tree canopies are likely to extend over the length of this road section. The bridge crossing over the Lag allows for a wildlife corridor, thus minimising ecological impact.

6.17. Refer to **Figure 6.4** and **6.5, Photosheet 6.4** and **Appendix B**.

7 Air Quality

Introduction

7.1. The Air Quality Chapter of the Environmental Statement considers the impact of the proposed development on local air quality with a site access provided via Titnore Lane. As part of the access strategy an option without the site access onto Titnore Lane has also been assessed including the impact on local air quality.

7.2. Air quality has been predicted on the site for 2012 (year of opening) and 2017 (year of completion) with and without the proposed development for both access options.

7.3. This option assessment uses the same methodology as the full assessment described in the ES.

Operational Impact

Road Traffic Data

7.4. PBA transport department provided annual average daily traffic (AADT), percentage of heavy duty vehicles (HDVs) (defined as vehicles over 3.5 tonnes) and average speed for roads likely to be impacted by the development.

7.5. Tables 7.1 and 7.2 show the traffic data used in the assessment with the site access and without the site access, respectively.

Link	Direction	Speed (kph)	HGV (%)			AADT						
			Without	With d'ment	With PFDA	2007	2012			2017		
						Base	Without	With d'ment	With PFDA	Without	With d'ment	With PFDA
Titnore Lane	Northbound	45	2	2	2	5158	5622	5817	5899	6137	6333	6415
	Southbound	43	2	2	2	5515	6012	6203	6283	6563	6755	6835
Titnore Way	Eastbound	32	1	1	1	2286	2492	2671	2746	2721	2900	2974
	Westbound	29	2	2	2	2098	2287	2470	2546	2497	2680	2756
Fulbeck Ave	Northbound	30	1	0	0	637	694	2348	3095	758	2412	3159
	Southbound	30	2	1	1	726	791	2448	3196	864	2521	3269
Tasman Way	Northbound	30	1	1	1	447	487	769	769	532	813	813
	Southbound	30	1	1	1	520	567	848	848	619	900	900
New Road	Eastbound	30	1	1	1	4531	4939	5231	5334	5392	5684	5787
	Westbound	30	1	1	1	4613	5028	5320	5423	5489	5781	5885
A27	Eastbound	70	9	9	9	15061	16416	16416	16416	17772	17772	17772
	Westbound	70	9	9	9	14560	15870	15870	15870	17181	17181	17181
Site Traffic	West of site	20	-	0	0	-	-	1045	1517	-	1045	1517
Site Traffic	Middle of site	20	-	0	0	-	-	3311	4806	-	3311	4806
Site Traffic	East of site	20	-	0	0	-	-	563	563	-	562	562
Site Access	Eastbound	20	-	0	0	-	-	525	762	-	525	762
	Westbound	20	-	0	0	-	-	520	755	-	520	755

Table 7.1 – Traffic data used in assessment – with site access

Link	Direction	Speed (kph)	HGV (%)			AADT						
			Without	With d'ment	With PFDA	2007	2012			2017		
						Base	Without	With d'ment	With PFDA	Without	With d'ment	With PFDA
Titnore Lane	Northbound	45	2%	2%	2%	5158	5622	5850	5941	6137	6366	6457
	Southbound	43	2%	2%	1%	5515	6012	6240	6331	6563	6792	6883
Titnore Way	Eastbound	32	1%	1%	1%	2286	2492	3011	3219	2721	3240	3448
	Westbound	29	2%	2%	2%	2098	2287	2806	3013	2497	3016	3223
Fulbeck Ave	Northbound	30	1%	0%	0%	637	694	2131	2706	758	2195	2769
	Southbound	30	2%	1%	1%	726	791	2227	2801	864	2299	2874
Tasman Way	Northbound	30	1%	0%	0%	447	487	1511	1920	532	1555	1965
	Southbound	30	1%	0%	0%	520	567	1590	1999	619	1642	2051
New Road	Eastbound	30	1%	1%	1%	4531	4939	5362	5531	5392	5815	5984
	Westbound	30	1%	1%	1%	4613	5028	5451	5620	5489	5912	6081
A27	Eastbound	70	9%	9%	9%	15061	16416	16416	16416	17772	17772	17772
	Westbound	70	9%	9%	9%	14560	15870	15870	15870	17181	17181	17181
Site Traffic	West of site	20	-	0%	0%	-	-	2873	4022	-	2872	4021
Site Traffic	Middle of site	20	-	0%	0%	-	-	2873	4022	-	2872	4021
Site Traffic	East of site	20	-	0%	0%	-	-	2047	2865	-	2046	2865

Table 7.2 – Traffic data used in assessment – without site access

Impact Assessment - Operational Impact

Nitrogen dioxide

7.6. Table 7.3 shows the predicted NO2 concentrations in 2012 the proposed year of opening for without and with the development, and also for the PFDA.

Receptor	Predicted annual mean NO2 concentration (µg/m3), 2012				
	Baseline	With site access		Without site access	
		With	PFDA	With	PFDA
16 Apsley Way (R1)	13	13	13	13	13
The Farmhouse (R2)	13	13	13	13	13
Flint Cottage (R3)	16	15	15	16	16
Campsite (R4)	13	13	13	13	13
2 Squadron Drive (R5)	13	13	13	13	13
South Lodge (R6)	14	13	13	13	14
20 Hobart Close (R7)	13	13	13	13	13
Proposed Residential Plot 6 (R8)	-	15	15	14	14
Proposed Residential B Plot 2b (R9)	-	13	13	13	13
Proposed School Plot A (R10)	-	13	13	13	13
Proposed Residential Plot 3b (R11)	-	12	12	13	13
Proposed Medical Centre Plot C (R12)	-	12	12	13	13
Proposed Residential Plot 11b (R13)	-	12	12	13	13
PDFA (R14)	-	18	18	18	18

Table 7.3 – Predicted annual average NO_2 concentrations, 2012

7.7. The NO_2 NAQOs and EU limit values are predicted to be achieved at all modelled receptors both with and without the site access.

7.8. Table 7.3 shows that without the site access the NO_2 concentrations are predicted to be higher at Flint Cottage (R3), Proposed Residential Plot 3b (R11), Proposed Medical Centre Plot C (R12) and Proposed Residential Plot 11b (R13) than with the site access. The modelled increase in predicted concentrations at these receptors is less than 0.5µg/m^3, and appears in the table due to the rounding of the data.

7.9. The PFDA has an additional impact on air quality at South Lodge compared to the 2012 with the site access. Concentrations on the PDFA are predicted to be suitable for residential use.

Receptor	Predicted annual mean NO2 concentration (µg/m3), 2017				
	Baseline	With Site Access		Without Site Access	
		With	PFDA	With	PFDA
16 Apsley Way (R1)	14	13	13	13	13
The Farmhouse (R2)	13	12	13	12	13
Flint Cottage (R3)	16	15	15	15	15
Campsite (R4)	14	13	13	13	13
2 Squadron Drive (R5)	13	13	13	12	13
South Lodge (R6)	14	13	13	13	13
20 Hobart Close (R7)	13	12	12	12	12
Proposed Residential Plot 6 (R8)	-	14	14	14	14
Proposed Residential B Plot 2b (R9)	-	12	13	12	12
Proposed School Plot A (R10)	-	12	13	12	12
Proposed Residential Plot 3b (R11)	-	12	12	12	12
Proposed Medical Centre Plot C (R12)	-	12	12	12	12
Proposed Residential Plot 11b (R13)	-	12	12	12	12
PDFA (R14)	-	17	17	17	17

Table 7.4 – Predicted Annual Average NO_2 Concentrations, 2017

7.10. Table 7.4 shows that in 2017 without the site access the NO_2 concentrations are predicted to be lower at 2 Squadron Drive (R5), Proposed Residential B Plot 2b (R9) and Proposed School Plot A (R10). However, these are less than 0.5µg/m^3 and appear in the table due to the rounding of the data.

Particulate Matter

7.11. Tables 7.5 and 7.6 show the predicted PM_{10} concentrations and number of days with a mean concentration above 50µg/m^3 for without and with the development, and also for the PFDA in the year 2012.

Receptor	Predicted annual mean PM10 concentration (µg/m3), 2012				
	Baseline	With Site Access		Without Site Access	
		With	PFDA	With	PFDA
16 Apsley Way (R1)	19	19	19	19	19
The Farmhouse (R2)	19	19	19	19	19
Flint Cottage (R3)	20	20	20	20	20
Campsite (R4)	19	19	19	19	19
2 Squadron Drive (R5)	19	19	19	19	19
South Lodge (R6)	19	19	19	19	19
20 Hobart Close (R7)	19	19	19	19	19
Proposed Residential Plot 6 (R8)	-	19	19	19	19
Proposed Residential B Plot 2b (R9)	-	19	19	19	19
Proposed School Plot A (R10)	-	19	19	19	19
Proposed Residential Plot 3b (R11)	-	19	19	19	19
Proposed Medical Centre Plot C (R12)	-	19	19	19	19
Proposed Residential Plot 11b (R13)	-	19	19	19	19
PDFA (R14)	-	21	21	21	21

Table 7.5 – Predicted annual mean PM10 concentrations, 2012

7.12 Table 7.5 shows that there are no differences in the predicted PM_{10} concentrations with and without the site access to Titnore Lane.

Receptor	Number of days with a mean concentration greater than 50µg/m3, 2012				
	Baseline	With Site Access		Without Site Access	
		With	PFDA	With	PFDA
16 Apsley Way (R1)	2	2	2	2	2
The Farmhouse (R2)	2	2	2	2	2
Flint Cottage (R3)	3	3	3	3	3
Campsite (R4)	2	2	2	2	2
2 Squadron Drive (R5)	2	2	2	2	2
South Lodge (R6)	2	2	2	2	2
20 Hobart Close (R7)	2	2	2	2	2
Proposed Residential Plot 6 (R8)	-	3	3	3	3
Proposed Residential B Plot 2b (R9)	-	2	2	2	2
Proposed School Plot A (R10)	-	2	2	2	2
Proposed Residential Plot 3b (R11)	-	2	2	2	2
Proposed Medical Centre Plot C (R12)	-	2	2	2	2
Proposed Residential Plot 11b (R13)	-	2	2	2	2
PDFA (R14)	-	5	5	5	5

Table 7.6 – Days where the mean concentration is greater than 50 ug/m^2, 2012

7.13. The number of days when the concentrations are predicted to be above 50µg/m3 are the same for with and without the site access to Titnore Lane.

7.14. Tables 7.7 and 7.8 show the predicted PM_{10} concentrations and number of days with a mean concentration above 50µg/m^3 for without and with the development, and also for the PFDA in the year 2017.

Receptor	Predicted annual mean PM10 concentration (µg/m3), 2017				
	Baseline	With Site Access		Without Site Access	
		With	PFDA	With	PFDA
16 Apsley Way (R1)	18	18	18	18	18
The Farmhouse (R2)	17	18	18	19	18
Flint Cottage (R3)	18	19	19	18	19
Campsite (R4)	17	18	18	18	18
2 Squadron Drive (R5)	17	18	18	18	18
South Lodge (R6)	18	18	18	18	18
20 Hobart Close (R7)	17	18	18	18	18
Proposed Residential Plot 6 (R8)	-	19	19	18	18
Proposed Residential B Plot 2b (R9)	-	18	18	18	18
Proposed School Plot A (R10)	-	18	18	18	18
Proposed Residential Plot 3b (R11)	-	18	18	18	18
Proposed Medical Centre Plot C (R12)	-	18	18	18	18
Proposed Residential Plot 11b (R13)	-	18	18	20	18
PDFA (R14)	-	20	20	18	20

Table 7.7 – Days where the mean concentration is greater than 50 ug/m^3, 2017

7.15. Table 7.7 shows that for without the site access there is an increase in the predicted concentrations at the Farmhouse (R2) and Proposed Residential Plot 11b (R13) compared to the with site access. There is a decrease in predicted concentrations at Flint Cottage (R3), Proposed Residential Plot 6 (R8) and the PFDA (R14) without the site access compared to with the site access. These increases and decreases are no more than 0.5µg/m^3 and appear due to rounding.

Receptor	Number of days with a mean concentration greater than 50µg/m3, 2012				
	Baseline	With Site Access		Without Site Access	
		With	PFDA	With	PFDA
16 Apsley Way (R1)	1	2	2	2	2
The Farmhouse (R2)	1	1	1	1	1
Flint Cottage (R3)	2	2	2	2	2
Campsite (R4)	1	1	1	1	1
2 Squadron Drive (R5)	1	1	2	1	1
South Lodge (R6)	1	2	2	2	2
20 Hobart Close (R7)	1	1	1	1	1
Proposed Residential Plot 6 (R8)	-	2	2	2	2
Proposed Residential B Plot 2b (R9)	-	1	2	1	2
Proposed School Plot A (R10)	-	1	2	1	1
Proposed Residential Plot 3b (R11)	-	1	1	1	1
Proposed Medical Centre Plot C (R12)	-	1	1	1	1
Proposed Residential Plot 11b (R13)	-	1	1	1	1
PDFA (R14)	-	3	3	3	3

Table 7.8 – Days where the mean concentration is greater than 50 ug/m^3, 2017

7.16. Table 7.8 shows that for without the site access the number of days where concentrations are above 50µg/m^3 are lower at 2 Squadron Drive (R5) and Proposed School Plot A (R10) than with the site access

7.17. The current PM_{10} NAQOs and EU limit values are predicted to be achieved at all modelled receptors in both 2012 and 2017. The provisional 2010 PM_{10} NAQOs are also predicted to be achieved.

Summary

7.18. NO_2 and PM_{10} concentrations at all modelled receptors in 2012 and 2017 are predicted to achieve the current and provisional NAQOs across the development site and PFDA.

7.19. The differences in predicted concentrations between the with and without site access scenarios are minimal and both will have a negligible impact on air quality.

8 Noise

Introduction

8.1. An assessment of the impact of road traffic noise on noise-sensitive dwellings surrounding the development site has been undertaken as part of the Environmental Statement. In addition to this, an assessment of the two access strategies, with and without the Titnore Lane access, has been undertaken.

Methodology

8.2. The assessment has been carried out using the prediction method within the 'Calculation of Road Traffic Noise' (CRTN); Department of Transport, Welsh Office: 1988. A baseline noise survey was undertaken at the site in April 2007 to validate the calculations. The full results of the survey can be found in the 'Noise Chapter' of the Environmental Statement.

8.3. Predictions of the road traffic noise levels in 2017 'with development' have been calculated for both 'with' and 'without' the Titnore Lane Access. Any change in noise level has been compared to the following significance criteria. An increase in noise level is described as adverse and a decrease in noise level as beneficial.

Severe:	A change in noise levels of greater than 15 dB;
Major:	A change in noise levels of 10 dB and 15 dB;
Moderate:	A change in noise levels of between 5 and 10 dB;
Minor:	A change in noise levels of between 3 and 5 dB;
Not Significant:	A change of between +3dB and -3dB.

Potential impacts

8.4. An assessment of the change in noise levels on Tasman Way and Fulbeck Avenue 'with' and 'without' the Titnore Lane access has been performed to determine the impact on noise levels at these access points. Table 8.1 gives the predicted noise levels 'with' and 'without' the Titnore Lane access and the associated increase in noise levels that will be experienced.

Location number	Location	'With' Titnore Lane Junction	'Without' Titnore Lane Junction	Change in Noise Level
		(dB $L_{Aeq\ 16\ hr}$)		(dB)
1	Tasman Way	51	56	5
2	Fulbeck Avenue	60	59	-1

Table 8.1 – Predicted Road Traffic Noise Levels and Changes

8.5. A 1dB decrease in noise at Fulbeck Avenue is of 'no significance' when compared to the significance criteria. The 5dB increase in noise at Tasman Way is on the border of 'minor adverse impact' and 'moderate adverse impact'.

Residual Effects

8.6. The residual noise impacts due to the removal of the Titnore Lane access would result in a decrease of noise at the Fulbeck Avenue access and an increase in noise at the Tasman Way access. The decrease on Fulbeck Avenue would be of 'no significance' and the increase on Tasman Way would be on the border of 'minor adverse impact' and 'moderate adverse impact'.