6. Earthworks Verification

INTRODUCTION

6.1 Verification works were required in PDZ15 where fill materials have been placed to complete the Human Health Separation Layer. Brick paving from the Olympic mode was removed and 100 mm of granular imported Type 1 fill and the marker layer was retained. The scope of the Transformation works was to place 300 mm thickness of material from the former Olympic warm-up track area above the retained material followed by 200mm of imported topsoil, which was subsequently seeded.

6.2 No unexpected ground conditions or ground suspected to be contaminated by visual and olfactory means were encountered during the earthworks.

6.3 The following methodology for determining the frequency of verification samples per cubic metre of material was outlined in the Remediation Impact Assessment / Method Statement and issued ahead of the works commencing to the London Borough of Hackney (LBH).

VERIFICATION METHODOLOGY

Sub-grade

6.4 On completion of excavations the base (sub-grade) will be visually inspected for:

- Potential pathways to the lower strata such as the presence or absence of any boreholes / wells etc. which if encountered shall be reported to the Project Manager and decommissioned in accordance with the appropriate guidance.

Fill Materials

6.5 The thicknesses of HHSL deposited on PDZ15 was undertaken using a mechanical excavator fitted with ground positioning survey (GPS) equipment and a laser guided blade. This instrumentation enabled the operator to spread the imported fill materials accurately to a specific thickness. The GPS equipment did not record the final levels of each layer of deposited material and Nuttall were not contracted to collate the level data. However, Nuttalls confirm that the levels conform to those specified in Section E3.1 of the Capita Symonds Ltd "Remediation Impact Assessment and Method Statement for Planning Delivery Zone 15 (REF 6).

6.6 Sampling and testing of the material to be placed in PDZ15 is outlined in Appendix I of the PDZ15 RIAMS during QEOP works will be conducted as follows:

- **Imported topsoil / sand**: Given the volume of available data associated with the proposed imported topsoil that demonstrate compliance with the SSAC, this will be sampled in situ at a frequency of 1 sample per 1,000 m^3 as discussed and justified within the import of fill submission included in Appendix H of the PDZ15 RIAMS document.
- **Material Former warm-up track material**: A significant sample dataset exists for the warm-up track material to be utilised within PDZ15. This additional data is presented and evaluated in Appendix E of the Capita Symonds Ltd "Remediation Impact Assessment and Method Statement for Planning Delivery Zone 15 (REF 6). Table 6.1 outlines the number of samples that have already been taken and the additional number of samples that are required to raise the **sampling** frequency to the PPDT frequency of 1 sample per 200 m^3 of material. The sampling frequencies indicated in Table 6.1 were designed considering the estimated volume of fill being approximately 30,000 m^3.

TABLE 6.1: WARM-UP TRACK MATERIAL SAMPLING AND TESTING FREQUENCIES

Category	*No. samples [soil totals]*	*No. samples [leachate]*
In situ samples from warm-up track	41	20
Stockpile samples prior to placement at warm-up track	22	22

Category	*No. samples [soil totals]*	*No. samples [leachate]*
Sample frequency to date	1 sample per 476 m^3	1 sample per 714 m^3
PDT required sample frequency for final validation	1 sample per 200 m^3	1 sample per 1,000 m^3
No. of additional samples required to meet minimum PDT required sampling frequency	87	0
Proposed in situ sampling frequency during placement in PDZ15	1 sample per 345 m^3	1 sample per 2,000 m^3 [reassurance]

6.7 Based on the review included in Table 6.1, in situ reassurance sampling and testing was undertaken during placement of warm-up track material in PDZ15 on the following basis:

- Minimum sampling frequency of 1 per 345 m^3 [soil totals] and 1 per 2,000 m^3 [leachate] based on a proposed import of 30,000 m^3;
- Samples were evenly distributed geographically to provide adequate spatial coverage in the earthworks area; and
- Testing suite for samples will include all contaminants with an applicable SSAC.

6.8 A visual inspection of all loads was conducted by personnel who had been briefed on what to look out for in terms of visual or olfactory indicators of potential contamination. Movements of material between the warm-up track and PDZ15 were tracked. The warm-up track material was segregated from other materials from excavation at the warm-up track to final placement in PDZ15.

GENERAL FILL

6.9 No general fill was placed as part of the Transformation Works in PDZ15 East Marsh.

Non compliances

6.10 Where any assessment of existing data and/or reassurance testing detects non compliances against relevant SSACs then statistical assessment shall be undertaken. Should outliers be identified then numerical risk assessment shall be undertaken in accordance with guidance current at the time of assessment in order to identify if the non-compliances form a potential risk.

6.11 Should numerical risk assessment identify a potential risk then excavation of the non-compliant soils shall be undertaken. The excavation shall be advanced in increments of 1 m depth and sampling undertaken as follows:

- 1 soil sample per 10 m length of sidewall for each 1 m depth; and,
- 2 soil samples from the base of the excavation 10 m in diameter (no base samples are required if the pathway for the risk driver for the contaminant of concern is human health dermal contact/ingestion).

6.12 At each increment of excavation, verification sampling shall be repeated for the CoCs identified as exceedance and assessed against the relevant SSAC. This process is to be repeated until the CoCs are compliant.

PDZ15 VERIFICATION OF TRANSFORMATION WORKS

Assessment Criteria

6.13 Appendix E 'PDZ15: Updated Position Paper' of 'Remediation Impact Assessment and Method Statement for Planning Delivery Zone 15 East Marsh Playing Fields' specifies the use of the following criteria for materials placed within PDZ15.

- Human Health: CZ6c SSRS (ref: 0241-ENW-NPK-CM-REP-0001); and,
- Controlled Waters: CZ7a SSRS (ref: REP-WYG-CM-CZ7a-XXX-XXX-E-4003).

SAMPLING AND ANALYTICAL TESTING

6.14 A summary of the verification samples collected for PDZ15 is listed below and included in Table 6.2 below:

- A total of 52,144 m^3 of material was placed AML in PDZ15 (NC20). This consisted of a 33,600 m^3 of HHSL sub-soil material and 18,545 m^3 of topsoil. The sources of this material included:
  - 35,520 m^3 sourced from PDZ3 (NC29).
  - 16,625 m^3 imported from outside the Olympic Park.
- A total of 77.8m^3 of topsoil and subsoil was used to infill the tree pits using material sourced from on the Olympic Park. A further 419.5 m3 of topsoil and subsoil material was imported from outside the Olympic Park
- A total of 250m^3 of topsoil and subsoil was used to construct the MTB trail. 120 m^3 of this material was sourced from the Olympic Park and 130 m^3 from outside the Olympic Park.
- A total of 36 soil samples and 12 soil leachability tests (in addition to those described in Table 6.1) were performed from the stockpile of this material at the WUT (PDZ3; NC29),
- A total of 112 samples were taken to validate the material once deposited which includes 3 No. targeted samples of placed material which originated from excavation works in NC25. When these 112 No verification samples are combined with the 63 samples taken as part of the Enabling Works Validation and 36 samples of the material from the warm-up track (total 211 samples), this corresponds to a sampling frequency of 1 sample per 169 m^3 of fill. This meets the required 1 sample per 200 m^3 of fill for subsoil.
- 20 samples were also used to validate the imported topsoil (British Sugar Topsoil) before deposition (17,043 m^3) which is required on a 1 sample per 1,000 m^3 volume;
- A total of 20 samples of the British Sugar topsoil; and
- A total of 3 samples taken of the Sharp sand used for backfill in the drainage runs and incorporated in to the top 25 mm of topsoil to increase the pitches resistance to wear and tear.

Table 6.2: Summary of PDZ15 Sampling Frequency

Source of Material	*Total Volume*	*Number of Samples*	*Sample Frequency*	*Sample Frequency Requirement*
Enabling Works (Existing Data)	35,718m^3	63	1 sample per 169m^3 of material	1 sample per 200m^3
WUT stockpile		36		
In-situ post-placement sampling		112		
Imported Topsoil (British Sugar) & Imported Sharp Sand	17,173m^3	23	1 sample 746m^3 of material	1 sample per 1,000m^3

6.15 Screening tables of the above soils and leachate results are provided in Appendix F and Laboratory Testing Certificates are provided in Appendix G.

ASSESSMENT

MATERIAL

6.16 An assessment of the chemical quality of fill materials was conducted on existing chemical data for the AML material sourced from NC29 (CZ3b) prior to placement across PDZ15 (NC20) This assessment utilised existing validation information from the Enabling Works and compared the data against applicable SSACs relevant to PDZ15 to determine whether the material meets the criteria in the PDZ15 RIAMS (Appendix F). A total of 63 No. samples from NC29 were included in the assessment, which equated to a sampling frequency of 1 sample per 526 m^3 of material based on total fill of 33,174m^3.

6.17 The assessment identified three exceedances of asbestos above the human health SSAC (0.0001%w/w) and one exceedance of Benzo(a)pyrene above the human health SSAC (3.38mg/kg). A decision was taken to exclude these hotspots from the material to be transported to PDZ15. Subsequent to excluding the hotspots, the assessment confirmed that the material sourced from NC29 was compliant with the applicable SSACs for PDZ15.

6.18 A total of 120 m^3 was excavated from works creating a footpath in NC25. The excavated material was stockpiled locally onsite pending the results of the laboratory analysis of two validation samples. The laboratory analysis did not measure chemical parameters above the human health SSAC for PDZ15 indicating this material could be reused as fill along the western NC20 site boundary.

6.19 A total of 135 verification soil samples were collected on NC20. This included of 112 samples of the subsoil imported from NC29, 20 samples of the British Sugar topsoil and 3 samples taken of the Sharp sand used for backfill in the drainage runs and incorporated in to the top 25 mm of topsoil to increase the pitches resistance to wear and tear. A summary of the identified human health and controlled waters exceedances of SSACs from sub-soil samples are provided in Table 6.3 below. The laboratory analysis of the twenty-three samples of topsoil and sharp sand did not measure exceedances of the SSACs and are therefore further evaluation of this material is not required.

6.20 The results of the laboratory analysis of material from the warm-up track material during enabling works included 63 soil samples and 42 soil leachability tests. This additional data is presented and evaluated in Appendix E of the Capita Symonds Ltd "Remediation Impact Assessment and Method Statement for Planning Delivery Zone 15 (REF 6).

Table 6.3 Summary of Human Health Soil Exceedances of Subsoil/

Contaminant of Concern	SSAC (mg/kg)	Samples Tested	Locations with Exceedances of SSAC	Exceedance Location	Concentration Exceeding SSAC (mg/kg)	Average Concentration from 112 Samples (mg/kg)
Arsenic	97.2	112	1	cslt-15-31	150	15.88
Lead	616	112	7	cslt-15-12	830	217.40
				cslt-15-46	660	
				cslt-15-87	740	
				cslt-15-93	1,000	
				cslt-15-94	810	
				cslt-15-95	1100	
				cslt-25-113	1200	
Benzo(a)anthracene	19.7	112	1	cslt-17-105	110	2.04
Chrysene	29.5	112	1	cslt-17-105	130	2.46
Benzo(b)fluoranthene	23.4	112	1	cslt-17-105	81	2.04
Benzo(k)fluoranthene	34.44	112	1	cslt-17-105	71	1.63
Benzo(a)pyrene	3.38	112	5	cstl-15-32	4.8	1.92

Contaminant of Concern	SSAC (mg/kg)	Samples Tested	Locations with Exceedances of SSAC	Exceedance Location	Concentration Exceeding SSAC (mg/kg)	Average Concentration from 112 Samples (mg/kg)
				cstl-15-95	3.5	
				cslt-15-99	3.5	
				cslt-17-105	81	
				cslt-25-113	3.9	
Dibenzo(ah)anthracene	3.53	112	1	cslt-15-105	13	0.39
Indeno(1,2,3-cd)pyrene)	13.9	112	1	cslt-15-105	58	1.35

6.21 The detailed results of the human health evaluation of the subsoil material is included as Table F2 (Appendix F). The summary table above indicates that nine chemical parameters were measured at concentrations above the human health SSAC in a limited number of samples. Although these exceedances were measured, the average concentrations of these nine parameters in the overall dataset of 112 samples is well below the human health SSACs.

6.22 Arsenic was measured at a concentration above the human health SSAC in 1 out of 112 samples tested. This single exceedance (150mg/kg) is less than double the human health SSAC (97.2mg/kg). Furthermore, the average arsenic concentration from the dataset (15.88mg/kg) is well below the human health SSAC.

6.23 Lead was measured at a concentration above the human health SSAC in 7 out of 112 samples tested. The measured exceedances ranged between 660mg/kg and 1,200mg/kg and are less than double the human health SSAC (616mg/kg). Furthermore, the average lead concentration from the dataset (217.4mg/kg) is well below the human health SSAC.

6.24 The laboratory analysis measured seven PAH compounds in one single sample (Ref cslt-15-105; benzo(a)anthracene, chrysene, benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, dibenzo(a,h)anthracene and Indeno(1,2,3-cd)pyrene). At the time of sampling this sample was described as 'sandy, clay loam, frequent gravel, asphalt and brick'. The presence of asphalt in this sample may have resulted in the elevated concentrations of PAHs measured in the laboratory analysis of this sample. With the exception of benzo(a)pyrene, no other PAH parameters were measured at concentrations above the human health SSACs. Furthermore, the average concentrations of these parameters in the full dataset of 112 samples were well below the human health SSACs.

6.25 Five samples measured benzo(a)pyrene at concentrations exceeding the SSAC. The measured benzo(a)pyrene concentration from four of the five samples were between 3.5mg/kg and 4.8mg/kg (compared to a SSAC of 3.38mg/kg) and represent marginal exceedances. However, one sample (referenced cslt-17-105) measured benzo(a)pyrene at 81mg/kg and approximately 24 times the SSAC. As described above, this sample also included elevated concentrations of six other PAHs and can potentially be attributed to the presence of asphalt within the sample.

OUTLIERS & SIGNIFICANCE TESTS

6.26 ProUCL 4.1 statistical software has been used to evaluate the results for the nine parameters listed in Table 6.4 from the 112 insitu-post placement samples. The statistical program has indicated that the chemical parameters listed in Table 6.3 from three samples represent potential outliers in the dataset. It is noted that the seven PAH parameters that represent outliers are from the same sample, which is described as containing asphalt.

Table 6.4: Outlier Tests Performed on In-situ post-placement samples

Sample Name	Parameter	Potential Outlier Concentration
CSLT-15-31	Arsenic	150 mg/kg
CSTL-25-113	Lead	1200 mg/kg
CSTL-17-105	Benzo(a)anthracene	110 mg/kg

	Chrysene	130 mg/kg
	Benzo(b)fluoranthene	81 mg/kg
	Benzo(k)fluoranthene	71 mg/kg
	Benzo(a)pyrene	81 mg/kg
	Dibenzo(a,h)anthracene	13 mg/kg
	Indenol(1,2,3-cd)pyrene	58 mg/kg

6.27 The ProUCL software has also been used to evaluate the upper 95% confidence limits (UCL95) in the data. The UCL evaluation results are presented in Table 6.5 and indicate that the calculated UCL95 is below the HH SSAC.

6.28 The calculated UCL95 for benzo(a)pyrene (3.383 mg/kg; including the identified outlier) is the same as the HH SSAC (3.38mg/kg). However, if the single benzo(a)pyrene outlier is removed from the dataset the UCL95 is reduced to 1.33mg/kg and is below the HH SSAC.

Table 6.5: Calculated UCL95 Data

Parameter	UCL Calculation Methodology	UCL95 (mg/kg)	UCL95 with outlier removed (mg/kg)	PDZ15 HH SSAC (mg/kg)
Arsenic	95% Students-t UCL	18.16	15.77	97.2
Lead	95% Chebyshev UCL	300.6	282.9	616
Benzo(a)anthracene	95% Chebyshev UCL	6.405	1.525	19.7
Chrysene	95% Chebyshev UCL	7.488	1.71	29.5
Benzo(b)fluoranthene	95% Chebyshev UCL	5.162	1.727	23.4
Benzo(k)fluoranthene	95% Chebyshev UCL	4.364	1.112	34.44
Benzo(a)pyrene	95% Chebyshev UCL	3.383	1.33	3.38
Dibenzo(a,h)anthracene	95% KM (BCA) UCL	0.627	0.309	3.53
Indenol(1,2,3-cd)pyrene	95% KM (BCA) UCL	2.398	0.941	13.9

6.29 The chemical parameters that have been measured at concentrations above the SSAC are not considered to represent an unacceptable risk to human health in NC20 based on the following:

- No exceedances were measured in the 16,600m^3 of topsoil material and sand imported from outside the Olympic Park.
- Exceedances of arsenic (1 out of 112 samples) and lead (7 out of 112 samples) were less than double the SSAC and the average concentration of these two metals were well below the human health SSAC. Furthermore, the exceedances are not considered statistical outliers and the calculated UCL95 is below the HH SSACs;
- Exceedances of six PAH parameters (excluding benzo(a)pyrene) were measured above the human health SSAC in 1 out of 112 samples. The average concentrations of these six PAHs in the dataset were well below the human health SSAC. The results of the six PAHs in this single sample are considered as outliers and this is considered due to the presence of asphalt in this sample, which is the likely source of these PAH measurements. The ULC95 for these PAHs is below the HH SSAC; and
- Exceedances of benzo(a)pyrene were measured above the human health SSAC in 5 out of 112 samples. The average concentration of benzo(a)pyrene is well below the human health SSAC. The concentrations measured in four of the samples were less than double the SSAC. One sample is elevated above the general dataset, but was measured from a sample containing asphalt. This sample is considered to represent an outlier in the dataset. The inclusion of this result in the dataset results in the UCL95 being the same value as the HH SSAC. However, when removed the UCL95 is below the SSAC.

6.30 The soil results have also been compared to SSAC protective of groundwater (see Section 6.13). The comparison of the soils data against these SSAC indicate that the soil has the potential to leach chemical parameters at concentrations that represent a risk to controlled water in the Chalk aquifer. Table 6.6 summarises the soil concentrations that exceed the Controlled Water SSAC.

Table 6.6 Summary of Controlled Water Soil Exceedances

Contaminant of Concern	Controlled Water (soil) SSAC	Samples Tested	Locations with Exceedances of GAC	Range of Results Exceeding GAC	Average Concentration
Arsenic	20 mg/kg	166	35	21 to 150 mg/kg	16.6 mg/kg
Cadmium	1 mg/kg	166	3	1.1 to 1.74 mg/kg	0.23 mg/kg
Nickel	50 mg/kg	166	1	72 mg/kg	20.5 mg/kg
Lead	450 mg/kg	166	10	470 to 1,200 mg/kg	180.74 mg/kg
Acenaphthylene	1 mg/kg	166	3	1.2 to 8.6 mg/kg	0.26 mg/kg
Naphthalene	5.6 mg/kg	166	1	58 mg/kg	0.63 mg/kg
Acenaphthene	12 mg/kg	166	2	13 & 37 mg/kg	0.64 mg/kg
Fluoranthene	95 mg/kg	166	1	280 mg/kg	3.63 mg/kg
Benzo[a]anthracene	72 mg/kg	166	1	110 mg/kg	1.6 mg/kg
Chrysene	32 mg/kg	166	1	130 mg/kg	1.79 mg/kg
Benzo[b]fluoranthene	16 mg/kg	166	1	81 mg/kg	1.54 mg/kg
Benzo[k]fluoranthene	16 mg/kg	166	1	71 mg/kg	1.77 mg/kg
Benzo(a)pyrene	1.3 mg/kg	166	33	1.4 to 81 mg/kg	1.44 mg/kg
Dibenzo[a,h]anthracene	1.3 mg/kg	166	1	13 mg/kg	0.3 mg/kg
Indeno[1,2,3-cd]pyrene	16 mg/kg	166	1	58 mg/kg	1.01 mg/kg

6.31 The evaluation has indicated four metal and eleven PAH parameters to exceed the soil SSACs protective of controlled water. The chemical parameters that have been measured at concentrations above the SSAC are not considered to represent an unacceptable risk to Controlled Water in NC20 based on the following:

- With the exception of benzo(a)pyrene, the average concentrations from the 112 samples from across the site are well below the SSACs. The average benzo(a)pyrene concentration (1.44 mg/kg) only marginally exceeds the SSAC (1.3 mg/kg).
- Eight of the PAH parameters that exceed the SSAC are from one sample in which asphalt fragments were observed.
- None of the averaged soil leachability tests in Section 6.30 exceed the controlled water SSAC for groundwater.
- The SSAC used were developed for PDZ7 and where the Chalk is not confined by Woolwich & Reading Beds. Therefore, the use of these SSAC criteria for PDZ15 is considered conservative.

6.32 The evaluation of the soil leachability results from thirteen samples of imported topsoil and sharp sand is included as Table F5 (Appendix F). This evaluation did not measure concentrations that exceeded the controlled water SSAC for PDZ15. No further assessment of the imported topsoil and sharp sand is considered necessary.

6.33 The detailed assessment of twenty laboratory soil leachability results from site sourced subsoil samples against controlled water SSACs is provided in Table F3 (Appendix F). A summary of the identified controlled waters exceedances of SSACs from the forty-four soil leachability tests from the material deposited in PDZ15 is included in Table 6.4 below. The evaluation of the soil leachability results indicate only moderate exceedances of the CZ7a controlled water criteria. Furthermore, the average concentration calculated from the forty-four samples are at or below the SSAC.

Table 6.7 Summary of Soil Leachability Exceedances of Controled Water

Receptor	Contaminant of Concern	SSAC	Samples Tested	Locations with Exceedances of GAC	Exceedance Location	Concentration Exceeding SSAC	Average Concentration
Controlled waters (Leachate)	Arsenic	0.03 µg/l	44	1	cslt-15-22	0.075 µg/l	0.008 µg/l
	Lead	0.09 µg/l	44	1	cslt-15-22	0.38 µg/l	0.01 mg/l
	Pyrene	0.008 µg/l	44	2	cslt-15-02	0.01 µg/l	0.0004 µg/l
					cslt-15-04	0.011 µg/l	
	Benzo(b)fluoranthene	0.002 µg/l	44	7	cslt-15-02	0.0065 µg/l	0.0007 µg/l
					cslt-15-33	0.0023 µg/l	
					cslt-15-43	0.003 µg/l	
					cslt-15-73	0.004 µg/l	
					cslt-15-81	0.00121 µg/l	
					cslt-15-22	0.0054 µg/l	
					cslt-15-84	0.0033 µg/l	
	Benzo(a)pyrene	0.001 µg/l	44	7	cslt-15-02	0.0068 µg/l	0.0007 µg/l
					cslt-15-33	0.0037 µg/l	
					cslt-15-43	0.006 µg/l	
					cslt-15-73	0.004 µg/l	
					cslt-15-81	0.0014 µg/l	
					cslt-15-22	0.0048 µg/l	
					cslt-15-84	0.0018 µg/l	
	Dibenzo(a,h)anthracene	0.0001 µg/l	44	5	cslt-15-02	0.0003 µg/l	0.0001 µg/l
					cslt-15-73	0.0002 µg/l	
					cslt-15-81	0.0004 µg/l	
					cslt-15-22	0.0012 µg/l	
					cslt-15-84	0.0004 µg/l	

FURTHER CONTROLLED WATER ASSESSMENT

6.34 The above exceedances of the CZ7a controlled water criteria have been further assessed using SSACs developed by Atkins in their position paper dated January 2011. Atkins undertook a similar screening exercise using the CZ7a values and followed it up by deriving site specific values where exceedances occurred from the initial screen. Atkins derived SSACs for all of the leachate PAH compounds listed in Table 6.5 below.

6.35 The Atkins Position Paper was submitted to the PPDT and approved as part of the QEOP Enabling Works. The assessment is based on the DQRA for the vertical pathway in CZ7a and includes the additional lateral migration from PDZ15 to CZ7a using the Environment Agency's remediation targets worksheet (P20) to model lateral contaminant transport in the RTD groundwater. Atkins raised the following key points in the relation to the modelling approach for PDZ 15 and all these points are still relevant to these verification works:

- use of CZ7a groundwater/leachate Atkins 2011 SSAC as target values for the P20 worksheets;
- plume width at source was considered to be equal to the full width of the site, due to the relatively low sampling density;
- pathway length is considered to be from the centre of the site to a point on the down hydraulic gradient site boundary in the direction of flow;
- the derived Atkins 2011 SSAC are applicable to River Terrace Deposits groundwater in PDZ15 and also to provide a conservative screen for leachate from overlying soils (model does not account for dilution of leachate);
- literature values for contaminant half-lives and partition coefficients were applied within the models;
- "steady-state" conditions were modelled by application of the maximum possible time since contamination entered groundwater; the presence or absence of a detectable concentration at the site boundary (i.e. interface with the dry zone, not the full distance to the receptor) was also noted; and
- P20 models were only set up for COC identified in the GQRA as requiring further assessment.

6.36 The initial exceedances of the C27a controlled water SSACs presented in Table 6.4 have been further evaluated by comparison to the SSAC values derived by Atkins[REF1]. The results of the comparison are presented in Table 6.8 below.

Table 6.8 Comparison of Controlled Water Soil Exceedances in Subsoil Against Atkins Derived SSACs

Receptor	Contaminant of Concern	Atkins 2011 SSAC	Subsoil Samples Tested	Locations with Exceedances of SSAC	Max Concentration
Controlled waters (Leachate)	Arsenic	273 µg/l	20	0	0.075 µg/l
	Lead	593 µg/l	20	0	0.38 µg/l
	Pyrene	12.9 µg/l	20	0	0.011 µg/l
	Benzo(b)fluoranthene	14 µg/l	20	0	0.0065 µg/l
	Benzo(a)pyrene	7 µg/l	20	0	0.068 µg/l
	Dibenzo(a,h)anthracene	0.7 µg/l	20	0	0.0012 µg/l

6.37 The evaluation has indicated that the maximum measured concentrations from the soil leachability tests performed on samples of subsoil are significantly below the SSAC developed by Atkins. The Atkins SSACs are based on modelled travel times of the chemical parameters from the centre to the PDZ to the PDZ boundary. Therefore, although exceedances of the C27a controlled water SSACs (Table 6.4) have occurred for two metal and four PAH parameters, the concentrations are not of sufficient magnitude to represent an unacceptable risk at the site boundary. The reported leachate concentrations are therefore not considered to present an unacceptable risk to the chalk aquifer.

Summary of Verification works

6.38 Verification works have been completed in accordance with the RIAMS, where non compliance samples were encountered supplementary assessment has been undertaken to determine whether the level of risk is acceptable for both future site users and controlled waters.

6.39 This assessment has not measured concentrations of chemical parameters that represent an unacceptable risk to human health or controlled water based on the intended use of the site as sports pitches. Therefore, supplementary remediation works are not considered necessary for PDZ15.

Verification of Outstanding Actions and Restrictions

6.40 There are no outstanding actions or restrictions associated with the Transformational Works undertaken by Nuttalls.