MOTT MACDONALD

Northumbrian Water PR24 Benchmarking

Climate Change Backwash

Project:	Northumbrian Water PR24 Benchmarking		
Prepared by:	Rosie Clough	**Date:**	19/08/2024
Approved by:	Steve Dobson	**Checked by:**	Alex Hoggins
Subject:	Climate Change Backwash		

1 Introduction

The six projects for climate change backwash produced as part of the PR24 costing process have been benchmarked against comparable water and wastewater companies. In each case, we have only benchmarked scope items where it is possible to draw a comparison with equivalent models from other water company data sets. The projects that have been benchmarked can be seen in **Table 1.1**.

Table 1.1: Benchmarked Projects

Project Ref	Project Name
01	Broken Scar
02	Fontburn
03	Hanningfield
04	Langford
05	Layer
06	Mosswood

Source: Mott MacDonald

The maturity level of the project definition deliverables has been set at an AACE Class 3 level of estimate confidence. The Mott MacDonald Cost Intelligence Team has assessed the confidence range at the 25th and 75th percentiles.

To improve upon this, further general project data is required, as well as design, and the optimum construction option selected to be progressed, at which point an estimate of higher confidence may be produced.

The lower interval is provided to manage stakeholder expectations, as projects rarely significantly reduce in cost because additional threats are identified and incur mitigation costs as the project progresses.

This report discusses the estimating methodology adopted to develop a CAPEX (Capital Expenditure) estimate and the main assumptions used. It presents indicative costs for all aspects of scope highlighted within the Total Cost Summary based upon information received from the project team.

Please note that the confidence range is based upon the current scope of work and should not be seen as the maximum cost variation pending changes to scope or market conditions. Each revision of the project going forward should be assessed on the design, phasing, constraints, and information present at the time of undertaking the review.

Change to the pricing assumptions could affect the viability of the estimate confidence range. It should also be noted that a detailed risk analysis to determine cost estimate contingency has not been carried out at this stage.

2 Methodology

2.1 Estimating Methodology (Direct Costs)

The scope of work considered within this exercise is based upon the iMod estimates provided. To undertake this exercise, we have used Mott MacDonald internal cost data and models.

The Net Direct Cost is defined as the supply, site installation and construction cost which is directly attributable to the provision of a new capital asset. To normalise the costs, the outputs have been inflated to the agreed-upon price base of **2022 Q2** using the Mott MacDonald Basket of Goods inflation index.

To generate a comparable benchmark for the Direct Works, we used Mott MacDonald's sector cost database calculated using industry cost models that have been aligned to the scope of work for the top-down approach. These models are predominantly at asset and equipment level and have been aligned in accordance with the scope item description where possible. **Table 2.1** shows the coverage and variance of the benchmarked projects.

Table 2.1: Direct Works Coverage

Project Ref	Project Name	Total Scope	Scope Benchmarked	Coverage	Direct Cost Benchmark	Variance
01	Broken Scar	£1,411,756.81	£819,256.81	58.03%	£455,152.18	80.00%
02	Fontburn	£758,333.83	£625,833.83	82.53%	£568,167.93	10.15%
03	Hanningfield	£3,834,022.06	£2,654,022.06	69.22%	£1,879,687.96	41.19%
04	Langford	£1,192,149.86	£1,009,649.86	84.69%	£857,091.23	17.80%
05	Layer	£1,133,075.77	£1,062,955.77	93.81%	£721,014.51	47.43%
06	Mosswood	£2,538,549.35	£1,576,549.35	62.10%	£1,175,335.01	34.14%
		£10,867,887.68	**£7,748,267.68**	**71.30%**	**£5,656,448.81**	**36.98%**

Source: Mott MacDonald

This resulted in models from 6 water companies being included across the benchmarks. Care has been taken when considering the minimum and maximum ranges of the selected benchmark curves to guarantee cost models have only been generated across the appropriate range. This helps to avoid behaviours that can skew the benchmark, such as curves providing inconsistent costs when used outside their applicable range.

The benchmarks have been generated using the Mott MacDonald benchmarking tools to ensure consistency of benchmarking across the scopes and allow for instantaneous normalisation of cost models.

Where possible, costs have then been presented alongside the 25th and 75th percentile confidence upper and lower intervals to give insight as to whether the scope costs fall within a reasonable range. The variance between the scope and benchmark costs have been presented with respect to the benchmark, to support the key findings.

2.2 Client and Contractors Preliminaries (Indirect Costs)

The estimate has been built-up using Net Direct Works, indirect costs and percentage allowance elements which form the Overall Project Total of the estimated costs.

Indirect costs are defined as a cost that cannot be directly allocated but can be apportioned to direct cost centres. The indirect cost elements are based on the estimated durations over the assumed schedule and site activities associated with the direct works as identified.

To develop an understanding of the all-in scope costs, Indirect costs have been applied on top of the Net Direct Works benchmark. Most water companies differ in their indirect costing approach, so Mott MacDonald have incorporated indirect cost data from 6 water companies into a standardised industry average, which have been applied as multipliers to the Net Direct Works. Firstly, we applied a contractor indirect costs multiplier of **1.473** to the Net Direct Works to outline the Tender Total and then we applied a client indirect cost multiplier, a further **0.446** to give us the Project Total.

2.3 Percentage Allowances (Indirect Costs)

Percentage allowances for risk (where applicable) have been calculated against the Project Total cost elements to provide an Overall Project Total cost. To calculate this, we used the High-Level Risk & Estimating Uncertainty Matrix, this produced an overall Risk percentage of **30%**.

3 Benchmarked Estimates – Overall Project Costs

3.1 Benchmark Summary

Direct costs are defined as those incurred on plant, labour, materials and equipment. The AACE offers the following definition – “the cost of installed equipment, material, labour and supervision directly or immediately involved in the physical construction of the permanent facility”.

Table 3.1: Benchmarked Estimates Summary (Including Indirect Costs)

Project Ref	Project Name	Client Cost	Base Cost Benchmark	Lower Interval Benchmark	Upper Interval Benchmark	Variance Cost	Variance %
01	Broken Scar	£4,490,982.80	£2,617,598.79	£2,357,615.25	£2,877,582.32	£1,873,384.01	71.57%
02	Fontburn	£2,313,503.17	£1,750,645.45	£1,523,522.79	£1,977,768.11	£562,857.72	32.15%
03	Hanningfield	£8,626,767.54	£7,644,746.65	£6,637,099.99	£8,652,393.30	£982,020.89	12.85%
04	Langford	£3,312,798.88	£2,597,458.19	£2,100,864.10	£3,094,052.27	£715,340.69	27.54%
05	Layer	£3,181,571.00	£1,976,679.62	£1,588,643.98	£2,364,715.27	£1,204,891.38	60.96%
06	Mosswood	£6,107,599.51	£5,340,212.73	£4,610,332.94	£6,070,092.52	£767,386.78	14.37%
		£28,033,222.90	**£21,927,341.42**	**£18,818,079.05**	**£25,036,603.79**	**£6,105,881.48**	**27.85%**

Source: Mott MacDonald

4 Analysis of Indirect Costs

Analysis of client and contractor indirect costs has been carried out to assess Northumbrian Water against the same comparators as the direct cost benchmarking. Indirect costs include but are not limited to project actions such as design, site setup, professional support and other costs not directly related to the construction aspect of a project.

Currently Northumbrian Water have indirect costs at **93.47%** of the direct costs, **20.60%** higher than the industry benchmark, as seen in **Table 4.1.**

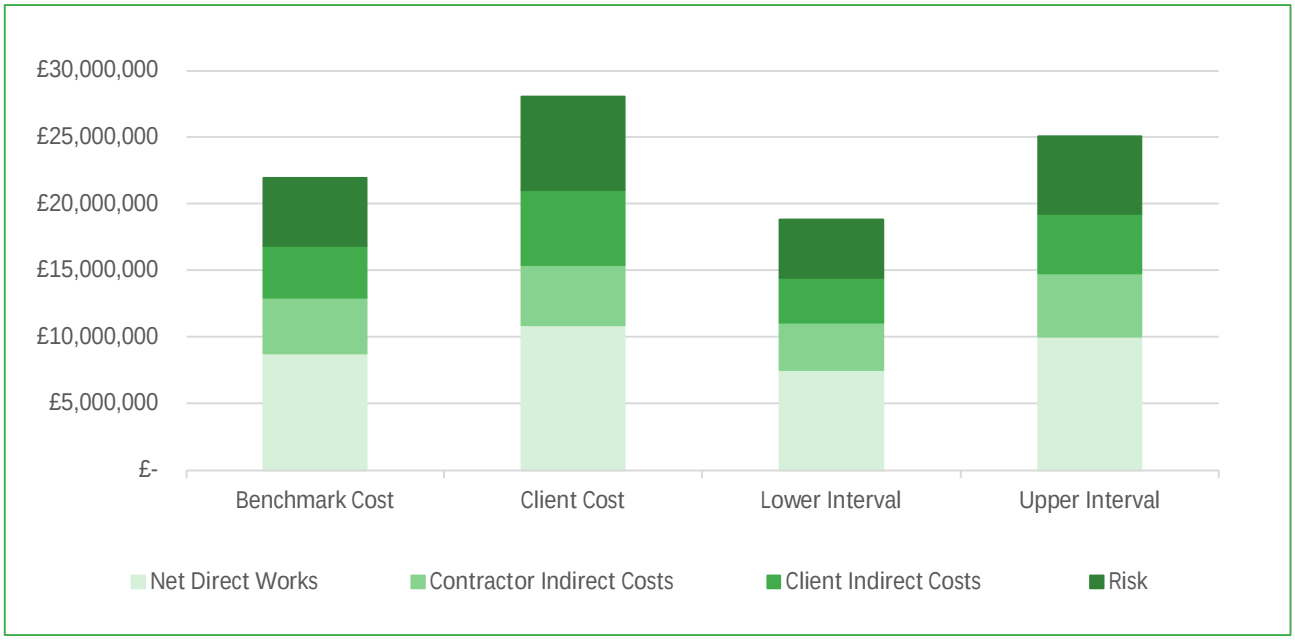
Table 4.1: Indirect Costs Comparison

Project Ref	Project Name	Client Indirect Costs	Benchmark Indirect Costs	Variance %
01	Broken Scar	106.58%	91.90%	36.01%
02	Fontburn	134.67%	91.90%	36.95%
03	Hanningfield	73.08%	91.90%	-0.35%
04	Langford	113.76%	91.90%	29.55%
05	Layer	115.99%	91.90%	44.68%
06	Mosswood	85.07%	91.90%	9.05%
		93.47%	**91.90%**	**20.60%**

Source: Mott MacDonald

The Climate Change Backwash estimate includes direct costs, contractor indirect cost, client indirect costs and risk costs, the total scheme cost is as highlighted in **Chart 4.1.**

Chart 4.1: Total Project Summary



Source: Mott MacDonald

5 Analysis Including Indirect Costs & Risk

To view the projects holistically we have applied the benchmarked indirect multipliers as discussed in **Section 2.2** along with risk **t**o the benchmark direct costs calculated as part of the analysis respectively. This has been carried out for each project and is detailed in the following four sections of this report.

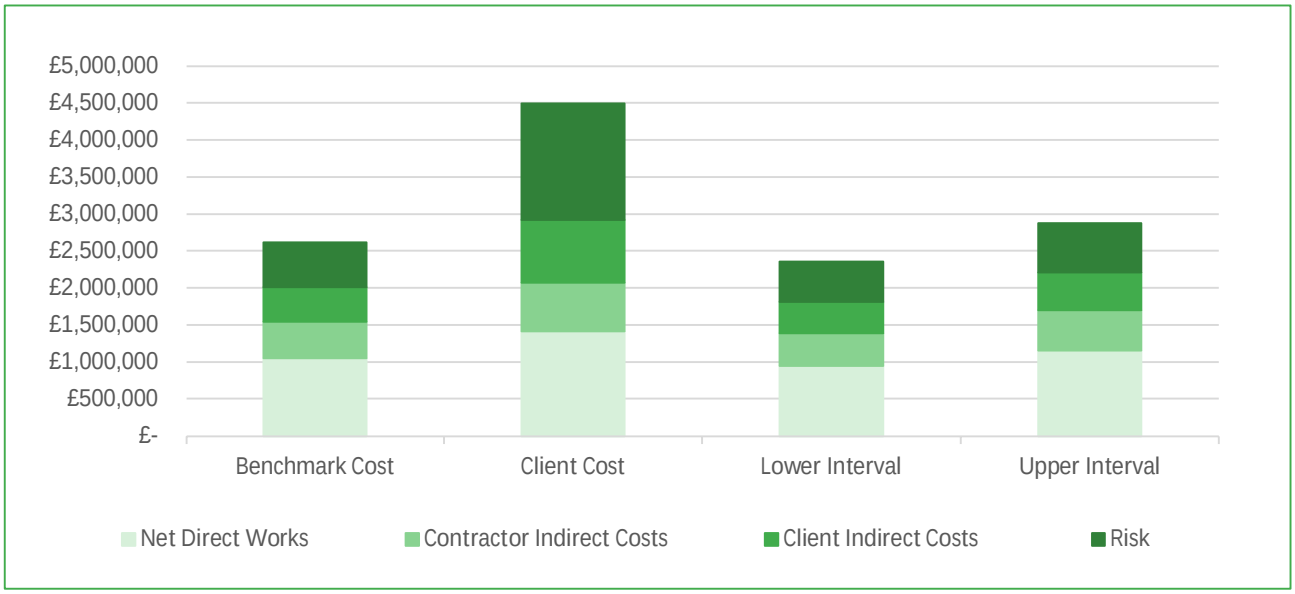
5.1 Broken Scar

Table 5.1: Broken Scar - Breakdown

	Client Cost	Lower Interval	Benchmark Cost	Upper Interval
Net Direct Cost Benchmark	£1,411,756.81	£943,597.92	£1,047,652.18	£1,151,706.44
Contractor Indirect Costs	£661,077.46	£446,321.82	£495,539.48	£544,757.15
Tender Total	£2,072,834.27	£1,389,919.73	£1,543,191.66	£1,696,463.59
Client Indirect Costs	£843,589.73	£420,844.67	£467,252.87	£513,661.07
Project Total	£2,916,424.00	£1,810,764.40	£2,010,444.54	£2,210,124.67
Risk	£1,574,558.80	£546,850.85	£607,154.25	£667,457.65
Overall Project Total	**£4,490,982.80**	**£2,357,615.25**	**£2,617,598.79**	**£2,877,582.32**

Source: Mott MacDonald

Chart 5.1: Broken Scar - Breakdown



Source: Mott MacDonald

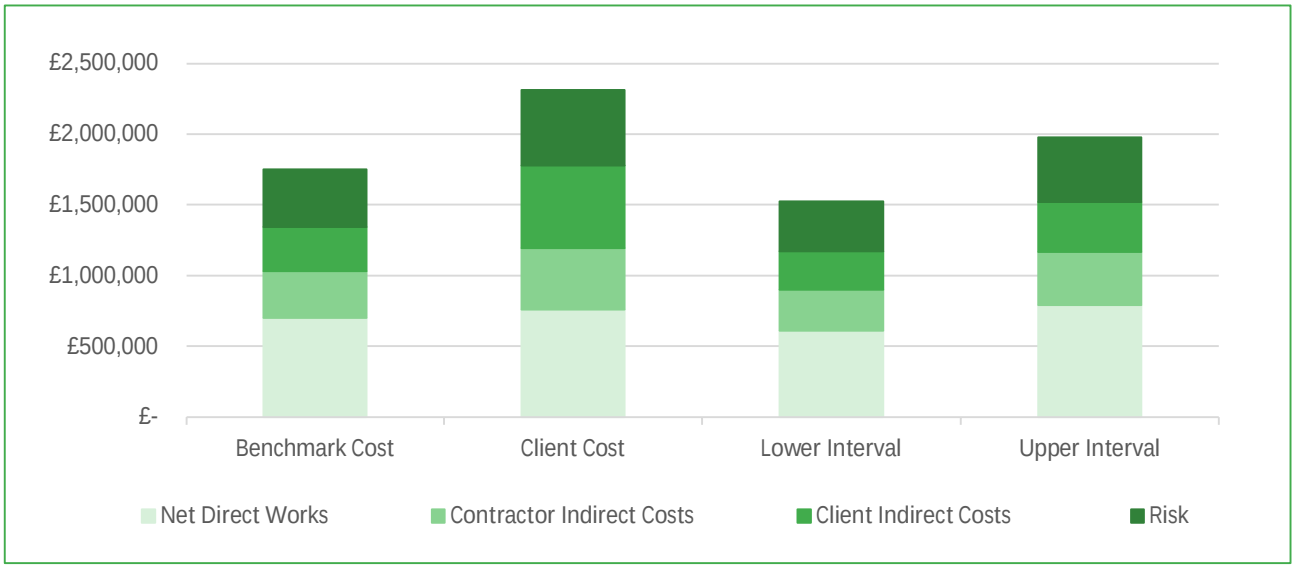
5.2 Fontburn

Table 5.2: Fontburn - Breakdown

	Client Cost	Lower Interval	Benchmark Cost	Upper Interval
Net Direct Cost Benchmark	£758,333.83	£609,765.71	£700,667.93	£791,570.15
Contractor Indirect Costs	£437,965.81	£288,419.18	£331,415.93	£374,412.68
Tender Total	£1,196,299.63	£898,184.89	£1,032,083.86	£1,165,982.84
Client Indirect Costs	£583,318.19	£271,955.51	£312,497.90	£353,040.29
Project Total	£1,779,617.82	£1,170,140.39	£1,344,581.76	£1,519,023.13
Risk	£533,885.35	£353,382.40	£406,063.69	£458,744.98
Overall Project Total	**£2,313,503.17**	**£1,523,522.79**	**£1,750,645.45**	**£1,977,768.11**

Source: Mott MacDonald

Chart 5.2: Fontburn – Breakdown



Source: Mott MacDonald

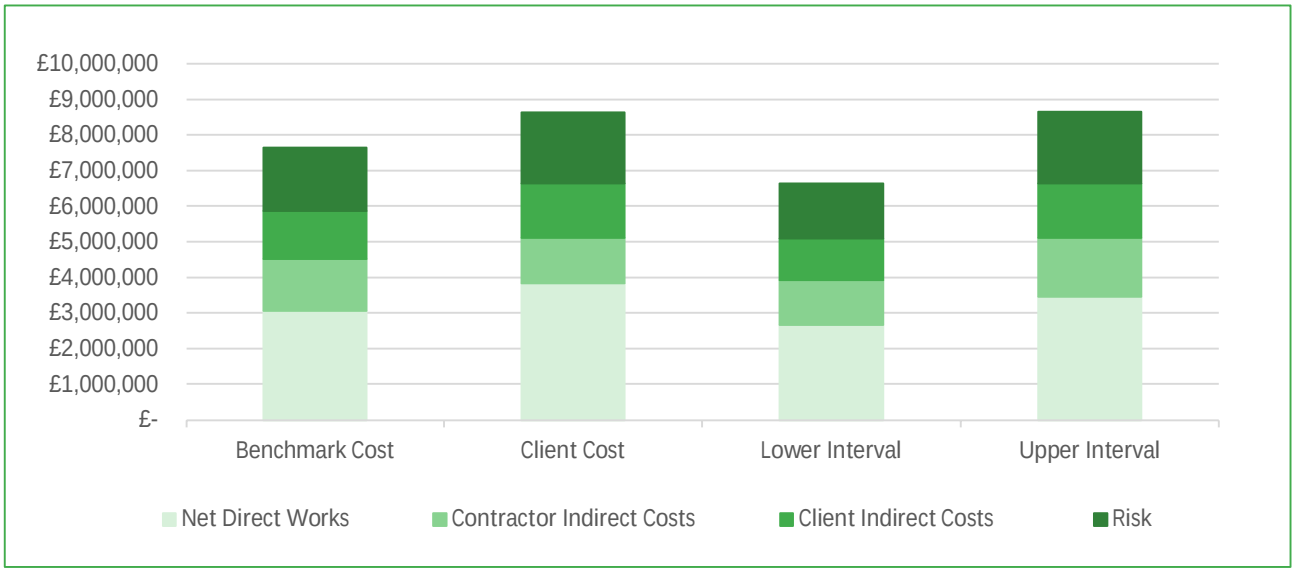
5.3 Hanningfield

Table 5.3: Hanningfield– Breakdown

	Client Cost	Lower Interval	Benchmark Cost	Upper Interval
Net Direct Cost Benchmark	£3,834,022.06	£2,656,393.46	£3,059,687.96	£3,462,982.47
Contractor Indirect Costs	£1,276,051.04	£1,256,474.10	£1,447,232.41	£1,637,990.71
Tender Total	£5,110,073.10	£3,912,867.56	£4,506,920.37	£5,100,973.18
Client Indirect Costs	£1,525,901.94	£1,184,751.48	£1,364,620.83	£1,544,490.18
Project Total	£6,635,975.04	£5,097,619.04	£5,871,541.20	£6,645,463.36
Risk	£1,990,792.50	£1,539,480.95	£1,773,205.44	£2,006,929.94
Overall Project Total	**£8,626,767.54**	**£6,637,099.99**	**£7,644,746.65**	**£8,652,393.30**

Source: Mott MacDonald

Chart 5.4: Hanningfield – Breakdown



Source: Mott MacDonald

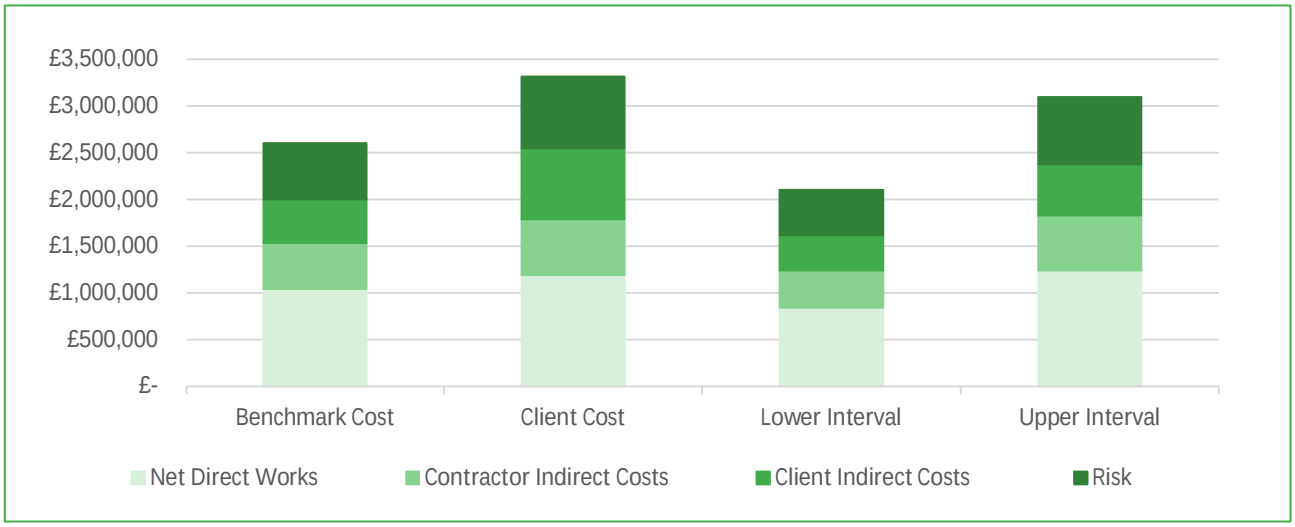
5.4 Langford

Table 5.4: Langford - Breakdown

	Client Cost	Lower Interval	Benchmark Cost	Upper Interval
Net Direct Cost Benchmark	£1,192,149.86	£840,837.36	£1,039,591.23	£1,238,345.09
Contractor Indirect Costs	£591,619.25	£397,716.07	£491,726.65	£585,737.23
Tender Total	£1,783,769.11	£1,238,553.43	£1,531,317.88	£1,824,082.32
Client Indirect Costs	£764,537.72	£375,013.46	£463,657.69	£552,301.91
Project Total	£2,548,306.83	£1,613,566.90	£1,994,975.57	£2,376,384.24
Risk	£764,492.05	£487,297.20	£602,482.62	£717,668.04
Overall Project Total	**£3,312,798.88**	**£2,100,864.10**	**£2,597,458.19**	**£3,094,052.27**

Source: Mott MacDonald

Chart 5.5: Langford – Breakdown



Source: Mott MacDonald

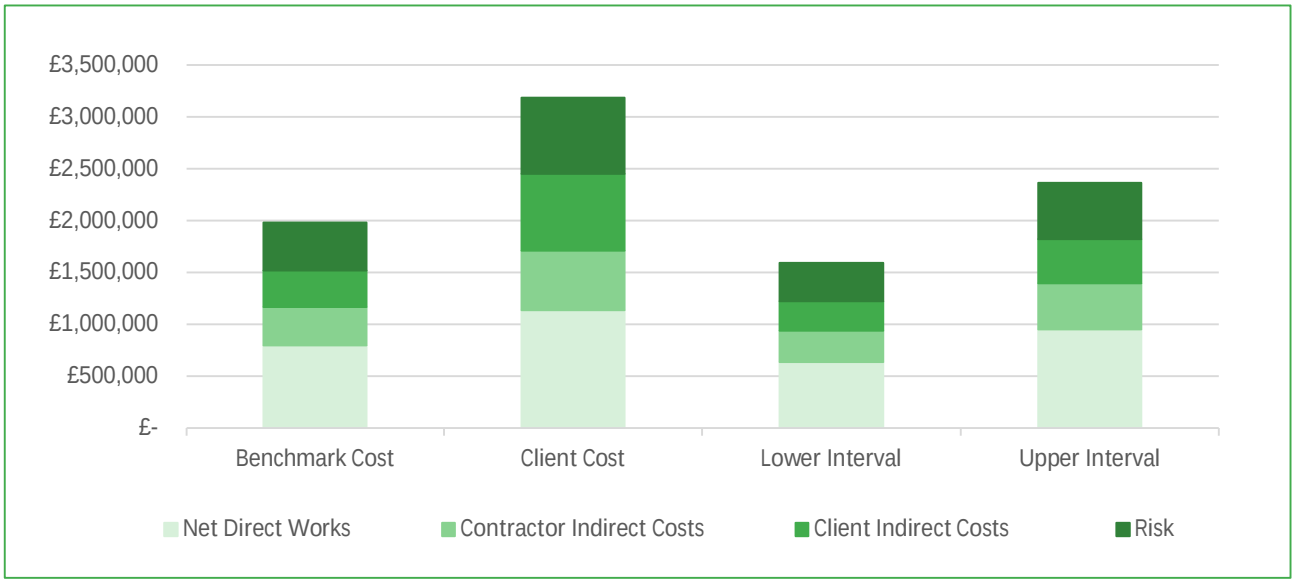
5.5 Layer

Table 5.5: Layer - Breakdown

	Client Cost	Lower Interval	Benchmark Cost	Upper Interval
Net Direct Cost Benchmark	£1,133,075.77	£635,829.42	£791,134.51	£946,439.59
Contractor Indirect Costs	£572,150.67	£300,747.32	£374,206.62	£447,665.92
Tender Total	£1,705,226.44	£936,576.74	£1,165,341.13	£1,394,105.51
Client Indirect Costs	£742,135.96	£283,579.92	£352,845.99	£422,112.06
Project Total	£2,447,362.40	£1,220,156.66	£1,518,187.12	£1,816,217.57
Risk	£734,208.60	£368,487.31	£458,492.51	£548,497.71
Overall Project Total	**£3,181,571.00**	**£1,588,643.98**	**£1,976,679.62**	**£2,364,715.27**

Source: Mott MacDonald

Chart 5.6: Layer – Breakdown



Source: Mott MacDonald

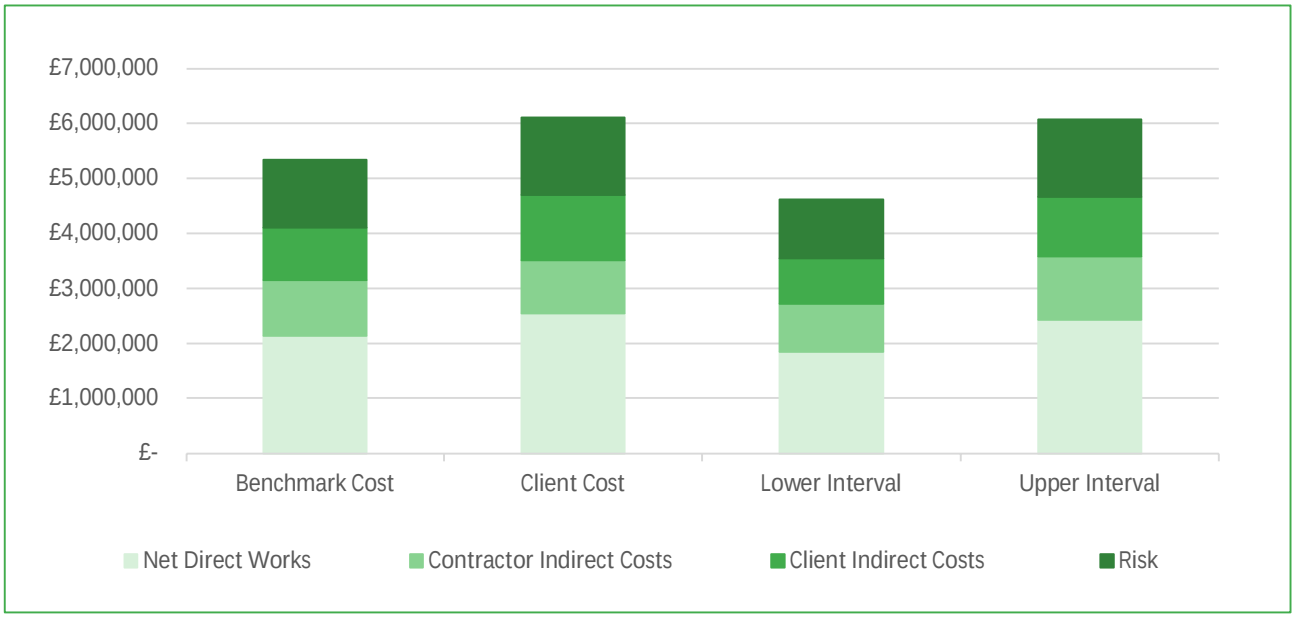
5.6 Mosswood

Table 5.6: Mosswood - Breakdown

	Client Cost	Lower Interval	Benchmark Cost	Upper Interval
Net Direct Cost Benchmark	£2,538,549.35	£1,845,212.25	£2,137,335.01	£2,429,457.76
Contractor Indirect Costs	£971,233.51	£872,785.40	£1,010,959.46	£1,149,133.52
Tender Total	£3,509,782.86	£2,717,997.65	£3,148,294.46	£3,578,591.27
Client Indirect Costs	£1,188,370.61	£822,964.67	£953,251.41	£1,083,538.16
Project Total	£4,698,153.47	£3,540,962.32	£4,101,545.88	£4,662,129.43
Risk	£1,409,446.04	£1,069,370.62	£1,238,666.85	£1,407,963.09
Overall Project Total	**£6,107,599.51**	**£4,610,332.94**	**£5,340,212.73**	**£6,070,092.52**

Source: Mott MacDonald

Chart 5.7: Mosswood – Breakdown



Source: Mott MacDonald

5.7 Exclusions to Direct Cost Benchmarking

Best endeavours have been made to include all direct costs within the benchmarking; however, some items have been excluded from the analysis due to data not being available at the time of analysing. The items include:

- Broken Scar - Modelling - £20,000.00
- Broken Scar – Update Control SCADA - £20,000.00
- Broken Scar – Launder (Steel incl. Trough Guard) - £552,500.00
- Fontburn - Modelling - £20,000.00
- Fontburn – Update Control SCADA - £20,000.00
- Fontburn - Launder (Steel incl. Trough Guard) - £92,500.00
- Hanningfield – Modelling - £20,000.00

- Hanningfield - Launder (Steel incl. Trough Guard) - £1,160,000.00
- Langford – Modelling - £20,000.00
- Langford - Launder (Steel incl. Trough Guard) - £162,500.00
- Layer – Modelling - £60,000.00
- Layer – Move Launder - £9,000.00
- Layer – Trough Guard - £1,120.00
- Mosswood - Modelling - £20,000.00
- Mosswood – New Headloss and Temperature Monitors - £240,000.00
- Mosswood – SCADA Integration - £12,000.00
- Mosswood - Launder (Steel incl. Trough Guard) - £690,000.00

These costs have been included in the estimates so that a comparison could be made when looking at the indirect costs.

6 Findings & Recommendations

This estimate has been developed and reviewed in the context of the scope of works. The costs have been reviewed against complexities identified at this stage of the project development (i.e. within the documentation provided).

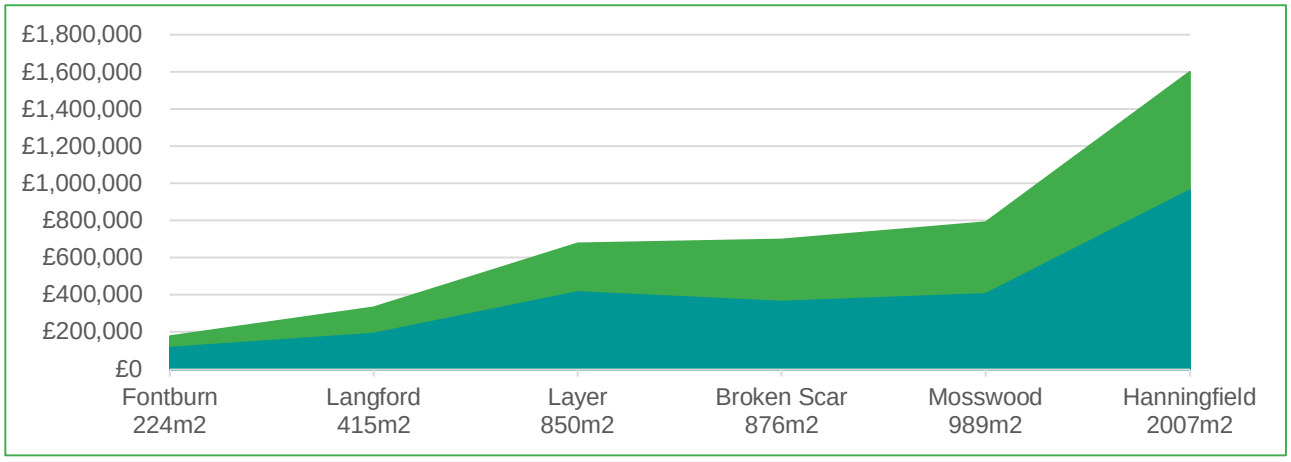
The following items are the main findings from this analysis:

- The overall project coverage for the Climate Change Backwash analysis was **71.30%**.

- The main driver of the variance at a programme level was Broken Scar with a variance of **80.00%.** The mesh walkway element of the comparison accounts for most of this variance (**£335,241.32** above the benchmark).

- The main driver for variance across all projects was the mesh walkway element which accounts for a **£1,822,526.69** cost variance from the benchmark (**74.37%** over the benchmark). This item is plotted in **Chart 6.1** and demonstrates that as the area of mesh walkways increases as does the variance. Northumbrian Water average unit rate was calculated at **£796.93/m** whilst the benchmark average unit rate was calculated at **£467.76/m** and this was supported by 3 comparator sources.

Chart 6.1: Climate Change Backwash Mesh Walkway Variance



Source: Mott MacDonald

The following steps are recommended for future design phases:

- Engagement with third party stakeholders to understand wider threats and opportunities in relation to the environment and additional requirements such as planning and regulatory consents.

- Review of the Northumbrian Water Climate Change Backwash element, to look at inclusions and exclusions in more detail.

When considering the deliverables associated with the scope, it will be important to consider the assumed durations including non-productive time and potentially working within an operational treatment works facility where there will be multiple interfaces with third parties.

The level of information currently available to inform the pricing for this cost exercise provides enough detail for a Class 3 estimate to be produced with a range of confidence within +/-25% on the estimated cost against the identified items within the scope.

As the project evolves through design stages, a greater understanding of scope, cost, risk, and programme can be established. The re-baselining of the cost estimate at these stages can inform budgets and facilitate greater cost control throughout the project. It can also enable cost-effective selection of design options. As the project develops, the estimating approach can also be refined to increase the confidence of the estimate.

To allow a deeper analysis of specific threat and opportunity to be included in the cost estimate, it is also suggested that the production, costing and modelling of a risk register is undertaken. This is to further develop the cost of identified risks, opportunities, and mitigations, to provide the cost estimate with a more specific analysis and more robust risk allowance.