

Briefing Note

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Briefing Note Title: Bran Sands LSO Cost Assurance

Objective: To assure the costs set out by Aqua and Mott MacDonald for the Bran Sands Outfall project proposed for AMP 8.

Revision History:

Version:	Date:	Summary of Changes:	Name:	Version name:
0.1	15/08/23	Draft documentation for review benchmarking the Offshore pipeline	JS/JM	Draft
0.2	05/09/23	Update of report to include Onshore Pipeline Assurance and Pumping Station. Updates in Blue text	JS/JM	Draft
0.3	13/09/23	Minor amendments	JM	Draft
1.0	03/08/24	Final External Draft	JS	Draft Final
1.1	16/08/24	Final	JS	Final

Approvals:

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1. Executive Summary

Gardiner & Theobald (G&T) has provided cost assurance for the proposed Long Sea Outfall (LSO) at Bran Sands as part of the PR24 cost assurance exercise undertaken by the Project Management Office (PMO). The outline scope of the project includes a new outfall pumping station capable of passing forward flows on 6197l/s, 3km of onshore pipeline (above ground level and below ground level) and 4.5km of offshore pipeline sat within a marine trench in the sea bed.

The cost assurance review was undertaken in three stages.

- An Initial review of the original iMOD estimate;
- A review of the offshore benchmark report produced by Aqua Consultants and;
- A review of the onshore pricing of the project based upon Howden PEPS

Upon completion of that review G&T have summarised the key points below:

Overall the G&T determine that the revised iMOD estimate as set out within table 1.0 below (Option ID: 50010118, produced on the 11.08.23) is a robust figure that can be utilised to progress the scheme forward (as detailed within table 1.0) based upon the scope set out within the Stantec pre-feasibility work. Section 4 of this report provides the overall conclusion and recommended next steps. Overall, we conclude that the respective direct cost meter rates for both the onshore and offshore chainage of pipeline benchmark against other more recent schemes in the north east and north west and based upon the complexity and difficulties of these type of schemes the risk being carried is commensurate. Around £1.6m of additional cost has been included within the estimate post review to ensure a robust budget for the complexity of the interface works between the onshore and offshore pipeline battery limit.

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Scope	£109,221,925.94
Contract Overheads	£29,772,532.57
Project Overheads	£36,255,777.78
Risk	£70,100,094.52
CAPEX	£245,350,330.81
ANNUAL OPEX	£1,563,565.97

Table 1.0 – iMOD (Option 50010118) excerpt

It should be noted that elements of the work within the estimate produced do conflict with the methodology justification from Mott MacDonald for the rest of the PR24 estimation rules noted in the meeting with Mike Madine and Thomas McCurdy on the 30th of August 2023. Variation of the scope and the associated additions cause significant increases to the overall cost once risk, contract and project overheads are added. These variations are largely down to a change of the estimating methodology being employed to produce the estimate, which moves away from the risk policy for PR24 by adding additional scope into the direct costs. However, due to the complexity of the project and the non-standard construction, we are in agreement with the variations of the scope set out.

1.1. Onshore Pipeline and Pump station

This is an addition of contingency within the direct cost estimate build-up in the onshore pipeline elements as detailed within section 2.4 of this report. Fundamentally, the Stantec report provides a scope for the scheme, deviations from this report should be agreed and justification provided. These additions to the Pump station could add between £10.6m and £13.3m to the scope of the project. However, all the assurance parties agree that the pump station sizing provided should be line with the Howdon sizing.

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There is also scope being removed from the Stantec scope by the estimators, such as the Air-relief valves, washouts and associated chambers along the route which have now been removed from the latest iMod estimate and do not appear within the Howdon PEPS benchmark. Additionally, there is an application of pro rata pipework calculations within the onshore pipeline element that does not take in to account the above and below ground elements of the Stantec Bran Sands scope. For example, elements of this could have been formed up, such as pipework pricing, to provide an initial baseline. Furthermore, there is a generalised blanket application of the Howdon bill that includes Howdon scope not included within the Bran Sands LSO scope.

1.2. Offshore Pipeline

There are significant deltas in programme length estimated from the supply chain approached and the Aqua bottom-up estimate. This ultimately provides a concerning programme delta that results in a supply chain order of magnitude estimate of c£70m based over one season, versus the Aqua build up that factors over two seasons but is at similar pricing levels. This leaves a significant risk element in the scheme. G&T support the overall risk pot of c£70m (inclusive of estimating uncertainty) due to the maturity of design at this stage, the complexity of the offshore marine works that are required, and that there is of course no firm offer or formal budget quotation at this time. The marine contractor sector rarely contracts under Lump sum contracts and therefore NWL must hold a significant risk pot to deal with issues such as adverse weather events, installation failures, marine trench failures and a shortening of offshore working seasons. In order to mature the risk allowance, work should be undertaken to formally cost up a scenario modelled risk register with the supply chain in an ECI phase, as well as producing a contract strategy and programme in collaboration with an ECI supplier.

2. iMOD and Offshore Pipeline

2.1.1. Contract Overheads

A lack of programme development has meant that the cost build-up has a high degree of variability. Further review of the Aqua bottom-up build-up of the LSO has indicated that the offshore works will be carried out during two (2) seasons. G&T have engaged with a specialist marine contractor, who can undertake works of this scale, and they have indicated that works could be delivered in one (1) season for the LSO. This would allow for reduction in contract overheads. At this stage, given the number of unknowns, the current allowance should be maintained, and work undertaken during an ECI phase with the supply chain should focus on programme development to firm this up.

2.1.2. Project Overheads

There is a considerable amount attributed to project management, feasibility and design (circa £22.5m). Project management and supervision will ultimately be a function of the programme. As mentioned above, given the limited development of a programme there is a degree of uncertainty around this value. A considerable feasibility study will be required to reach the proposed solution for the project and it is recommended that a collaborative ECI phase is undertaken as part of the feasibility phase. This should engage specialist contractors and suppliers to drive efficiencies and enable de-risking of known key risks prior to contract award and various contracting models should be assessed for this. It is unclear in the iMOD breakdown, what the scope of the proposed feasibility study is. G&T would recommend engaging with key supply chain partners in this feasibility study in an alliance style ECI phase to ensure both the onshore and offshore elements and relevant interfaces are addressed (e.g. and onshore Feasibility partner supported by the likes of Royal Haskoning DHV, Van Oord or Boskalis for the offshore elements).

2.1.3. Scope

It may be prudent to evaluate the suitability of the cost curves used in the iMOD against similar projects recently undertaken. Given the scale and complexity of the project, there is a concern that the cost curves for some components may not be appropriate. The key example of this is the diameter of the pipework proposed

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and the nature of the offshore element of the works has no current data points within the iMOD system. These have now been removed in favour of the Aqua bottom up cost build up. This is assured by the work that Aqua have done to support a bottom up of the offshore works, however, G&T have concerns surrounding the curves and prices used for the onshore works even from the Howdon works which reference smaller plant data points and quotations (e.g. onshore pipework curves use 1800mm Steel pipework). Upon review of the WBS it was noted that there is no cost allowance for a lifting gantry for the pumping station, which in turn may increase the power requirements for the site, hence additional costs associated with the DNO upgrade.

Furthermore, the construction interface methodology in managing the onshore/offshore pipeline battery limits is key. This is an area we have highlighted (as have the supply chain) as a key risk that may incur extra cost depending upon the chosen construction method. In previous work, the cofferdam areas have been extended as much as 600m from shoreline which led to approximately 1-1.2km of sheet piling in total. On major projects such as this, the fixing and understanding the battery limits between packages early will be key to better defining the current risk, estimating uncertainty and on-costs currently allowed.

2.1.4. Risk and Estimating Uncertainty

A risk value of approximately 10% and estimating uncertainty value of 30% has been applied within the iMOD in accordance with the PR24 risk guidelines set out. On reflection and given the stage of the project we would suggest that time is spent now to build up a formal costed risk register within the feasibility stage to support justification of this within OFWAT. Given the offshore complexities and onshore pipeline size and route, it is perhaps prudent to pursue a different risk profile for the project based upon a QSRA once the programme is in development. A summary of the key risks that have been identified are detailed in the table below.

Risk	Description	Mitigation
Permits	Several permits and licences will be required for the project. These will range from onshore lands access to licences required offshore works.	Early engagement with key statutory authorities and stakeholders to understand the requirements and inputs in gaining licences and permits. Approvals to be included as key milestones within the project programme.
Land rights and acquisition for access Chambers and the number of them required	Land for Air relief Valves/PRV chambers	Undertake a full feasibility study and identify these locations and work on easements at the soonest stage so that pipeline routing can be fixed.
Ground conditions	Ground conditions may prove to unfavourable for installation of caissons for PS and laying of pipework on and offshore. The Onshore Area of Bran Sands has known hazardous soils (chromium deposits)	Under site investigation and surveys during ECI phase. Engage with Contractors to assess the most suitable route and construction method based on information return from investigation.
Weather Conditions (offshore and onshore)	Inclement weather may impact the progress and productivity if works on site meaning that key dates within the programme are missed. There may be a limited working window during the offshore pipe laying.	During the ECI phase develop the project programme collaboratively to ensure that most suitable working times and conditions can be achieved.
Material Cost	Material cost inflation beyond initial project budget.	Regularly engage with supply chain to gain insight into market. Secure a supplier at the earliest point. This will have to be secured from an overseas supplier as the UK has no Steel or HDPE pipe assemblies at this size –

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		Therefore there is also an arbitrage risk as well as an inflation risk.
Procurement	Given the scale and complexity of the project there may be a limited number of delivery partners cable of undertaking the works with the specific Offshore skill sets	Engage with delivery partners under ECI phase to understand lead in times and delivery capabilities. Develop project programme to establish key date for all stakeholder to work towards.
Construction and pipeline interface risks	Due to the complexity of the project, the construction is more onerous than initially envisaged.	Engage with Contractors though ECI phase to assess and construction method.

Table 1: Key Risks identified.

2.2. Review of Aqua Benchmark Report

From the initial review of the iMOD breakdown it is evident, due to the scale of the project, that a significant number of the cost curves embedded did not have enough relevant data for a project of this size or complexity. As a result of this, Aqua were asked to provide a benchmark report of the offshore section of the project. G&T have undertaken a review of this benchmark report and noted the following in the table below.

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Bran Sand LSO Benchmark Report Review				
Package	Sub-package	Document	Observation	Severity
Plant & Labour	Goliath Backhoe Dredger utilisation (Van Oord)	2190 - Benchmark Report - Bran Sands Long Sea Outfall - August 2023	<p>Section 4.2 - Assumption that the works will be undertaken over 2 seasons (May to September). Given the nature and the depth of the pipework installation a one-of-a-kind dredger is proposed. Given the plant required, a standdown fee of 50% of the standard weekly charge has been included during the off-season. It is suggested that early engagement from the Marine Contractor is undertaken to;</p> <ol style="list-style-type: none"> 1) Assess the productivity of the dredger to determine if it is required during the 2nd season 2) If required, establish it will be required for the entire duration of the 2nd season or part thereof 3) Include contract provision to fully de-mob the dredger between seasons to minimise the standdown cost. <p>G&T have engaged with a well-established Marine Contractor who have noted that works would be undertaken in 1 season and that a combination of dredgers could be utilised based upon water depths</p>	High
Materials	Concrete Collars	2190 - Benchmark Report - Bran Sands Long Sea Outfall - August 2023	Budget allowance used in price build up. G&T have engaged with various precast suppliers and have determined that this may be out by approximately 25% per unit. It is proposed that a collar is required every 4m along the 4.5km offshore section of the pipework. Approximately 1125 collars will be required.	Medium
Materials	Diffuser	2190 - Benchmark Report - Bran Sands Long Sea Outfall - August 2023	A provisional cost allowance has been used in price build up. No formal budget pricing has been obtained	Low
Materials	Pipework	2190 - Benchmark Report - Bran Sands Long Sea Outfall - August 2023	Pipelife Norge AS have been engaged as a specialist in the large diameter offshore pipework. Quote obtained is for SDR21 pipework. Supplier has suggested that it may be possible to utilise SDR26 at shallower sections, which will have a potential cost saving.	Medium

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General	Price Index	2190 - Benchmark Report - Bran Sands Long Sea Outfall - August 2023	Price build-up is based on September 2023 prices. Price index to be applied based on proposed delivery date.	Medium
General	Project Programme	2190 - Benchmark Report - Bran Sands Long Sea Outfall - August 2023	There does not appear to be a project programme to back up the durations within the estimate. There seems to be a high degree of uncertainty around the project duration, which impacts the project and contract overheads.	High
General	Risk Register	2190 - Benchmark Report - Bran Sands Long Sea Outfall - August 2023	Risk register lacks specific costs associated with the scale if the project.	Medium

Table 2: Observations noted during the review of Bran Sands Benchmark report from Aqua consultants.

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3. Onshore Pipeline & Pumping Station

3.1. Howdon PEPS Comparison

Due to the scale and complexity of the project at Bran Sands a comparison was undertaken with a recently designed and progressed project at Howdon for the onshore pipeline and pumping station which is of similar sizing and flows. The following sections summarise the assurance for this element of the works.

3.1.1. Onshore Pipeline

Comparison of Howdon PEPS and Bran Sands has been carried out on a pro rata basis, assessing the cost per metre as a function of the pipe size. This poses several queries in relation to the outline scope of the Bran Sands project as, although in its infancy, there are some differences between the two projects. It should be noted that additionally Bran Sands has known hazard soil content and that provision should be made for working within and mucking away hazardous and non-hazardous waste including known chromium issues on the site. NWL have existing ground information data at the Bran Sands STW and further trial holes at the nearby BP Net zero site and Conoco sites around Seal Sands have incurred similar.

3.1.2. Pipework Diameter

Bran Sands proposed pipe diameter is 2000mm compared to the 1800mm used at Howdon. The information available should give a good indication of pipework cost for the Bran Sands project, however it is recommended that design criteria used at Howdon is reviewed to ensure that the rate is appropriate. It is also recommended that early engagement is sought with the supply chain to inform lead in time and delivery.

3.1.3. Pipework Length

The onshore pipeline element of the proposed Bran Sands LSO accounts for 3km in length and currently requires it to be both above ground and below ground, with a proposed even split of 1.5kms above and below. The Howdon site only accounts for an installation of 591m below ground, and as noted in 3.1.1, has not had allowance for dealing with hazardous muck-way. The value used from the Howdon BoQ is the complete PEPS pipework and valve plan cost, which is below ground pipework (at varying depths) and inclusive of other works such as road and additional cranes. There is a concern that the values used, although recent, do not correlate as a direct comparison of the proposal at Bran Sands. It therefore may not consider site specific scope and risk factors and considerable differences in costs with the differing lengths and installation of the pipeline in both projects. This is to be carried as a risk within the Bran Sands LSO budget pricing.

3.1.4. Pipework Fittings

The initial proposal at Bran Sands accounts for several utility and major transport crossings. There is also a number of high points identified based upon a minimum cover to crown of the pipe based upon the current identified routing. It is recommended that an allowance is included for air valves and associated access chambers at these high points and crossings and engagement is undertaken with the DNO and Network Rail to ensure full understanding of the standards required to cross under that infrastructure given the diameter of the pipework (e.g. steel sleeving maybe required). Upon review of the Howdon comparison it is evident that pro-rata metre rate does not allow for these site specific factors. Given the diameter and length of the pipeline, the fittings required could account for a considerable additional sum and it should be captured at this stage given that it will be required in the scope of the design.

3.1.5. Ground Conditions

There is no information to assess the similarities in ground conditions at both Bran Sands and Howdon. It is therefore recommended that an allowance is included with the risk provision to ensure that there is adequate build up to the risk provision of the Bran Sands budget estimate. A further desktop environmental survey

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would prove highly beneficial to confirm preliminary ground conditions. The ground conditions that the Bran Sans pipeline route proposes goes through a contaminated brownfield site which has hazardous waste and chemical deposits. This needs to be assessed at the earliest opportunity and new trial holes conducted to ascertain a fully costed ground conditions risk allowance for hazardous waste throughout areas of the site within which NWL do not currently hold data

3.1.6. Pumping Station

As no drawings have been provided for Howdon PEPS, review of the costs has been based on the descriptive nature of the BoQ. Upon review, there is a significant variance in the volume of the pumping stations at Howdon and Bran Sands. The volume of Howdon PEPS wet well is 4712m³ and Bran Sands is 650m³. According to the Stantec report Bran Sands will have approximately 14% of the volume of Howdon, as such consideration must be given to how appropriate the use of the Howdon figure is to estimate the cost of Bran Sands pumps station and flatly applying these costs. However the flows proposed for the LSO are similar to Howdon, so G&T are aligned with Mott MacDonald that the allowance should be to allow for a wet well volume of the pump station to be materially larger than is currently specified by Stantec, to deal with the similar flow/throughput. *Note – G&T understand that at the date of the revision of this document – a review has been undertaken by Stantec which does in fact materially increase the wet well volume.

A number of items included with the Howdon build-up such as the inlet chamber, pipework manifold and MCC building may not be entirely appropriate for a direct comparison and may require changes to sizing. When compared to iMOD there is no allowance for an inlet chamber, there is only 1no. raising main being fed from Bran Sands so it is likely that a large manifold arrangement will not be required and size of MCC proposed may fit within a kiosk instead of being housed with a building due to the lack of other process required. However, we note that it is likely there may be iterations of this or bypass arrangements in the final Scope.

Howdon also includes for a number of items that are not in the final Bran Sands LSO Scope:

- Howdon includes c£500k for a new retaining wall structure and it is not clear whether the Stantec scope requires this. Temporary works and battering to support existing services is already included with the BoQ for Howdon therefore if no structure is required it could be removed.
- Minor missed inclusion for the bill for bulk earthworks of c£25,000

3.2. Risk and Estimating Uncertainty

As per the offshore elements the 10% risk and 30% estimating uncertainty has been applied in accordance with the PR24 guidelines. The rationale of this is firm but the Mott Macdonald estimators have added further risk within the direct costs (5% allowance with the Howdon PEPS costs still included) and furthermore decisions have been made by the estimators to vary the scope provided by Stantec as detailed above. These decisions will need to be explained by the Mott MacDonald team fully in their estimating report. As mentioned above the c9x allowance for upgrading the pumpstation volume in line with the Howdon PEPS sized pump station needs immediate review and discussion with Stantec but G&T are in agreement that making allowance for this size of pumpstation is sensible based upon the flows being incurred. Currently these benchmark costs used for the pumpstation could add between £4-5million of direct cost to the scheme which once oncosts and risk are added becomes between £10.6m and £13.3m million of additional cost added to the scheme.

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4. Conclusion

Overall, the G&T assurance exercise supports the proposed Bran Sands budget set out, but also identifies a number of additional allowances that should be made as part of the submission to ensure NWL have the necessary risk and contingency allowances. However from the initial review of the iMOD breakdown it is evident, due to the scale of the project, that a significant number of the cost curves embedded did not have enough relevant data for a project of this size or complexity and these have since been replaced by specific exercises to price the Stantec scope bottom up using first principles. G&T have also engaged with further suppliers to assure the cost within the Aqua report, which can be found in the table below.

OFFSHORE ASSURANCE	AQUA	G&T review	Comments
Direct			
Materials	£ 11,945,737.90	£ 70,528,000.00	Van Oord Budget estimate
Plant and Labour	£ 55,247,446.10		In Van Oord Estimate
In Direct			
Interface Works	£ 373,152.50	£ 373,152.50	This figure seems low
Project Supervisor	£ 239,088.16	£ 239,088.16	Dependent on programme
Main Contractor	£ 679,683.91		In Van Oord Estimate
Shared Facilities	£ 204,729.16	£ 204,729.16	Dependent on programme
Fees and Licences	£ 169,370.00	£ 169,370.00	
Design Consultancy	£ 400,000.00	£ 200,000.00	Design Included Van Oord Estimate. Provision included for Consultancy input
Tax and Insurances	£ 123,987.00	£ 123,987.00	
Pre Contract Management			
Investigation Works	£ 286,000.00	£ 286,000.00	
2 Stage Procurement	£ 1,437,800.00	£ 1,437,800.00	Dependent on programme
DPC Procurement	£ 6,614,400.00	£ 6,614,400.00	Dependent on programme
Inspection/Project Management/Supervision	£ 830,000.00	£ 830,000.00	Dependent on programme
	£ 78,551,394.73	£ 81,006,526.82	
Added Extra Costs for Interface works			
Sheet piling additional for interface area to cover MSL working		£ 1,215,581.00	Includes hire, maintenance and removal- this is a specific exclusion with the Van Oord rate
Risk that 40m diffuser is missing from the trench cost		£ 480,000.00	Additional trench dig associated with Diffuser installer -provisional sum rates and pro rates minus materials and ballast install
Subtotal		£ 1,695,581.82	
Total		£ 82,702,107.82	EX VAT - All NWL ON COSTS AND RISK to be added

Table 3: G&T review of Aqua offshore benchmark following engagement with supply chain

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Howdon PEPS has been used in order to assess the appropriateness of the cost build up for Bran Sands LSO onshore scope. A number of clarifications and queries have been identified above to determine the appropriateness of using Howdon as a benchmark. Although beneficial, due diligence must be taken to ensure that the benchmark figures are appropriate and to the scale and scope of Bran Sands. Simplistic pro rata techniques of an entirely different scheme and scope should be augmented where possible with material quotations and supply chain support and commentary to ensure that the additional diameter does not necessitate additional temporary works and engineering. Currently, it does not appear this has been done. There are additional allowances that should be made due to the differences which are identified in the table below.

Onshore Additions	Imod	G&T review	Comments
Direct			
Lifting Gantry for 500kw Pumps over Pump station	£ 0.00	£ 100,000.00	Know missing scope for Onshore works - Provisional Sum
Associated power upgrade	£ 0.00	£ 25,000.00	Provisional Sum
Allowance for dealing with Hazardous waste	£ 0.00	£ TBC	TBC
Subtotal	£ 0.00	£ 125,000.00*	

Table 4 – Onshore additions required

*note that we have been unable to price the Hazardous waste as there has been no detail provided of chemical make-up. We would suggest allowance of 5% of total muck-away should allow for hazardous muck-way and another 5% on non-hazardous of the total muck-away allowance.

As detailed above given the diameter of the pipework proposed at Bran Sands, a pro rata of Howdon's build-up may not be entirely appropriate without first taking into consideration the pipe route, length, construction techniques and ground conditions in that area. A similar assessment must be undertaken to determine the correlation of the pumping station costs. Further work must be undertaken to ensure that there is an appropriate comparison between Howdon and Bran Sands, undertaking a direct comparison of the scope, to ensure that benchmark figures used are applied appropriately to give confidence the budget cost of Bran Sands LSO.

4.1. Recommendations

The following is recommended next steps to progress the delivery of the project post the early stage pre-feasibility report:

1. G&T recommend a Pre-FEED study is undertaken at the soonest possible point. The current price is based upon benchmarks that may be incorrect, and due to the per metre rates being quoted need to be justified under a detailed BoQ. Furthermore, a detailed cost engineering exercise should be undertaken.
2. G&T suggest an ECI phase should be undertaken to assess whether a trenchless solution may reduce programme length and risk onshore and reduce any underlying hazardous waste risks. The ECI phase needs to focus on confirming the pipeline route and a more detailed scope to allow an engineering bottom-up estimate to be conducted.
3. G&T recommend that this project is included within the earliest phase of AMP8 with budget allocated to start surveys in the offshore season in 2025.
4. Develop ECI scope to allow engagement with supply chain and delivery partners during FEED.
5. Development of project programme and risk register with key stakeholder input.

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