Cadent
Your Gas Network

Detailed Analysis Study
Powergen Example

DAS/EX/000
Prepared for Cadent Gas Ltd
Jan 2020

Document Purpose

The aim of this document is to provide an indication of what could be expected within a DAS report for a power generation site.

Any costs or reinforcement options detailed within this report are provided as an example and do not represent any exact costs or reinforcement works in reality.

The below describes what the purpose of a DAS for a powergen site would be.

The aim of this document is to provide Cadent Gas Ltd the findings of the Detailed Analysis Study (DAS) undertaken for the Power Generation connection request.

Detailed analysis has been carried out to understand the capability of the network in relation to the customer's request to connect and reserve capacity. This study is a reflection of the network at the time delivered and is **not** a guarantee of gas flow or capacity due the changing dynamics of the gas distribution network.

If you wish to secure capacity and connect to the network, please submit an FM138 Connections Request via the official connections route allowing for further analysis to verify the capability of the network again.

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Contents

Statement of Requirements

This section of the DAS will outline the customer's requirements such as requested load, times of usage and any other site specific requirements.

1. Site Location

The proposed power generation site location is off A5120, Westoning.

The site address provided by Cadent Gas Ltd is:

Land adj. to A5120
Westoning
MK45 5JB

Figure 1 below shows the anticipated site location highlighted.

Figure 1 - Google Maps image showing site location

1.1. Anticipated Flow and Pressure Requirement

Cadent Gas Ltd has a maximum preferred gas load of 100,000kwh (9,230.77scmh) which is expected to be taken during times of peak demand as outlined in figure 2. Due to the nature of the gas network our 1:20 winter demand conditions fall in line with the expected times of gas usage – therefore capacity will be available at any time of year once reserved.

The Demand profile has been captured in figure 2 and a breakdown of the three load options are captured in Figure 3.

Period	Peak Demand	Off Peak Demand	Peak Demand	Low Demand
	06:00 – 10:00	10:00 – 16:00	16:00 – 22:00	22:00 – 06:00
January – March	✓	✓	✓	✓
April – June	✓	✓	✓	✓
July – September	✓	✓	✓	✓
October - December	✓	✓	✓	✓

Figure 1 - Anticipated times of gas demand – identified from DAS Report Application.

The required pressure (at the gas meter) for this power generation site is 270mbar. The required pressure at the connection point is 450mbar.

As such, the most suitable connection point would be on a Medium Pressure (MP) network. This has also been taken into consideration when looking for suitable connection points, however other pressure tiers (if deemed more economical) have not been ruled out during the optioneering phase.

Option	Kwh	Scmh
Load Option 1	100,000	9,230.77
Load Option 2	50,000	4,615.38
Load Option 3	25,000	2,307.69

Figure 2 - Load options identified from DAS Application

1.2. Connections History

Cadent Gas Ltd have submitted 2 previous land enquiries under reference numbers 1100****** and 1100****** which both indicated that reinforcement would be required.

Connection Option(s)

This section of the DAS report will provide you with the connection options that don't require reinforcement for all requested loads. There will be a network map showing the suitable connection options with multiple pressure tiers being assessed.

2. Suitable Connection Points – without reinforcement

Optioneering takes into account pressure requirements (at the connection point and elsewhere), network constraints (such as maintaining acceptable velocities and upstream restraints) and available routes to connection (avoiding bridges, major highways and private land etc. where possible).

There is a 6" Steel medium pressure gas main within the highway on the A5120 running adjacent to the site.

Unfortunately this MP pipeline would not be suitable for a new significant demand. The pressure loss across the pipeline breaches our minimum pressure requirement at existing nearby customers both upstream and downstream of the proposed power generation site.

Figure 4 shows the suitable connection point which would not require network reinforcement (for all three load options).

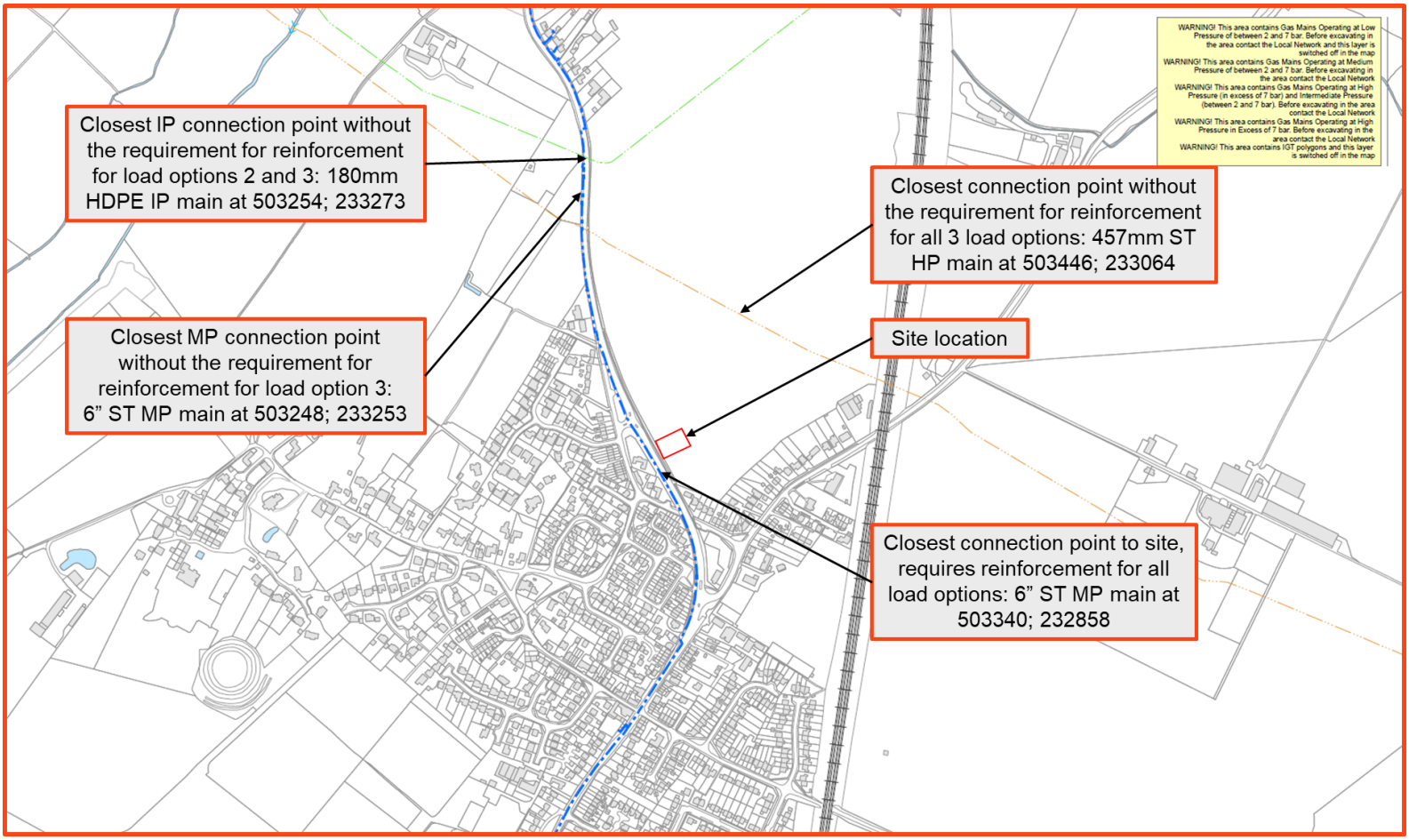


Figure 4 – Map showing connection point options

2.1. Load Option 1 (9,230.77scmh)

The closest connection point to supply the highest requested load without reinforcement is on the 457mm ST high pressure (HP) main at co-ordinates 503446; 233064; located in farmland off the A5120.
This connection point is approximately 5.1Km East of the site location (as the crow flies).
The operating pressure of this network is between 32bar and 16bar.

2.2. Load Option 2 (4,615.38scmh)

The closest connection point to supply load option 2 without reinforcement is on the 180mm HDPE intermediate pressure (IP) main at co-ordinates 503254; 233273; located within the highway of the A5120.
This connection point is approximately 420m North of the site location (as the crow flies).
The operating pressure of this network is between 7bar and 3.5bar

2.3. Load Option 3 (2,307.69scmh)

The closest connection point to supply load option 3 without reinforcement is on the 6" Steel medium pressure (MP) main at co-ordinates 503248; 233253; located within the highway of the A5120.
This connection point is approximately 400m North of the site location (as the crow flies).
The operating pressure of this network is between 2bar and 350mbar

2.4. Available Pressures

A minimum of 450mbar is the available pressure for the MP connection point identified in section 2.3.
A minimum of 3.64bar is the available pressure for the IP connection point identified in section 2.2.
A minimum of 16bar is the available pressure for the HP connection point identified in section 2.1.

Pressures recorded are based on peak analysis – which also reflects our 1:20 winter worst case pressure – so should be the minimum seen under normal operating conditions.

2.5. Alternative high pressure connection point

North of the site a 457mm ST HP pipeline at coordinates 503446; 233064; located within farm land as shown in figure 3 has capacity to supply any of the three requested load options.
One of the reasons this is highlighted is for load option 1 the load causes the HP to IP pressure reduction system to exceed it's nominated capacity if it were to be connected to either the IP or MP system.

Reinforcement Options

This section of the report will provide you with reinforcement options for the connection point requested by the customer. If no preferred connection point was identified upon request reinforcement will be based on connecting to the main of the most suitable pressure tier closest to the site location.

3. Utilising the requested connection point

As previously mentioned in section 1 the requested connection point on the 6”ST main within the highway of the A5102 does not have capacity to supply any new significant loads without reinforcement.
This section will demonstrate the reinforcement options to ensure security of supply to the connection point.

3.1 Load Option 1 (9,230.77scmh)

Utilising the requested connection point triggers the requirement for reinforcement. Two pipe-lay options have been identified to ensure security of supply to the proposed connection point. The first option is fully non-contiguous and the second option offers a contiguous option.

In addition to one of the two pipe-lay options it will require a rebuild of the HP to IP PRS as mentioned in section 2.5.

Below is an example of the detail of the reinforcement works you will receive as part of the DAS report. We will provide a plan showing the route of the reinforcement main along with the length and diameter of the main.
Where possible we will look to provide both a contiguous and non-contiguous option. Contiguous means the reinforcement main ties into the connection point, non-contiguous means it tied back into the network away from the connection point.

Contiguous reinforcement is open to competition with the potential for it to be carried out by UIP’s. Non-contiguous reinforcement would normally be delivered by Cadent in the first instance.

3.1.1 Reinforcement non-contiguous option:

The route to the connection point to supply loading scenario one (which is acceptable for up to 9,230.77scmh) is within public access shown in figure 5.
Approximately 750m of 315mm would be required to maintain acceptable pressure drops and velocities from the 250mm PE MP pipeline at 503236; 234289 to 503153; 233631 tying back in to the 180mm PE MP pipeline approx. 800m North of the connection point.

This option will require an SCJ design study both due to cost and a bridge crossing.

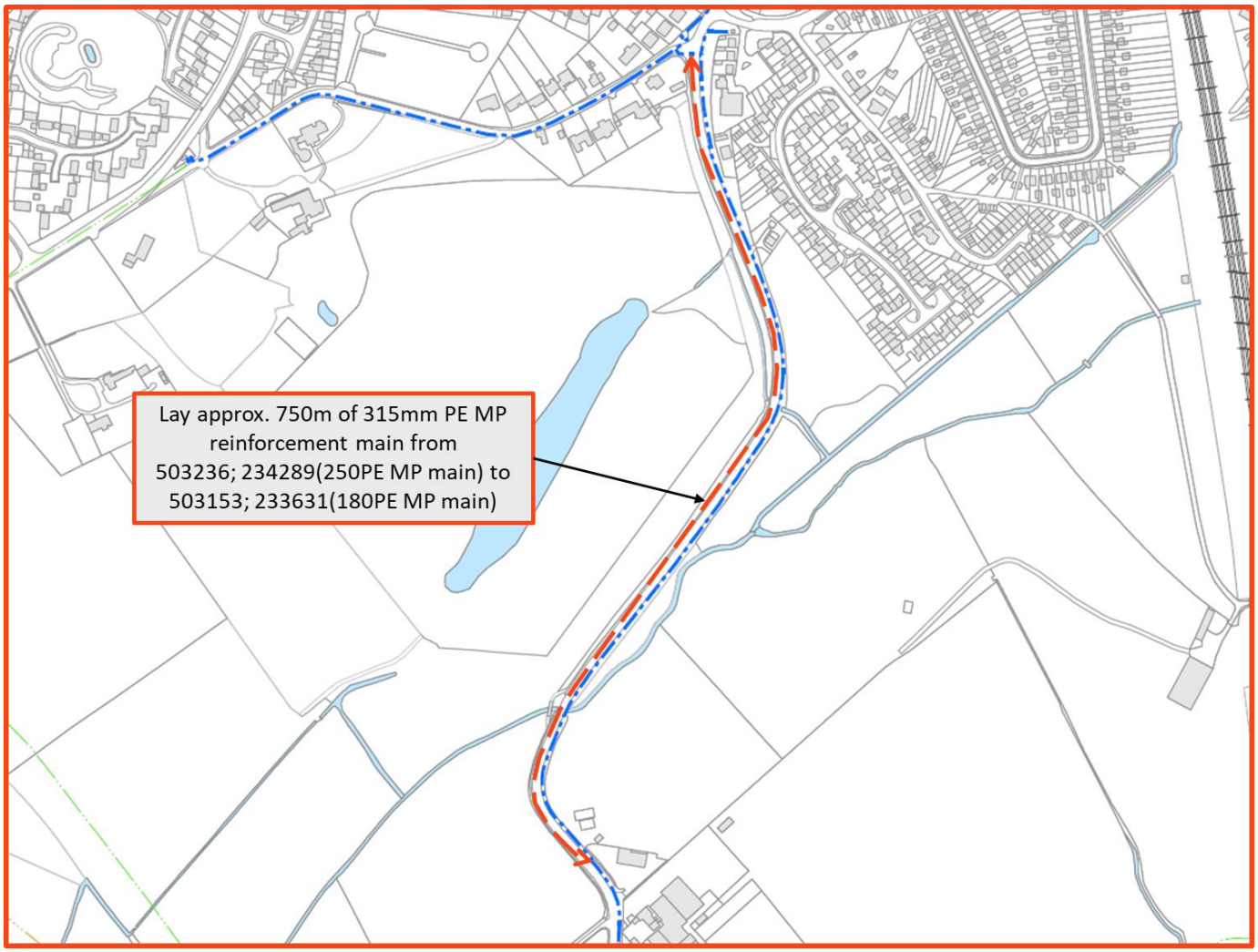


Figure 3 - Route of non-contiguous option

3.1.2 Reinforcement contiguous option:

The route to the connection point to supply loading scenario one (which is acceptable for up to 9,230.77scmh) is within public access shown in figure 5.
Approximately 1200m of 315mm PE would be required to maintain acceptable pressure drops and velocities from the 6”ST MP pipeline at 502823; 231845 to 503340; 232858 tying back in to the 6”ST MP pipeline at the connection point.

This option will require an SCJ design study both due to cost.

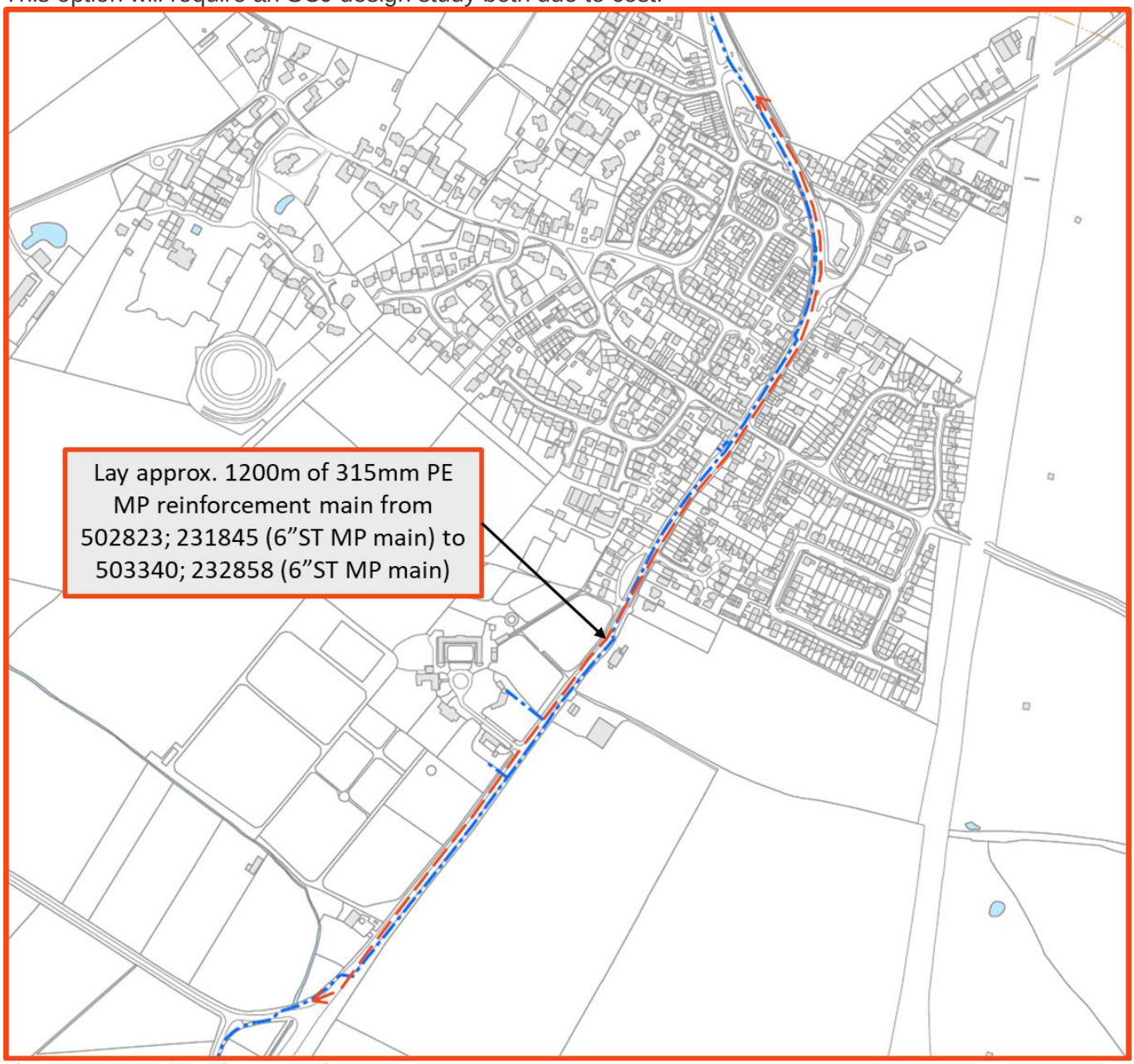


Figure 6: Route of contiguous option

3.1.3 Rebuild of HP>MP PRS

As mentioned previously by taking the demand from the MP or IP system this causes the PRS that feeds into the network to exceed its designed capacity. Through analysis it has been identified that the component on this PRS that is the restricting factor is the regulators.
This means that a feasibility study will need to be undertaken to understand whether the site rebuild is feasible or not. However, this is the first of three studies normally required to be undertaken prior to a formal quotation being issued for the work.

The previous section describing the reinforcement would be repeated here for as many load options as are identified in the DAS application; in this example the reinforcement required to supply load options 2 and 3 would go here.

4. Charging Point

This section of the report will identify where the charging point is for each of the requested load options compared to the requested connection point. The diagram below shows the distinction between the connection point and charging point with the dashed line representing the reinforcement main.

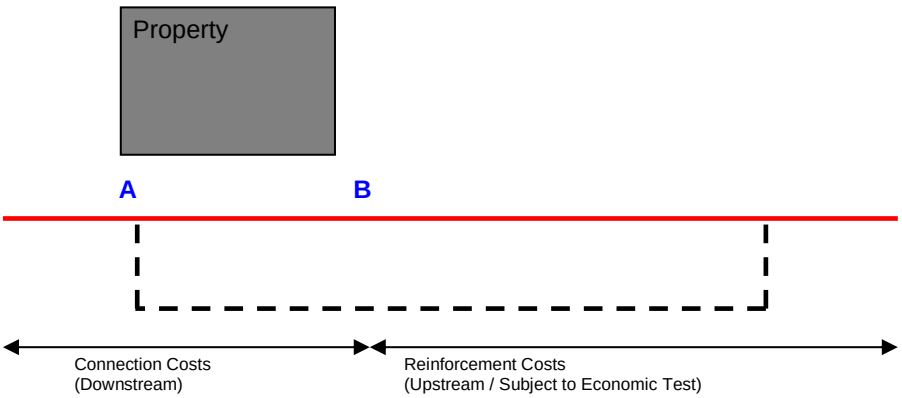
The Connection Charging Point is the closest economically feasible point (taking into account any customer request for gas to be made available at a particular pressure) on our system, which is deemed to have enough capacity to supply the new load disregarding existing loads.

The Connection Charging Point creates the financial distinction between Connection Costs, that are fully chargeable to the person concerned and upstream reinforcement costs, which may be funded by us subject to any contractual requirements.

If a booster or compressor is to be installed as part of the downstream equipment, any charging point shall lie on a main which is at least the same diameter as the new connecting main.

Load Option	Charging point co-ordinates	Distance to requested connection point
1 – 9,230.77scmh	503251; 233097	210m
2 - 4,615.38scmh	503307; 232913	60m
3 – 2,307.69scmh	503340; 232858	0m

Figure 4 - Charging point summary



A = Customers requested connection point / nearest relevant main
B = Charging Point

5. Alternative options

The alternative options section of the DAS will look at possible alternatives to pipe lay reinforcement. These alternatives may or may not be feasible at the point of the report being issued. If it is viable then it will be captured in the acceptance options at the end of the report.

Below are a few examples of some alternative options you may see; however, there may be other options explored on your report as each DAS is specific.

5.1. MP Elevation

To avoid the pipe-lay element of the MP reinforcement identified in section 3 one option is to raise the outlet pressure of the IP>MP regulator that feeds the MP network. When undertaking analysis, it was identified that by raising the outlet pressure to 1.85bar compared to 1.7bar which it is currently set at you would avoid the need for either of the pipe-lay options required in section 3.1.1 and 3.1.2. This would also guarantee the necessary pressure at the connection point for load options 2 and 3. Load option 1 would still require the feasibility study for the rebuild of the HP>IP PRS.

However, the majority of the pipework that feeds into the MP network from the regulator is made of ductile iron. When checking if the outlet pressure can be raised a condition check on the pipework in that network is carried out and any iron mains may need to be replaced before the pressure elevation can be put in place.

The MP elevation option could be looked at as part of the SCJ design study required for load option 1 or as an alternative to the reinforcement options to load options 2 and 3 once a quotation is accepted.

5.2. HP to MP PRS installation

For load option 1 where a HP>IP PRS rebuild is necessary when connecting to the MP or IP network; an alternative could be to install a new HP >MP PRS at 503267; 233141. By installing a new PRS at this location it would decrease the flow through the existing HP>IP PRS thus, a rebuild is no longer required, and would eliminate the need for any MP pipeline reinforcement identified in section 3.1.

As it is the installation of a new PRS this will require a feasibility study costing £18,000 and the budget cost for this is between £3,000,000-£4,500,000.

5.3. Reduced pressure at connection point

For load option 3 were the customer to accept a lower source pressure of 400mbar rather than the guaranteed 450mbar then this load could be accepted without the need for reinforcement.

6. Reinforcement costs

This section of the report will detail the costs of each reinforcement option identified previously in the report. Where a cost is identified as a budget indication this means that further studies would need to be carried out to achieve a firm cost. These budget costs will still be put through Cadent's economic test to give an indication of whether customer contribution would be required.

Figure 13 shows a budget indication of investment to maintain security of supply to the connection. These costs do not represent the downstream pipework from the connection point to the site.

The contiguous reinforcement aspects of the reinforcement options have been identified in sections 3.1.2, 3.2.2 and 3.3.2 are shown within the Total Estimated Cost Range within the summary in figure 13. This aspect of work is open to competition.

Figure 13 also highlights the non-contiguous reinforcement element of the option and this part must be delivered by Cadent (i.e. this is not open to UIPs to carry out the work).

Reinforcement Level	(Total) Estimated Cost Range	HP>IP PRS Rebuild	Non-contiguous Reinforcement	Customer Contribution	Contiguous Reinforcement	Customer Contribution
Load Option 1 – 9,230.77scmh	£2,000,000 - £3,350,000	£1,500,000 - £2,500,000 (budget)	£500,000 - £750,000 (budget)	£90,000 - £150,000 (budget)	£600,000 – £850-000 (budget)	£120,000 - £175,000 (budget)
Load Option 2 – 4,615.38scmh	£200,000 - £250,000	N/A	£200,000	£10,000	£250,000	£13,000
Load Option 3 – 2,307.69scmh	£160,000 - £180,000	N/A	£160,000	£0	£180,000	£0
HP Connection All load scenarios	£3,500,000 - £4,500,000 (budget)	-	-	-	-	-
HP to MP PRS	£3,000,000- £4,500,000	-	-	-	-	-

Figure 5 Table showing indicative reinforcement costs

Reinforcement Level	HP>IP PRS rebuild study cost	Non-contiguous reinforcement study cost	Contiguous reinforcement study cost
Load Option 1 – 9,230.77scmh	£18,000	£8,000	£8,000

Figure 8 – Table showing cost of studies required for elements of reinforcement

6.1. Indicative Connection Routes & Indicative Costs

The routes identified are potential options when looking to lay pipeline.

Pipeline diameter, length and costs provided are indicative only and based on works being delivered entirely by Cadent (or strategic partner).
No in-depth design work has been carried out as part of this DAS; therefore the cost range covers the cheapest laying techniques (i.e. in verge) to the more complex and expensive (i.e. road/highway) – and diameters of such pipelines are subject to change following design stages.

Please also note that a more suitable route may be available.

The construction of connecting to <7 Bar pipe work is open to competition and customers therefore have the option to employ a Utility Infrastructure Provider (UIP) to carry out this work. The UIP must have met the following obligations to undertake the work:

- be a signatory to the Cadent Final Connection Agreement
- hold the appropriate GIRS accreditation
- follow Cadent Safe Control of Operations at all times whilst carrying out the works.

Disclaimer: any costs provided are an example and do not reflect actual costs of the work.

Conclusions and Summary

Detailed network analysis has determined that (i) the nearest MP connection point would require some levels of reinforcement, and (ii) has identified the closest points of connection which could supply the new power generation site.

Figure 9 summarises the options available for a connection to the MP gas network at the requested point of contact (costs based on Cadent only works – and are not an official quote).

Reinforcement Level	(Total) Estimated Cost Range	HP>IP PRS Rebuild	Non-contiguous Reinforcement	Customer Contribution	Contiguous Reinforcement	Customer Contribution
Load Option 1 – 9,230.77scmh	£2,000,000 - £3,350,000	£1,500,000 - £2,500,000 (budget)	£500,000 - £750,000 (budget)	£90,000 - £150,000 (budget)	£600,000 – £850-000 (budget)	£120,000 - £175,000 (budget)
Load Option 2 – 4,615.38scmh	£200,000 - £250,000	N/A	£200,000	£10,000	£250,000	£13,000
Load Option 3 – 2,307.69scmh	£160,000 - £180,000	N/A	£160,000	£0	£180,000	£0
HP Connection All load scenarios	£3,500,000 - £4,500,000 (budget)	-	-	-	-	-
HP to MP PRS	£3,000,000- £4,500,000	-	-	-	-	-

Figure 9 - Summary of connection point / reinforcement options

To proceed with a connection to the Cadent gas distribution network and secure the relevant capacity please submit an FM138 Connection Request and reference this DAS reference within the email.

Of the options identified you have the choice to request a quotation to connect to the Cadent network, without incurring the usual quotation charge. This can be completed by you chosen UIP/GT or via the non-standard route.

This offer is available for 21 days following the issue of this document.

If you choose an option which has not been captured within the report this will incur the normal quotation charge.

Acceptance Options

This section of the report is where all the options identified throughout the report that can be accepted are collated and this must be submitted along with the quotation request ticking the option that you wish to proceed with.

☐ Connect to the 180mm HDPE IP main at 503254; 233273; as identified in figure 4, this option will not require any reinforcement for load option 2 or 3.

☐ Reinforcement option 1: connect to the 6”ST MP main at 503340; 232858; and choose the reinforcement option outlined in section 3.1 for load option 1. This will require both an SCJ design study costing £8,000 and a feasibility study for the PRS rebuild costing £18,000.

☐ Reinforcement option 2: connect to the 6”ST MP main at 503340; 232858; and choose the reinforcement option outlined in section 3.2 for load option 2. This will require customer contribution towards the reinforcement costing £10,000.

☐ Reinforcement option 3: connect to the 6”ST MP main at 503340; 232858; and choose the reinforcement option outlined in section 3.3 for load option 3. This option would require no customer contribution

☐ Connect to the 457mm ST HP main at 503446; 233064 as identified in figure 4, his option will not require any reinforcement for any of the load options identified.