Appendix 11d:

The Potential Application of the NAV model to new developments in Yorkshire

YorkshireWater

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Albion Water Limited

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Title	The Potential Application of the NAV model to new developments in Yorkshire
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Responsibility

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1 Introduction

Yorkshire Water is aware of a number of large housing developments in its area which are expected to be built over the next 20 years. They have done an initial assessment of how they would provide water and sewerage services to these sites, and for a number of them the infrastructure costs are likely to be very significant. At this stage they have identified four sites in particular where this applies – Catterick, Parlington, Green Hammerton and Elvington.

Yorkshire Water want to explore alternative ways of serving these developments, including the use of markets and NAVs.

Albion Water is a NAV company looking to grow rapidly over the next 5 to 10 years by providing a "full service" NAV offering to new developments, particularly for waste water, rather than the more common bulk supply / bulk discharge model used by most NAVs. The full service offering has the potential to add value to the developer and incumbent by taking an alternative approach to that which the incumbent would otherwise have implemented.

Albion Water is working with water companies, developers, land owners and their consultants to identify sites where the approach that an incumbent might take to water supply and waste water for new developments will involve significant costs or delays. These costs and delays may come from the provision of large pumping stations, long connecting sewers and the extensive reinforcement of the existing networks. In these circumstances Albion Water offers an alternative approach based on onsite (or near site) sewage treatment, new sources of water and water recycling.

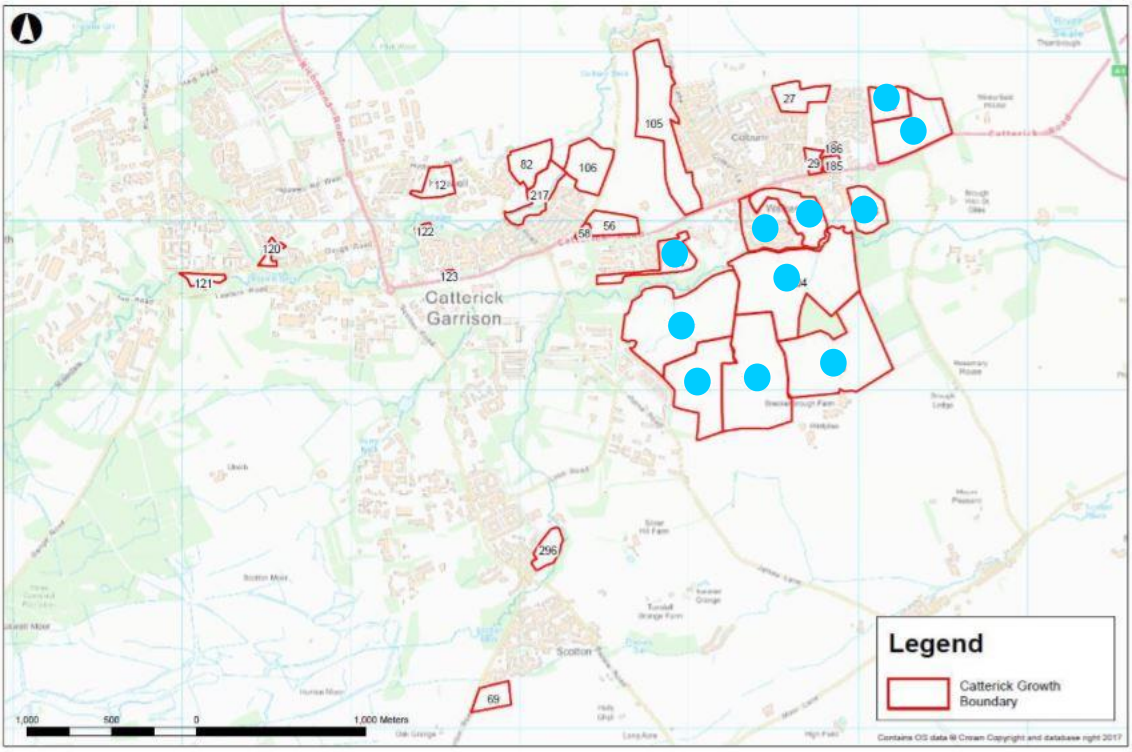
This document reviews the information provided by Yorkshire Water and provides an initial assessment as to whether the NAV model, and the full service NAV model in particular, can add value. The assessment considers practical, financial and regulatory aspects.

2 Catterick

The development at Catterick is driven by the MOD recently confirming that 2,900 military personnel will be relocated to the area. In total this could lead to an increase in the population by 4,800 people.

Richmondshire District Council has also allocated 1,000 new homes to be built in the period up to 2028.

A particular characteristic of this development is that the potential development areas are scattered around the existing town. Therefore at this stage we have taken an approach of considering only the development areas to the south and east of Colburn as suitable for a NAV – as shown on the map below.



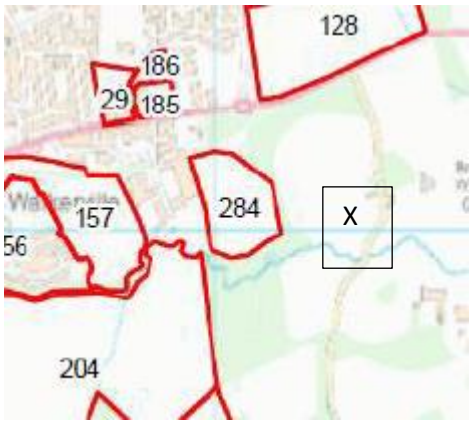
The number of properties predicted in these areas is shown in the table below.

Area	AMP7 – 2020 to 2025	AMP8 - 2025 to 2030
26	75	
124	126	
128		118
156	175	
157	250	
204		615
284		97
298		487
299		477
300	302	
301	533	
Total	**1,461**	**1,794**

2.1 Waste water issues

The waste water from the new developments could be treated either at the existing Richmond and Colburn WwTW which are likely to require expansion, or at a new treatment works.

For the purposes of this assessment we have assumed a new WwTW at the location shown on the map below. This would serve the areas of new development listed above via a new dedicated sewerage network. The remaining 818 properties on the other sites would drain via the existing network to the existing WwTWs.



2.2 Water supply issues

The assessed total increase in demand due to the development is 1.4 Ml/d as an average. During the summer this may increase by up to 25%, primarily driven by garden watering. This would give a peak week demand of approximately 1.8 Ml/d.

The supplies to the area are limited firstly by the ability to transfer water from the Thornton Steward WTW and by a licence condition at the local Catterick boreholes.

Yorkshire Water has assessed the infrastructure improvements that would be required to bring more water in from Thornton Steward. In summary these involve 13km of new water main and a new 4 Ml capacity service reservoir.

Three other potential options are

1. Changing the licence at Catterick to allow both boreholes to be pumped at the same time, assuming the daily or annual licence is not constraining as well. Albion Water is aware of water companies who have made a similar change.
2. Recycled water from the new sewage works. This could reduce the peak demand to approximately 1.3 Ml/d.
3. Develop a new source of water

The Catterick growth sites are underlain glacial Till deposits, with one nearby borehole log showing a thickness of at least 30m. The Till deposits overlay Carboniferous sandstones or Richmond Cherts Little Limestone. These rock deposits are classified by the Environment Agency as Secondary A aquifers, defined as: *permeable layers capable of supporting water supplies at a local rather than*

strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Only one record of a yield has been identified in the area of interest, which indicates a yield of 4.3 Ml/d from a ~110m deep borehole into the Sandstone aquifer. The aquifer may have limited connection to nearby surface water course due to the overlying Till, but this groundwater will form baseflow to the River Swale. The Environment Agency's Abstraction Licensing Strategy (Feb 2013) for the area, indicates 'limited water availability' at Q70 and Q95, and 'water available' at Q30 and Q50.

A standalone borehole source of water for the new development area appears to be a possibility. There may be water quality issues relating to agricultural or MoD contamination of the local aquifers.

Taking the CAMS assessment at face value there may be a problem in providing a year round supply to the development, however this should be mitigated by the flow benefit of the additional discharge from a new local WwTW.

3 Parlington

Parlington is a development of up to 5000 new homes, but a long term forecast of 4000 properties is thought to be more realistic for the location. The first houses are expected to be occupied in 2024. The development will happen in two phases, firstly 1850 homes by 2033, and then an additional 2150 subject to a review of the local plan.

We have taken as our default that only Phase 1 will happen, but have looked at phase 2 occurring as well as a sensitivity.

3.1 Waste water issues

The site is currently unserved and at a significant distance from the nearest suitable infrastructure for a waste water connection. Therefore the preferred option is for a new on site or near site WwTW. At this stage Yorkshire Water has assumed a discharge consent of 20mg/l and 5 mg/l based on the tightest consent conditions for three local works.

3.2 Water supply issues

The assessed total increase in demand due to the development is 0.8 Ml/d as an average. During the summer this may increase by up to 25%, giving a peak week demand of approximately 1.0 Ml/d.

The local network is a small diameter distribution network with no capacity to supply a large new development. Network extensions and reinforcements would therefore be expensive.

Alternative options would be

1. a new local source to supply at least 1.0 Ml/d.
2. water recycling from the onsite STW could reduce this demand by 30%, i.e. to 0.7 Ml/d.

The outcrop geology over the majority of the Parlington development area is Permain Cadefy Formation, a Dolostone (magnesium limestone). Faulting and erosion means an outcrop of Carboniferous Westphalian Lower Coal Measures (LCM) also occurs over part of the site. The LCM comprise, mudstone, siltstone, with numerous thick sandstone and coals and seat earths. These

deposits underlie the Dolostone, at an estimated depth of 20-50m. The Dolostone is classified by the Environment Agency as a principal aquifer and the LCM as a Secondary A aquifer, defined as: permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers. At Parlington the Dolostone is at the edge of its outcrop and form a 'thin' layer over the LCM. The LCM will therefore be the controlling influence on the yield from a borehole at this location. No local yield information has been obtained.

The Parlington area is drained by the Cock Beck, with a tributary running along the western boundary. Abstraction from the LCM is likely to be at the expense of flow in this watercourse. The Environment Agency's Abstraction Licensing Strategy (Feb 2013) for the area (Wharfe and Lower Ouse), indicates 'limited water availability' at Q95, and 'water available' at Q30, Q50 and Q70, at the Cock Beck assessment point. The Parlington site is near the headwaters of the catchment, so the available water may be more limited in this upper reach of the Cock Beck. However given that the water abstracted will be returned locally to the river a reliable year round source of water is a possibility if the yield can be found.

Due to the potentially elevated metal concentrations water abstracted from the LCM will may need additional treatment to produce potable water.

4 Green Hammerton

This development is for 2809 homes and construction is expected to start in 2020/21.

4.1 Waste water issues

There is a local waste water treatment work at Kirk Hammerton but it would require significant enhancement to deal with the additional load from this development.

An alternative would be to construct a new WwTW to discharge to the River Nidd and a potential location has already been identified. An initial assumption is that the consent would be the same as for the existing Green Hammerton WwTW – BOD 20 mg/l, SS 40 mg/l, NH3 5mg/l.

4.2 Water supply issues

The assessed total increase in demand due to the development is 0.9 Ml/d as an average. During the summer this may increase by up to 25% to give a peak week demand of approximately 1.1 Ml/d.

There is potential to supply the development from Boroughbridge WSS however considerable improvements to the infrastructure would be required.

Alternative options would be

1. a new local source to supply at least 1.1 Ml/d.
2. water recycling from the onsite STW could reduce this demand by 30%, i.e. to 0.8 Ml/d.

The Green Hammerton growth locations are underlain by Vale of York Formation, comprising clay, sand and gravel (10-15m thick), beneath which is the Triassic Sherwood Sandstone, classified by the Environment Agency as a Principal aquifer, defined as: These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most

cases, principal aquifers are aquifers previously designated as major aquifer. The required yield should be readily available from this formation. A short (5 hour) pumping test near to Great Hammerton produced 0.69 Ml/d for ~13m of drawdown.

The Green Hammerton site is located ~1.5 from the River Nidd, which should receive baseflow from the Sherwood Sandstone. The Environment Agency's Abstraction Licensing Strategy (Feb 2013) for the area (Swale, Ure, Nidd and Upper Ouse), indicates 'limited water availability' at Q70 and Q95, and 'water available' at Q30 and Q50. As with the other sites a local discharge of the abstracted water should enable a year round reliable abstraction despite these constraints.

The site is within a Nitrate Vulnerable zone for surface water and nitrate concentrations are likely to be elevated in the water from the sandstone aquifer.

5 Elvington

Elvington (ST15) is the largest potential developments identified in the York area. This assessment focuses on Elvington. However, there are a number of other sites above 950 properties.

Reference, name	Properties	Comment
ST1 – British Sugar	1140	Positive as close to river (potential discharge site)
ST5 – York Central	1500	Negative as probably embedded in existing network
ST8 – Monk's Cross	968	Medium – new development but possibly close to existing infrastructure
ST14 – Wigginton Road	1348	Positive – probably away from existing infrastructure

The sites ST1, ST14 and possibly ST8 may also be worthy of review for a NAV approach.

5.1 Waste water issues

There is no nearby WwTW to Elvington therefore the construction of a new works is the default assumption. Yorkshire Water has not inferred an indicative consent, this would need to be discussed with the EA at an early stage.

5.2 Water supply issues

The assessed total increase in demand due to the development is 1.0 Ml/d as an average. During the summer this may increase by up to 25% to give a peak week demand of approximately 1.25 Ml/d.

Given the location a water supply from existing infrastructure will involve 6km of 200mm main and associated connections.

Alternative options would be

1. a new local source to supply at least 1.25 Ml/d.
2. water recycling from the onsite STW could reduce this demand by 30%, i.e. to 0.9 Ml/d.

The Elvington site is underlain by ~30m of superficial deposits comprised of clay, sand and gravel. These are underlain by Triassic Sherwood Sandstone to depth of 200-300m. The Sherwood Sandstone is classified by the Environment Agency as a Principal aquifer, defined as: These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer. The required yield should be readily available from this formation. Nearby a pumping trial showed a yield exceeding 1 Ml/d.

The nearby (~1km west) Heslington Tillmire SSSI (neutral grassland) may limit the scale of abstraction that can be undertaken. The Environment Agency's Abstraction Licensing Strategy (Feb 2013) for the area (Swale, Ure, Nidd and Upper Ouse), indicates 'limited water availability' at Q70 and Q95, and 'water available' at Q30 and Q50.

The site is within a Nitrate Vulnerable zone for surface water and nitrate concentrations are likely to be elevated in the water from the sandstone aquifer.

6 Financial viability of a NAV

6.1 Waste Water

We have made an initial assessment of the financial viability of building and operating these sites as full service NAVs for waste water.

A threefold assessment has been made

- Net present value assessment assuming zero net capex
- Long term operating margin at full build out
- Likely net capex

The net present value takes account of the fact that costs will be front end loaded relative to income as a result of the build out rate.

The long term operating margin is an assessment of the annual cash flow of the site in the long term.

These both exclude any assumptions over the capex position, i.e. no account is taken of the cost of building the sewage treatment works, capital contributions from the developer or others or infrastructure charges.

Likely net capex is an initial qualitative assessment as to whether an onsite sewage works is likely to be cost competitive with a connection to existing waste water assets. This is an assessment of the costs, not the price that would be presented to the developer in these two scenarios.

At this stage we have only applied a green, amber, red classification – partly due to the uncertainties at this stage and partly due to the commercial considerations.

Site	Net present value	Long term operating margin	Likely net Capex
Catterick			
Parlington - 1850			
Parlington - 4000			
Green Hammerton			
Elvington			

6.2 Water Supply

Full service NAV

At each site there appears to be a possibility of obtaining a local borehole source of water, except perhaps Parlington. However, the water supply installation would need to be very resilient to provide a similar level of service to that provided by a network connection, and this will be reflected in the cost of provision. At this stage we feel it is unlikely that a connection to the mains could be avoided at any of these sites as they are too small to provide the economies of scale required for a robust water supply system. However this is more driven by the capital requirements than the operating costs so ultimately it does depend on the cost differential with the alternative modes of supply.

However, at each site there would be scope for water recycling if a local WwTW approach is adopted. This would reduce the demand for water on the site and consequently the size of the infrastructure required to serve the site and the need to develop supply / demand options within the relevant Water Resource Zone.

Bulk supply NAV

Whilst "not in the brief" we have also briefly reviewed the financial viability of a bulk supply NAV for water supply. For each of the sites a bulk supply NAV looks to be viable with the exception of Elvington. This is because Elvington appears to be in the area previously covered by York Waterworks which significantly reduces the large user to retail margin.

For the other three sites this does open up the possibility of a NAV based on a combination of bulk water, onsite sewage treatment and water recycling to reduce the water demand to benefit water resource needs, the sizing of any connecting infrastructure charge and to meet potentially challenging pcc requirements.

7 Regulatory issues

A key feature of the new charging rules is that developers pay for site specific requisition costs (less an income offset in some cases) but they do not pay for the provision or upgrade to sewage treatment works or new water supply sources.

Therefore if these developments are served by new sources and treatment works then the water company appointee (for instance Yorkshire Water or Albion Water) will, under almost all circumstances, have to pay for those works rather than the developer.

Possibly the only way to avoid this, and to achieve a level playing field with the pipeline infrastructure approach, would be for the NAV to agree a fee with each developer to change its appointed area in a piecemeal manner to only cover the area controlled by each developer. There would be an incentive for the developer to pay this fee to avoid the Yorkshire Water requisition charge.

Under the current rules it would not be sensible for the whole development area to be transferred by consent to a NAV before developers are involved because then the NAV would have to provide the treatment facilities at its own expense.

This illustrates a fundamental problem with the charging rules – namely that developers pay for infrastructure that connects their development to an existing treatment plant, but cannot be required to pay for local treatment works capacity even if this avoids the need for an expensive connection.

8 Conclusions and next steps

All of these sites have potential for a full service waste water NAV. On water supply whilst a bulk supply NAV appears financially preferable (to a NAV), a combination of bulk supply with water recycling could provide benefits for all. The viability of a full service water supply NAV would be dependent on a more detailed comparison of the capital costs in particular.

The NAV model provides a means for developers to contribute to the cost of local treatment, both for water supply and waste water, where this is the overall more cost effective relative to a network connection. This is particularly relevant for water companies, like Yorkshire Water, who do not provide an income offset against requisitions.

The key uncertainty is whether discharge consents and abstraction licences could be obtained for the local sewage treatment works and water sources with conditions that mean they can be provided for a similar or lower cost than the pipeline alternatives.

Given the size of the developments a standalone new water resource will be financially more challenging than a local sewage treatment works, however water recycling from a new local WwTW could bring significant advantages by offsetting water demand by 30%.

The key next steps are therefore:

- Obtain indicative consents from the Environment Agency for new treatment works for these locations and loads
- Investigate with the Environment Agency whether abstraction licences could be obtained for local water sources.
- Undertake a more detailed costing exercise
- Discuss this approach with Ofwat

9 Other points to note

Below are a number of points we have noted that may be appropriate to discuss further

- Impact of P level on new discharge consents
- 40 l/h/d infiltration for new properties – high?
- 140 l/h/d water use – high for new metered properties, compliant with building regulations?