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SSE Wandle Delta Heat Network

Initial Route Proving Study

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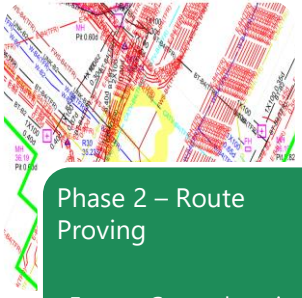
29 May 2020

WANDLE DELTA STUDY OVERVIEW & AIMS

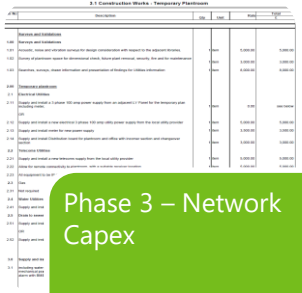
Phase 1 - Energy Mapping

- Review and processing of Identified loads
- Waste Heat Opportunities
- Identify Clusters
- Technical Constraints Analysis
- GIS mapping



Phase 2 – Route Proving

- Energy Centre locations and supply technology
- Energy modelling
- C2 asset record search
- Route design (heat loss, sizing, HAZID)



Phase 3 – Network Capex

- Route and connections costing
- Consideration of HAZIDS
- Benchmarked vs. recent schemes
- Contingency

Phase 4 - Strategic Considerations

- Reccomended actions for implementation
- Gap analysis

A) Provide an optimised network route concentrating on demands; energy sources; transmission and building connections; &

B) Having assessed the viable connections and route, to provide a detailed cost (Capex) breakdown of this network route.

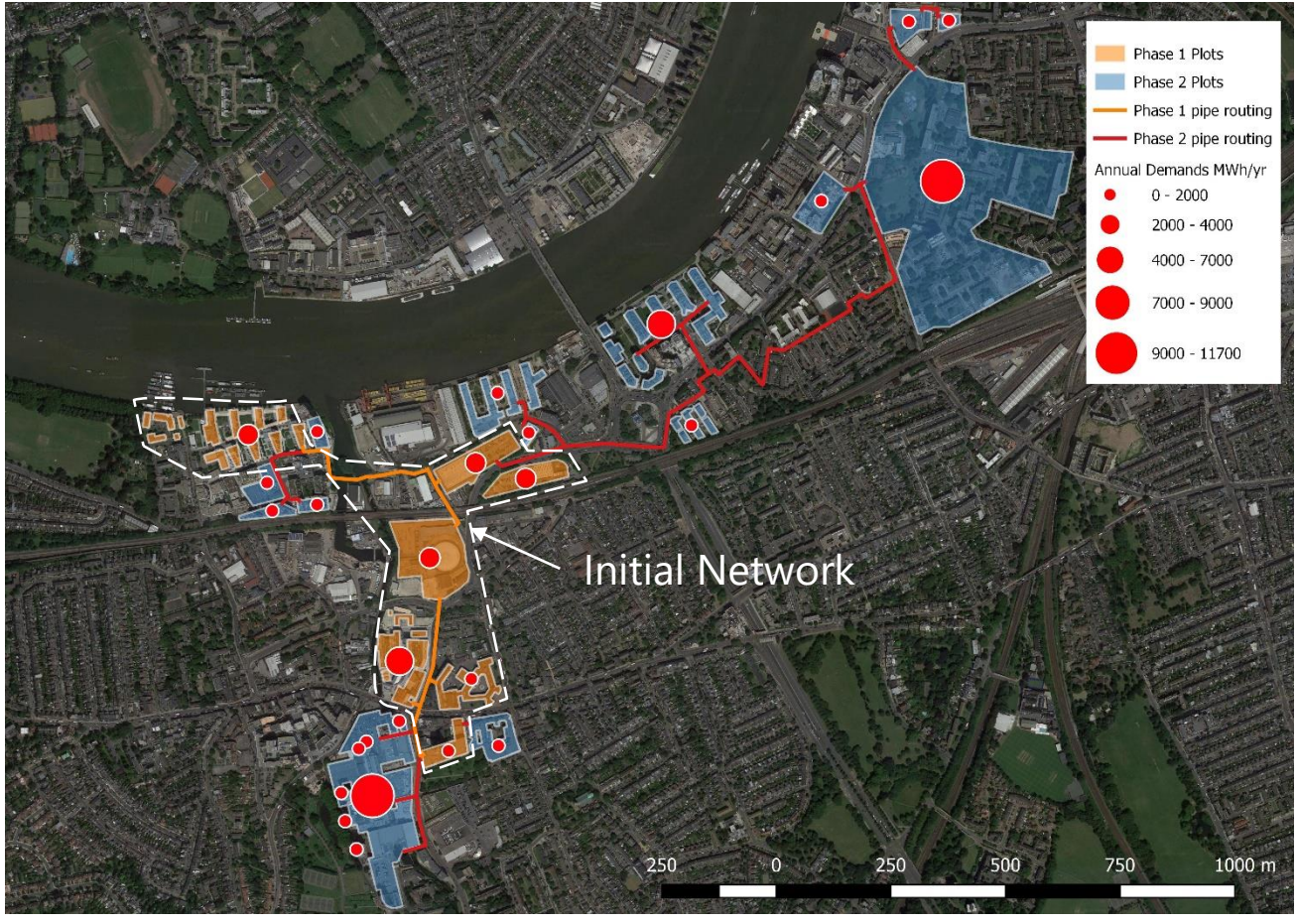
STUDY AREA OPPORTUNITY OVERVIEW

Initial Network – 18.4 GWh

1. Riverside Quarter *(existing)*
2. SGN site *(future)*
3. Swandon Way - Homebase *(future)*
4. Smugglers Way - B&Q *(future)*
5. RAM Brewery *(existing)*
6. Wandsworth Civic Centre *(existing)*
7. South Thames College Residential Tower *(future)*

Full Buildout – 56.3 GWh

8. Winstanley Estate *(future)*
9. Council Supplied Residential *(existing)*
10. Riverside West *(existing)*
11. Holiday Inn *(existing)*
12. Battersea Reach *(existing)*
13. Nine Eastfields *(future)*
14. Osiers Square *(future)*
15. Osiers Point *(future)*
16. Osiers Road *(future)*
17. South Thames College *(existing)*
18. The School Yard *(future)*
19. Southside Shopping Centre *(existing)*
20. Royal Academy of Dance *(future)*
21. York Road Business Centre *(future)*
22. SW11 3QD site *(future)*



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DEMANDS

				Annual Demands (MWh)				Peak Demands (kW)			
Phase	Development Name	No. of Resi Units	Non-Resi GFA m2	Space Heating (SH)	Domestic Hot Water (DHW)	SH+DHW Total	Cooling	Space Heating (SH)	Domestic Hot Water (DHW)	SH+DHW Total	Cooling
Phase 1	Riverside Quarter (existing)	531	2,973	1,413	1,427	2,840	457	774	833	1,606	1,695
	SGN site (future)	1,000	0	1,185	2,100	3,285	700	883	1,199	2,081	2,745
	Swandon Way - Homebase (future)	343	2,408	Included Within SH + DHW Total		3,270	291	Included Within SH + DHW Total		2,455	1,095
	Smugglers Way - B&Q (future)	517	8,129	Included Within SH + DHW Total		3,394	-	Included Within SH + DHW Total		2,930	1,911
	RAM Brewery (existing)	691	6,920	2,214	1,894	4,108	682	1,199	1,097	2,295	2,443
	Wandsworth Civic Centre (existing)	-	-	750	-	750	-	1,000	-	1,000	-
	South Thames College Residential Tower (future)	201	2,458	335	452	787	211	302	448	750	749
	Phase 1 Total	***3,283***	***22,888***	***5,897***	***5,872***	***18,433***	***2,341***	***4,157***	***3,576***	***13,118***	***10,637***
Phase 2	Winstanley Estate (future)	2,550	20,600	3,833	5,602	9,435	2,375	3,288	3,081	6,369	8,617
	Council Supplied Residential (existing)	536	-	1,057	1,405	2,462	375	592	725	1,317	1,471
	Riverside West (existing)	361	-	713	947	1,660	253	399	535	934	992
	Holiday Inn (existing)	148	4,440	680	498	1,178	80	197	281	478	466
	Battersea Reach (existing)	1,084	10,300	3,405	2,964	6,369	1,054	1,845	1,574	3,419	3,787
	Nine Eastfields (future)	172	918	247	373	620	137	191	452	643	550
	Osiers Square (future)	109	926	166	240	406	103	144	291	435	376
	Osiers Point (future)	85	470	119	184	303	73	99	246	345	274
	Osiers Road (future)	168	3,653	343	397	740	222	333	436	770	752
	South Thames College (existing)	172	6,000	1,077	523	1,600	292	570	499	1,068	947
	The School Yard (future)	119	-	235	312	547	83	132	242	374	327
	Southside Shopping Centre (existing)	-	70,000	8,607	840	9,447	2,005	7,000	808	7,808	5,492
	Royal Academy of Dance site (future)	299	5,943	753	717	1,471	284	525	629	1,154	1,360
	York Road Business Centre (future)	168	10,671	850	506	1,356	274	617	655	1,272	1,383
	SW11 3QD site (future)	82	911	120	182	303	75	105	251	356	273
	Phase 2 Total	***6,053***	***134,832***	***22,205***	***15,690***	***37,895***	***7,686***	***16,037***	***10,704***	***26,741***	***27,067***
	Full Build-out Total	***9,336***	***157,720***	***28,102***	***21,562***	***56,328***	***10,027***	***20,194***	***14,280***	***39,859***	***37,704***

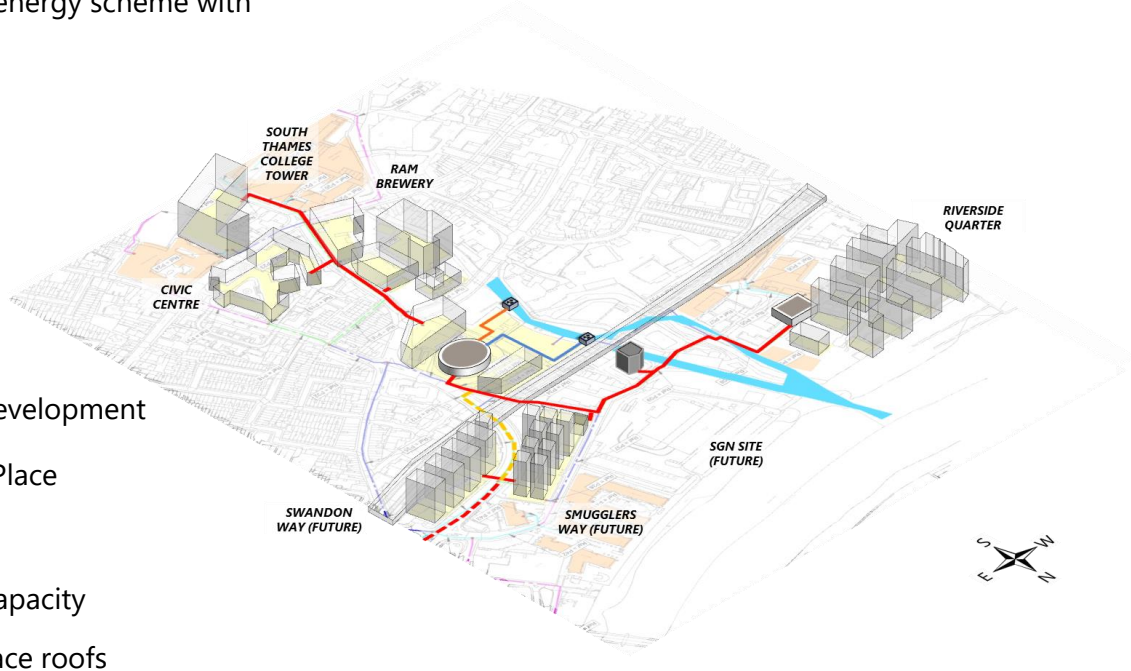
Values added manually For Wandsworth Civic Centre, Swandon Way / Smugglers Way site based on external information received

EXECUTIVE SUMMARY

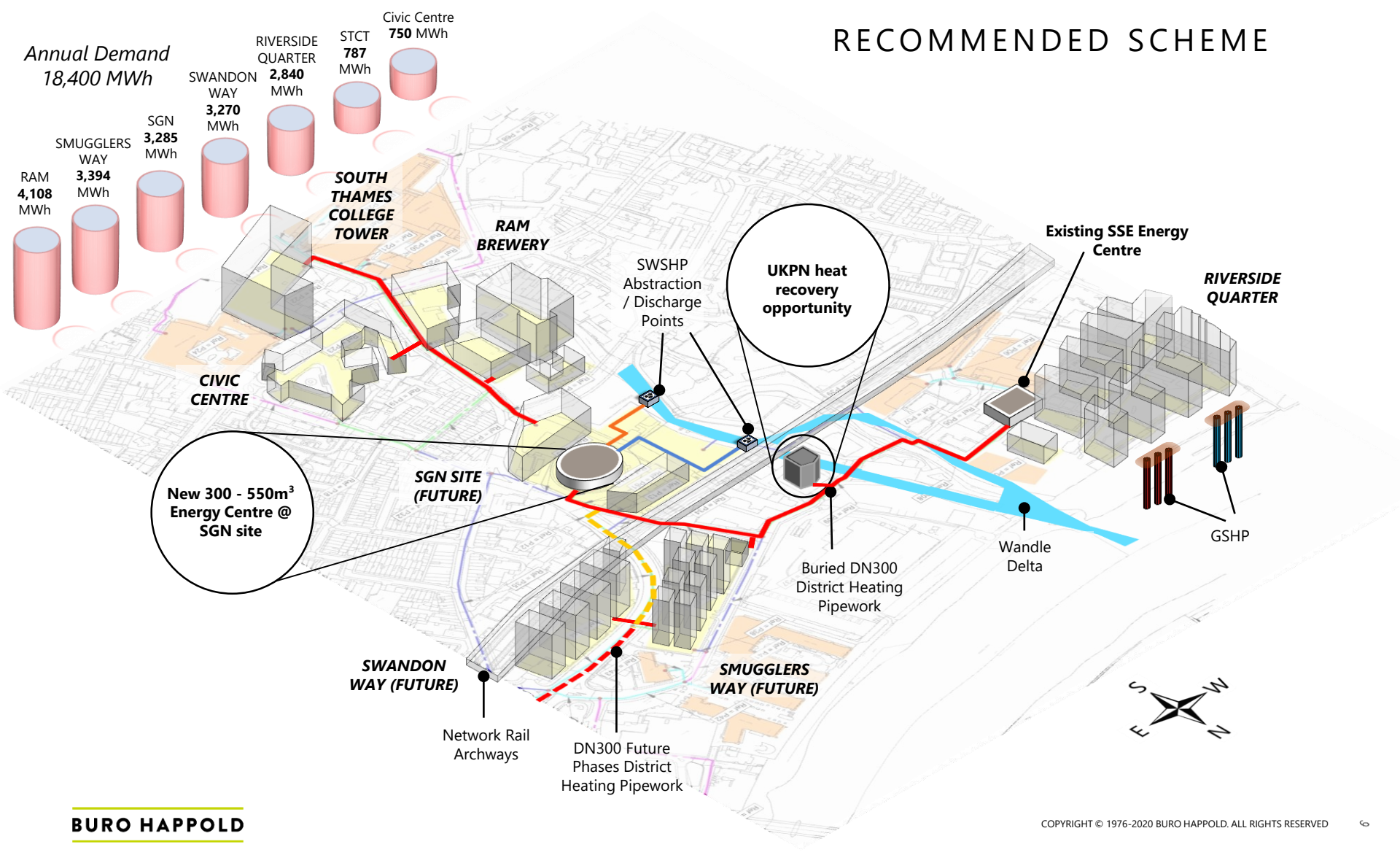
- We have identified an initial low carbon district energy scheme with potential to grow
- **High demand in a small area**
  - 3,000 units / 7 connections
  - ~18GWh/a
  - ~ £1.2m/a @ £70/MWh/a

  High linear heat density ~20 MWh/m

  Timing is still right to capitalise on upcoming development
- **Energy Centre availability** based around SGN Place
- **Access to Low carbon heat sources**
  - Wandle Delta for SWSHP estimated ~2MW capacity
  - Opportunity for ASHP integration on SGN Place roofs
  - Waste Heat from UKPN Substation
- **Opportunity for further customer acquisition** → ~55GWh/a



RECOMMENDED SCHEME



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KEY OPPORTUNITY – SWANDON / SMUGGLERS WAY DEVELOPMENT

- L&G development – clearing of B&Q underway
- ~1000 units in close proximity to SGN site
- Required connection for recommended scheme
- 36 month build programme @ old B&Q site (Smugglers Way) – Occupancy expected by 2022
- Old Homebase (Swandon Way) SOS TBC

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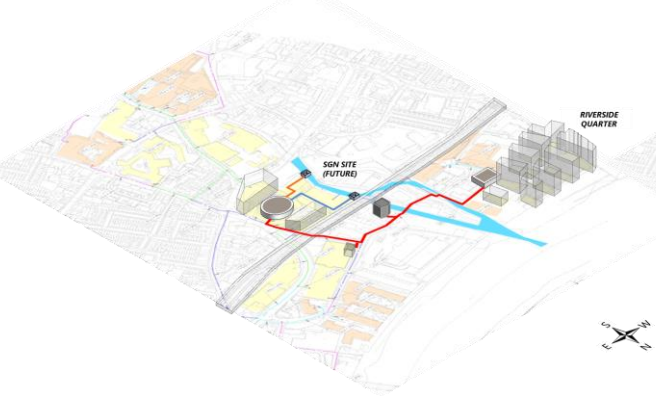
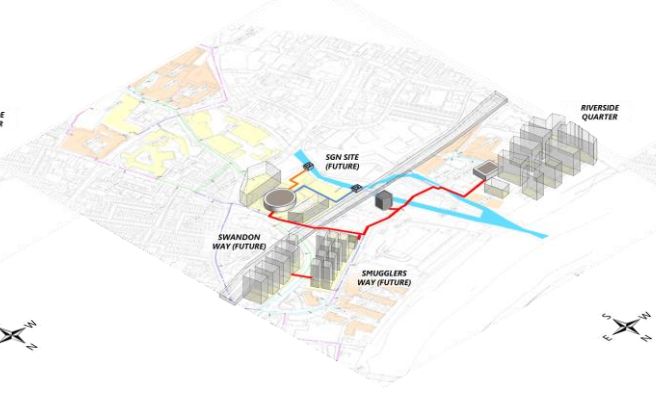
INITIAL SCHEME OPTIONS AND GROWTH POTENTIAL

Innovation Scheme



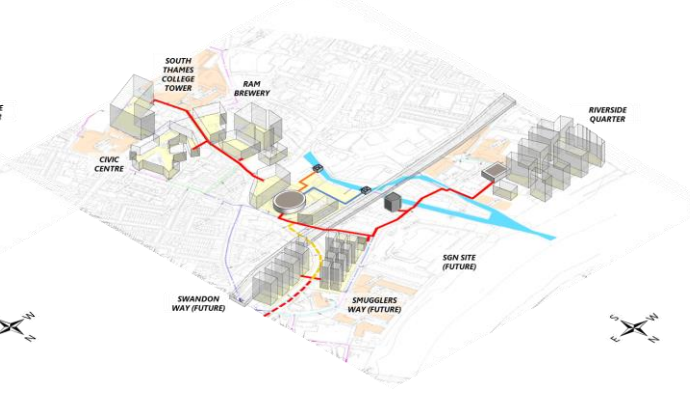
- SSE / SGN sites only
  - ~1,500 units + commercial
  - ~6,000 MWh/a
  - 12 MWh/m
- Limited benefit and reduced commercial performance
- Could play as an innovation scheme

Minimum scheme



- SSE / SGN sites + Smugglers / Swanson Way
  - ~2,400 units + commercial
  - 12,700 MWh/a
  - ~23 MWh/m
- High line density and opportunity to grow from SGN site

Recommended Scheme



- SSE / SGN sites + Smugglers / Swanson Way + RAM, Civic & STC
  - ~3,300 units + commercial
  - 18,400 MWh/a
  - ~20 MWh/m
- Likely commercially viable – good basis for extending network to capture future connections @ Southside Shopping Centre

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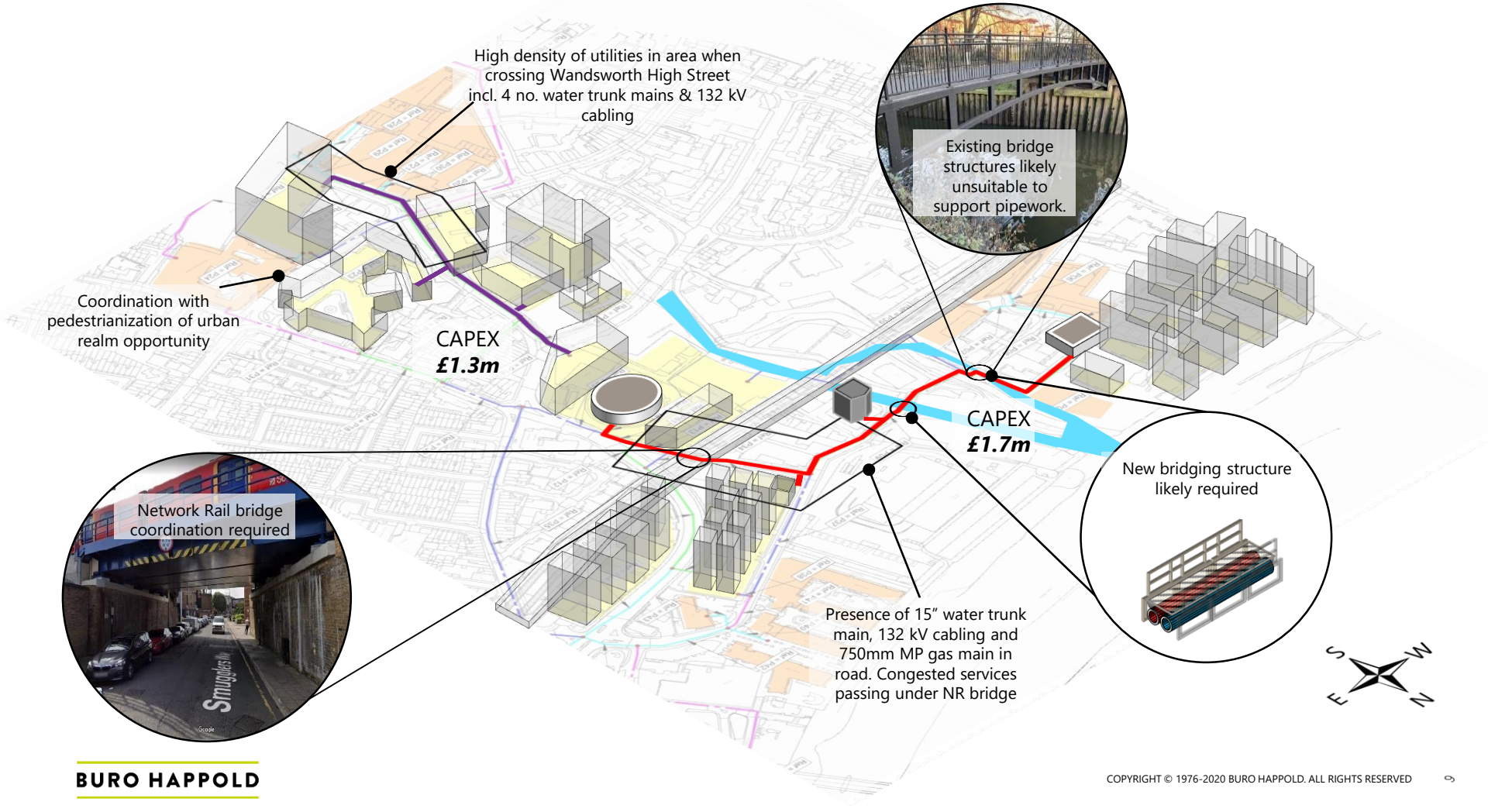
PREFERRED ROUTE – KEY RISK AREAS & CAPEX



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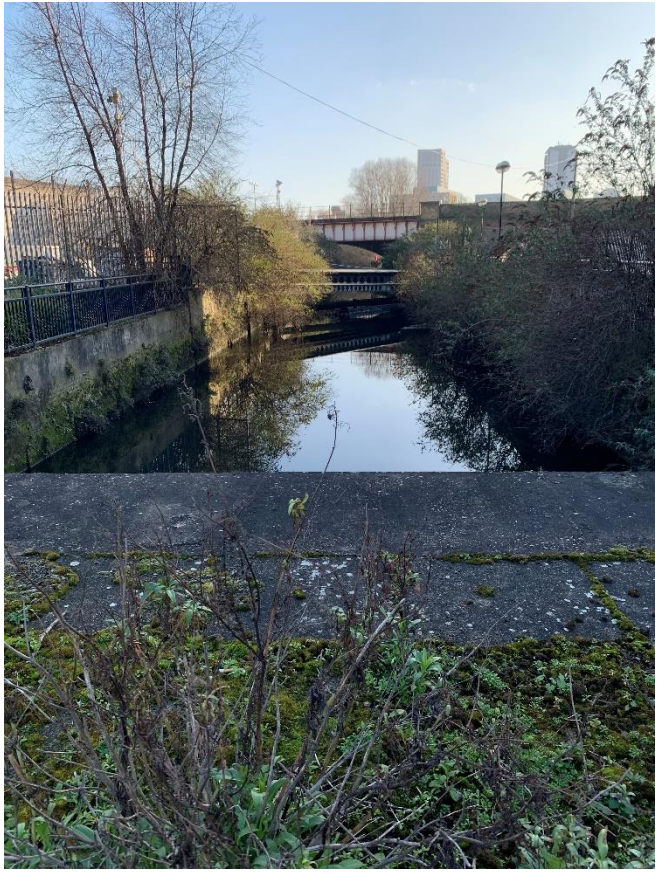
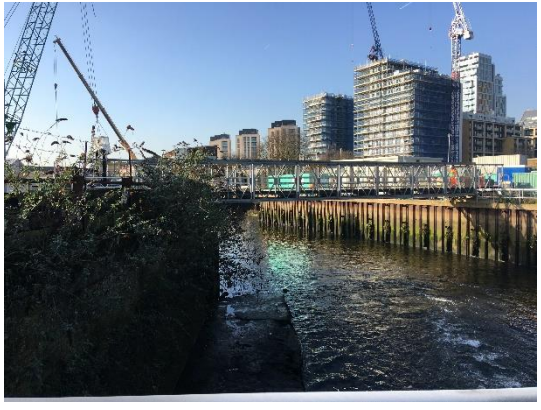
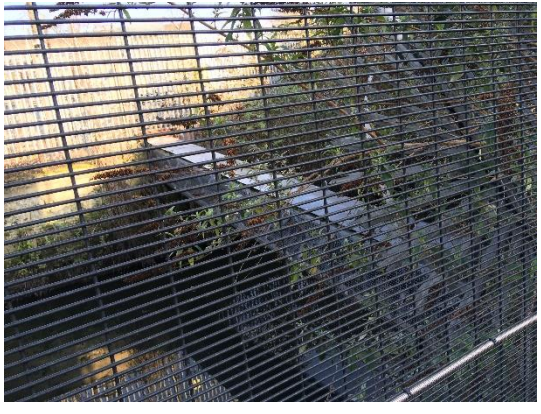
CONSTRAINTS

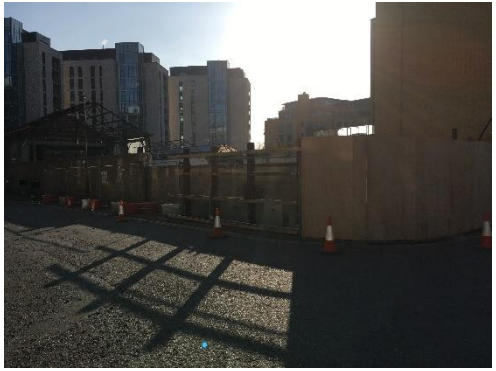
CONSTRAINTS – CONT.



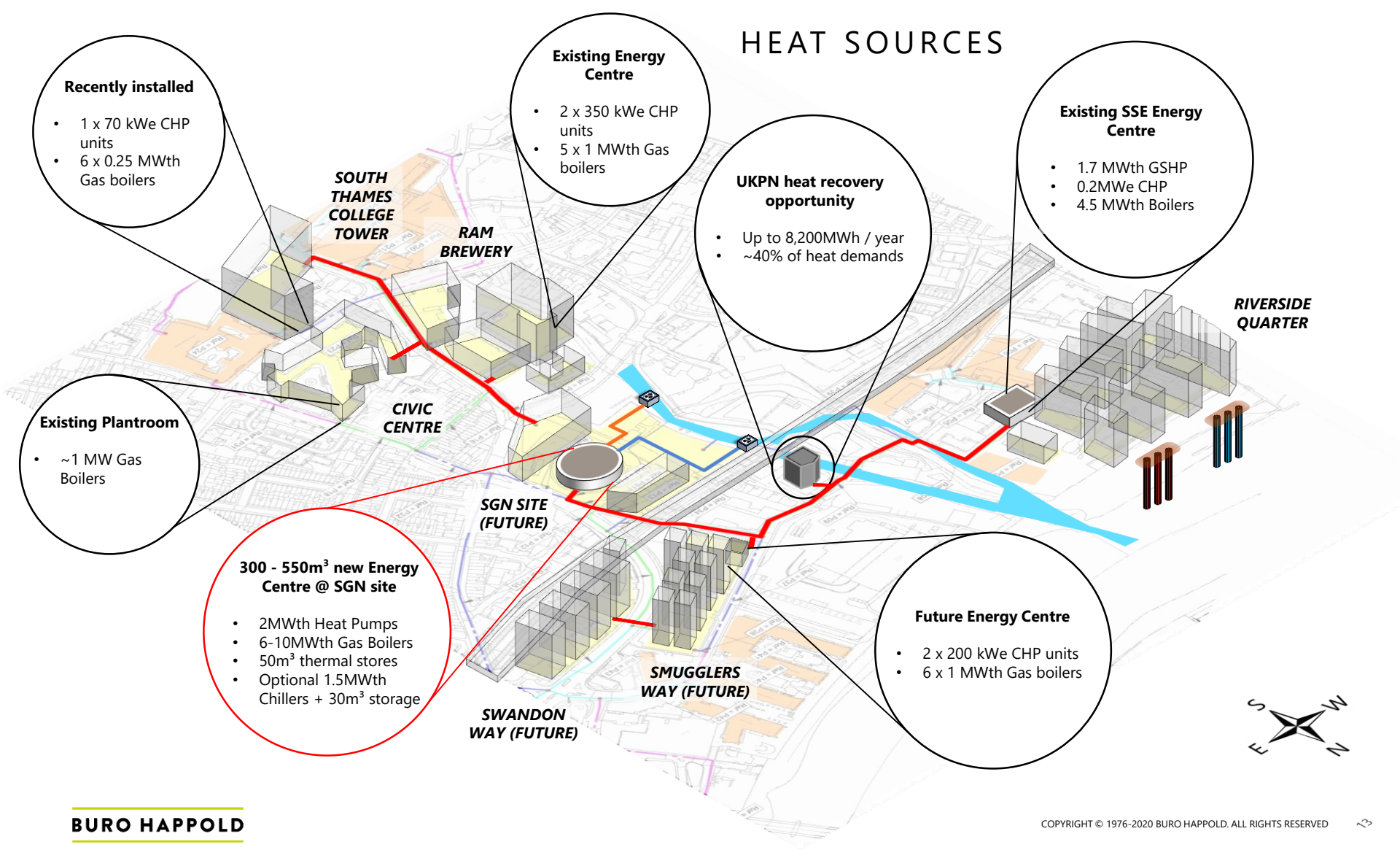




DEVELOPMENT



HEAT SOURCES



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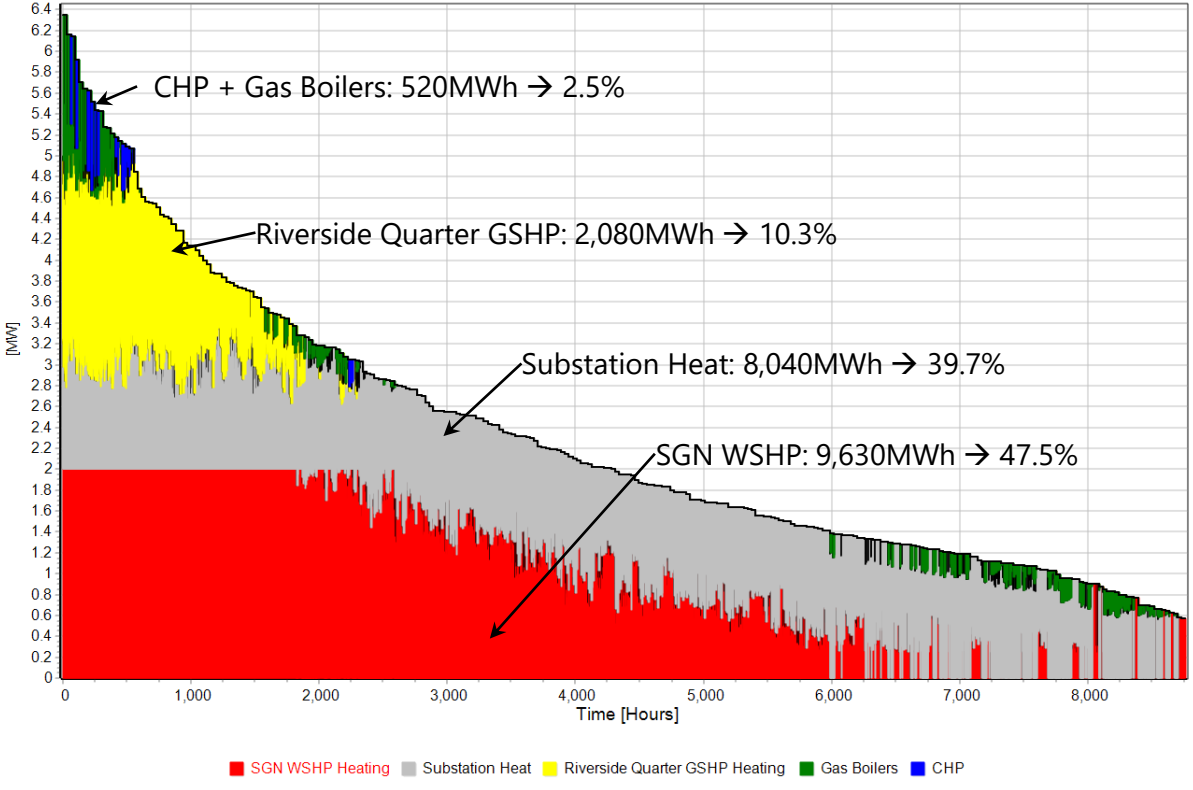
HEAT SUPPLY FRACTIONS – RECOMMENDED SCHEME

- Peak Demand ~12.8 MW
- Annual Demand ~18,400 MWh
- Connections:

1. Riverside Quarter *(existing)*
2. SGN site *(future)*
3. Swandon Way - Homebase *(future)*
4. Smugglers Way - B&Q *(future)*
5. RAM Brewery *(existing)*
6. Wandsworth Civic Centre *(existing)*
7. South Thames College Residential Tower *(future)*

Phase 1 – Load Duration Curve



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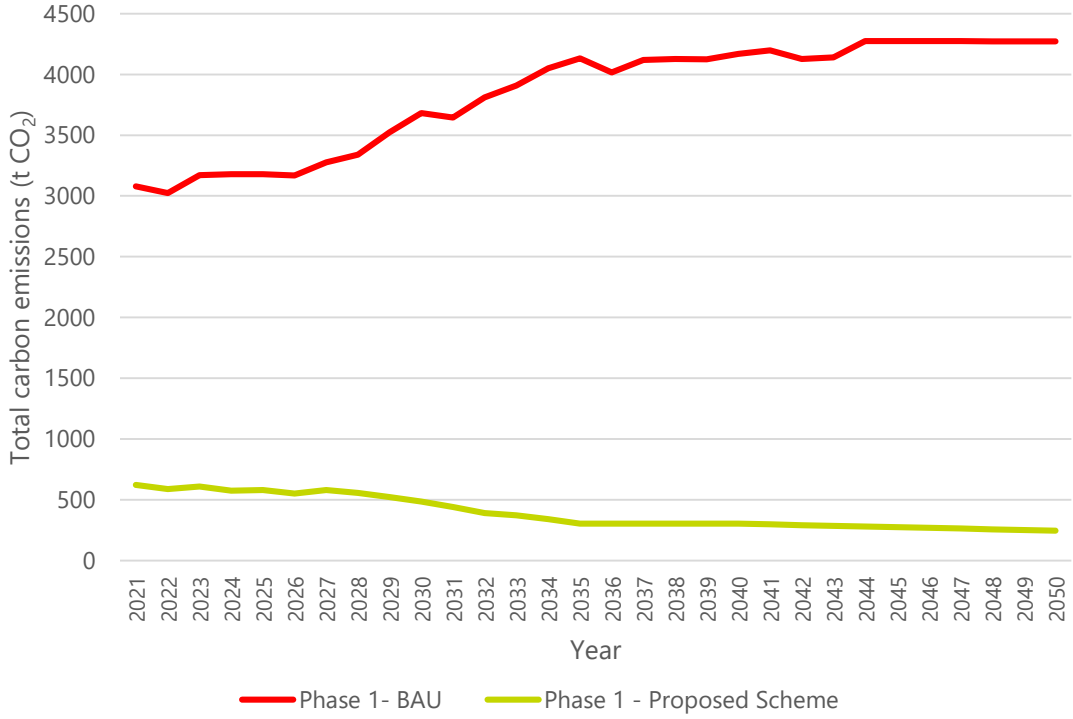
INDICATIVE CARBON - RECOMMENDED SCHEME
Proposed vs. BAU

- Proposed scheme:
  - 2021: ~5x less CO2 vs BAU
  - 2050: ~12x less CO2 vs BAU
- Key decarbonisation factors:
  - High contribution from power substation heat recovery (~40%)
  - High contribution from river and ground source heat pumps (~60%) with high efficiency (~350%)
  - Grid decarbonisation trend vs increasing CHP electricity carbon factors



Key Assumptions:
- BEIS carbon factor projections for electricity updated to May 2019
- BEIS bespoke carbon factors projections for CHP electricity
- BAU energy split: 45% CHP, 45% gas boilers, 10% WSHP

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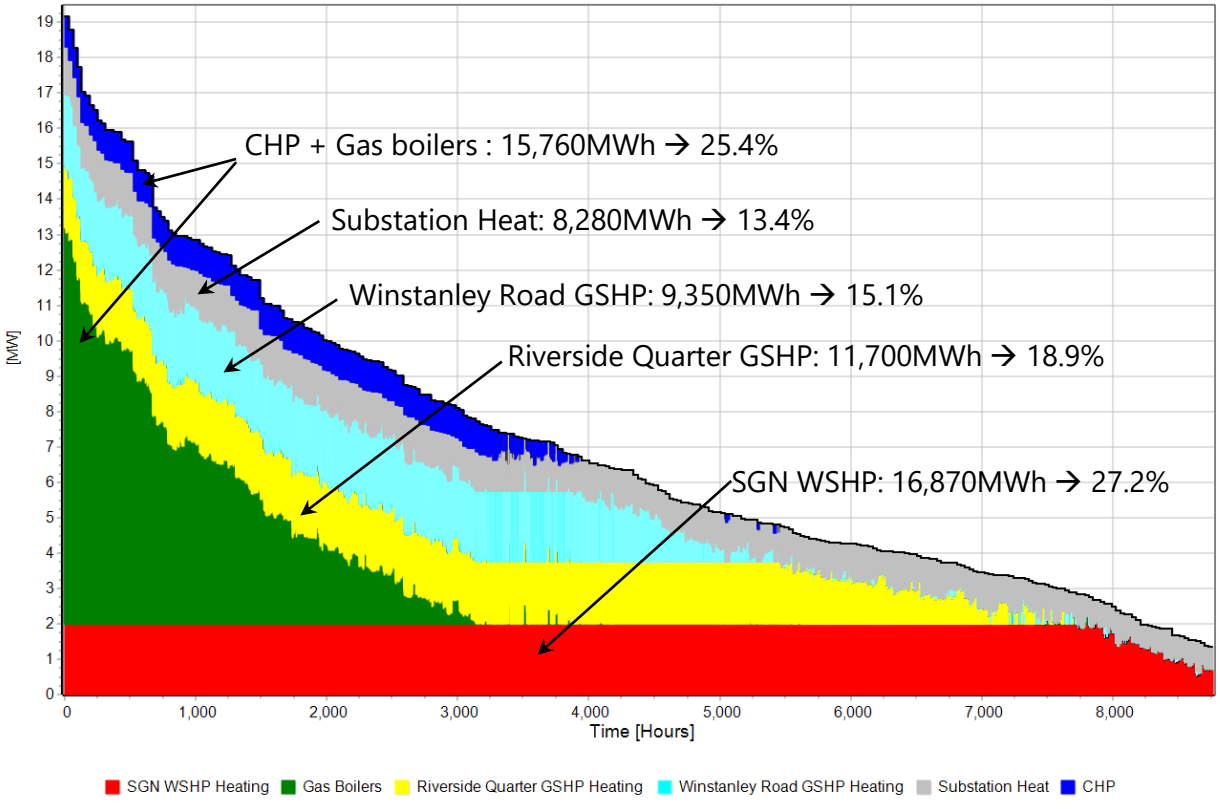
HEAT SUPPLY FRACTIONS – FULL SCHEME

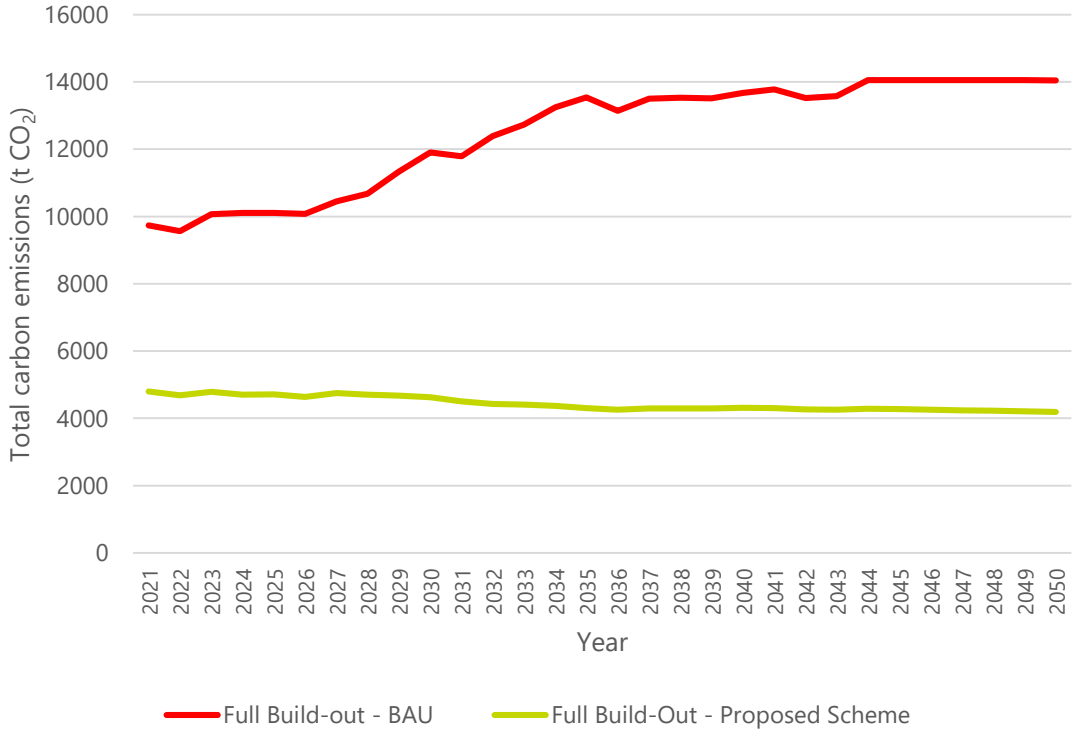
- Peak Demand ~39 MW
- Annual Demand ~56,300 MWh
- Assumes 2MW GSHP installed at Winstanley and connected to network

Full Build Out– Load Duration Curve



INDICATIVE CARBON - FULL-BUILDOUT
Proposed vs. BAU

- Proposed scheme:
  - 2021: ~2x less CO2 vs BAU
  - 2050: ~3.5x less CO2 vs BAU
- Key decarbonisation factors:
  - Reduced overall contribution from power substation heat recovery (~15%) vs Ph1 (~40%)→ more gas boilers (~20%) and CHP (~5%)
  - High contribution from water and ground source heat pumps (~60%) with high efficiency (~350%)
  - Grid decarbonisation trend vs increasing CHP electricity carbon factors



Key Assumptions:
- BEIS carbon factor projections for electricity updated to May 2019
- BEIS bespoke carbon factors projections for CHP electricity
- BAU energy split: 52% CHP, 45% gas boilers, 3% WSHP

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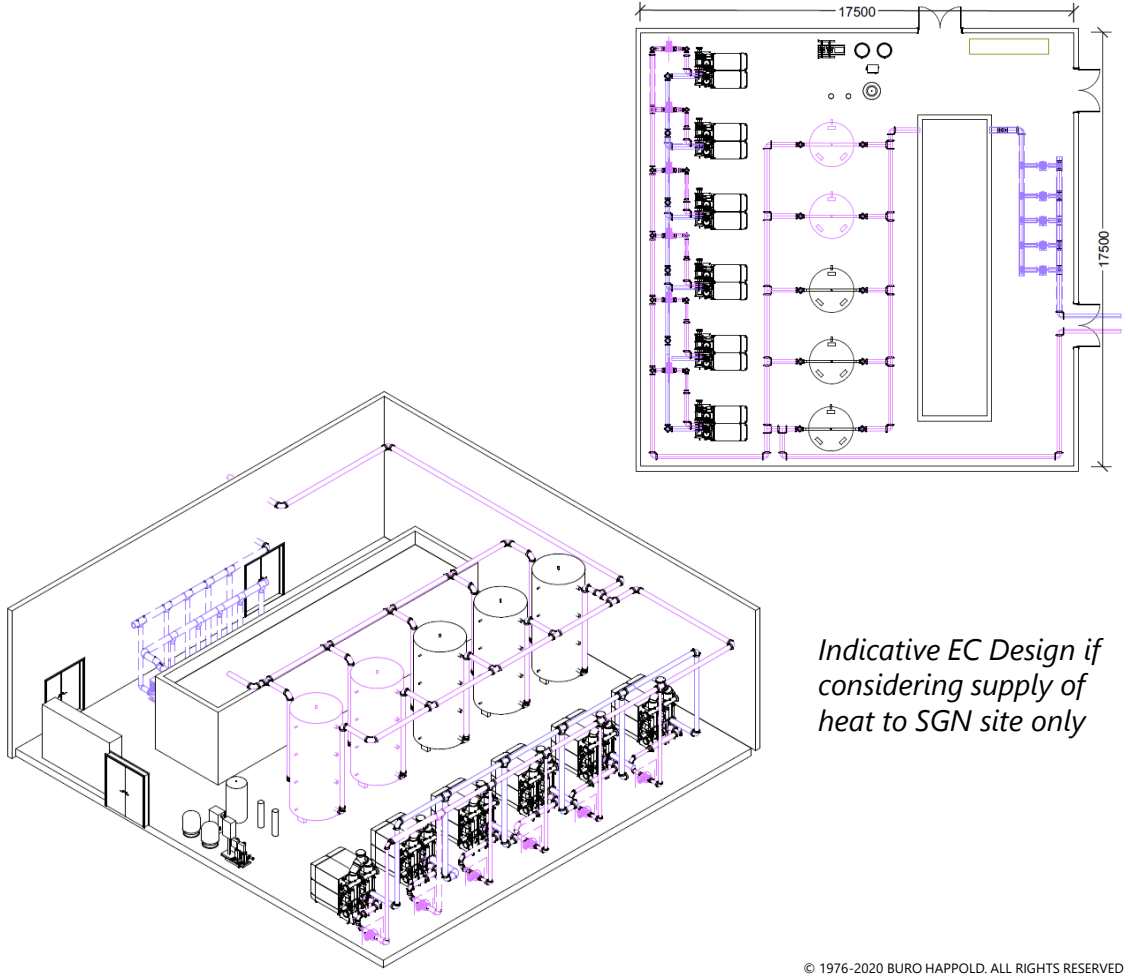
INITIAL EC SIZING – SGN SITE ONLY

- Initial Plant Requirements – SGN site only (assuming 1,000 homes), heating only
- Current GLA requirements stipulate need for energy centre
  - ~300m2 footprint
  - 2 MW of heat pumps + 50m3 thermal storage
  - OR 2 MW of roof mounted ASHP (occupying ~200m2 of roof area)
  - Up to 6 MW Boilers for peaking / backup

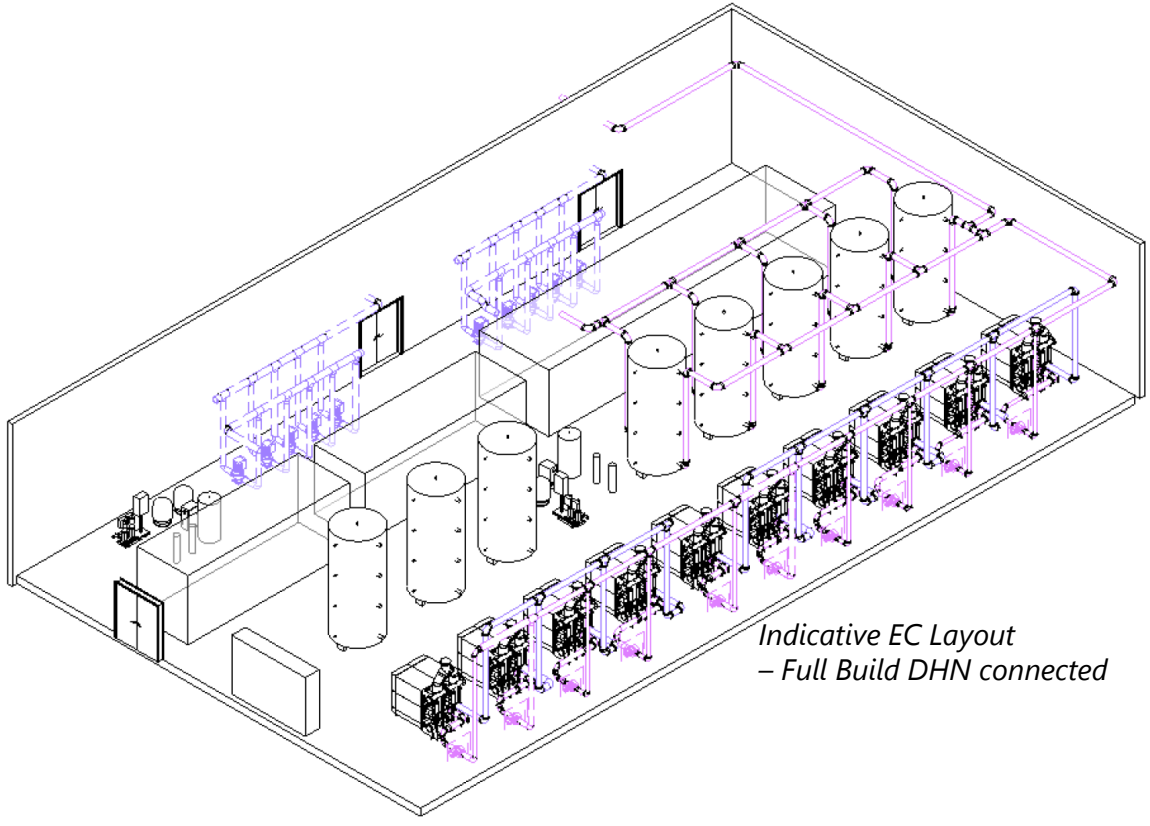


Indicative EC Design if considering supply of heat to SGN site only

INITIAL EC SIZING– TO SERVE WIDER DHN

- Future Plant Requirements for DHN
  - 550m2 footprint
  - 1.5 MW of Cooling Capacity (if required via SWSHP) + 30m3 CHW storage
  - Additional 4 MW of Boilers
  - Roof area could host air cooled chiller plant / ASHP if required
  - Below ground (I.e. basement area) would require supporting plant for mechanical ventilation
  - **Total – 12 MW Installed heating plant**
    - **10 MW Gas Boilers**
    - **2 MW Heat Pumps + 50m3 storage**

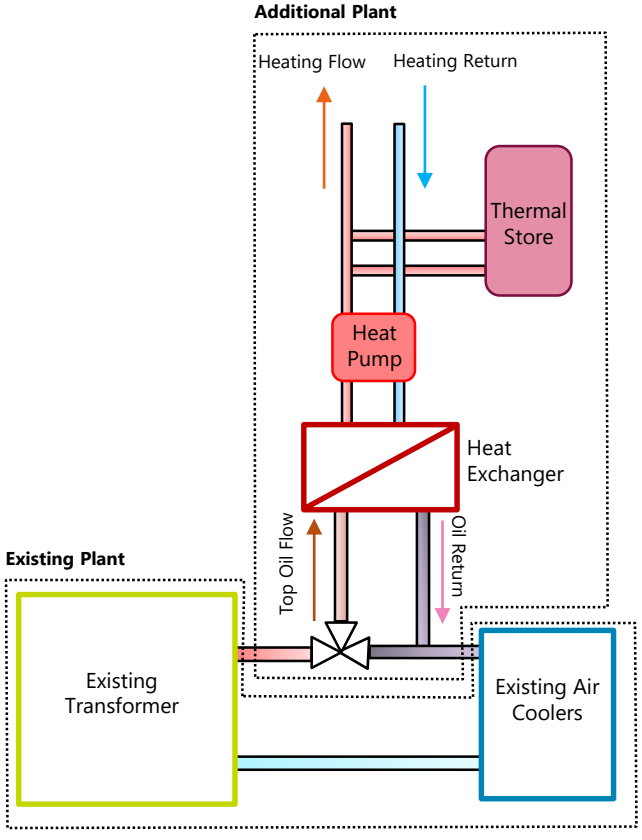
    (~1.5 MW cooling capacity)



Indicative EC Layout – Full Build DHN connected

UKPN TRANSFORMER HEAT RECOVERY
Estimated Heat Potential

- Recover heat from 4.no existing 132/66kV 90MVA transformers – operate 2 at a time.
- Typical heat loss per 90MVA transformer: ~700kW
- Constant profile
- Potential heat recovery incl. 10% losses: 630kW per TX ~ 1.26MWth peak total
- Annual Yield considering power demand profile: ~8,200MWh/year
- Up to ~40% of total Recommended Scheme heat demand
- Up to ~13% of total Full Scheme heat demand



TRANSFORMER HEAT RECOVERY:
Assessing benefits and potential issues

Benefits	Potential Issues
General: • Source of low carbon heat • Flagship 'trial' project To heat network operator: • Cheap supply of low carbon heat • Maximise local potential • Provide synergy with power operator To UKPN: • Potential additional source of income from heat sales • Allows to save money on transformer cooling power demand • Innovation project funding available • Off-setting grid reinforcement costs • Scalability and repeatability	General: • Relatively new system/lack of previous experience • Difficult in retrieving record data To heat network operator: • Spatial availability to fit new plant within substation needs to be checked • System operation and temperatures • Load variability (mismatch supply-demand) To UKPN: • Risks related to new system/lack of previous experience • Economic viability, including potential long payback

HEAT NETWORK CAPEX

Mapping the costs: Full Scheme

Section	Total Cost £m
1	1.7
2	1.0
3	0.3
4	0.7
5	0.5
6	0.9
7	1.8
8	3.0
Total	**9.8**

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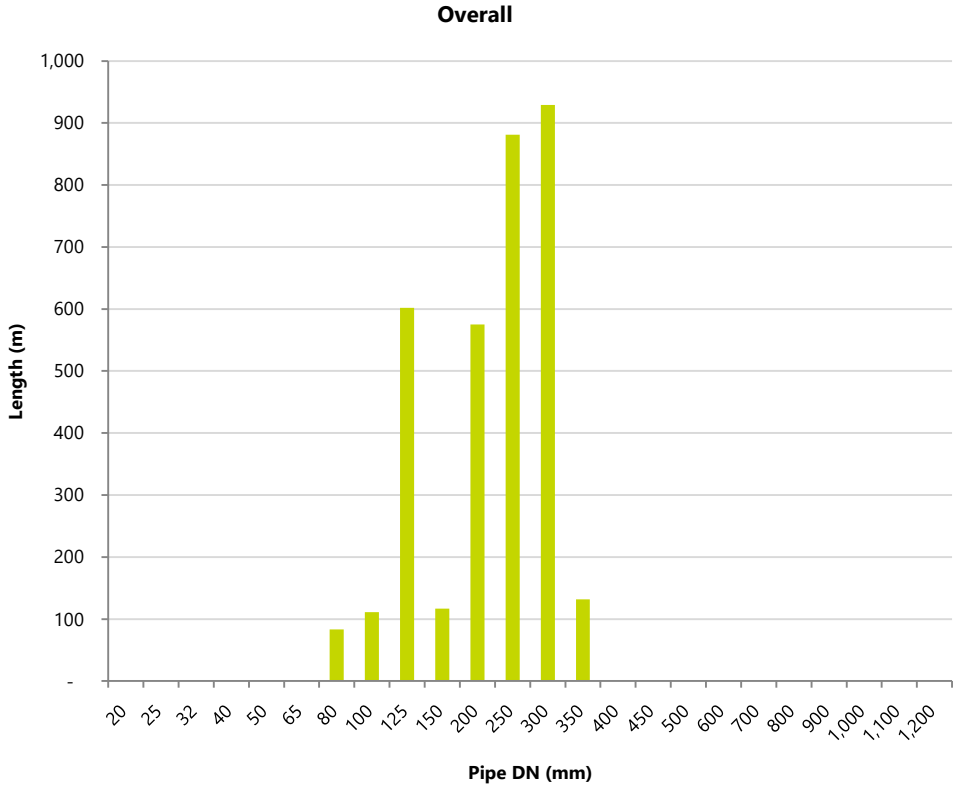
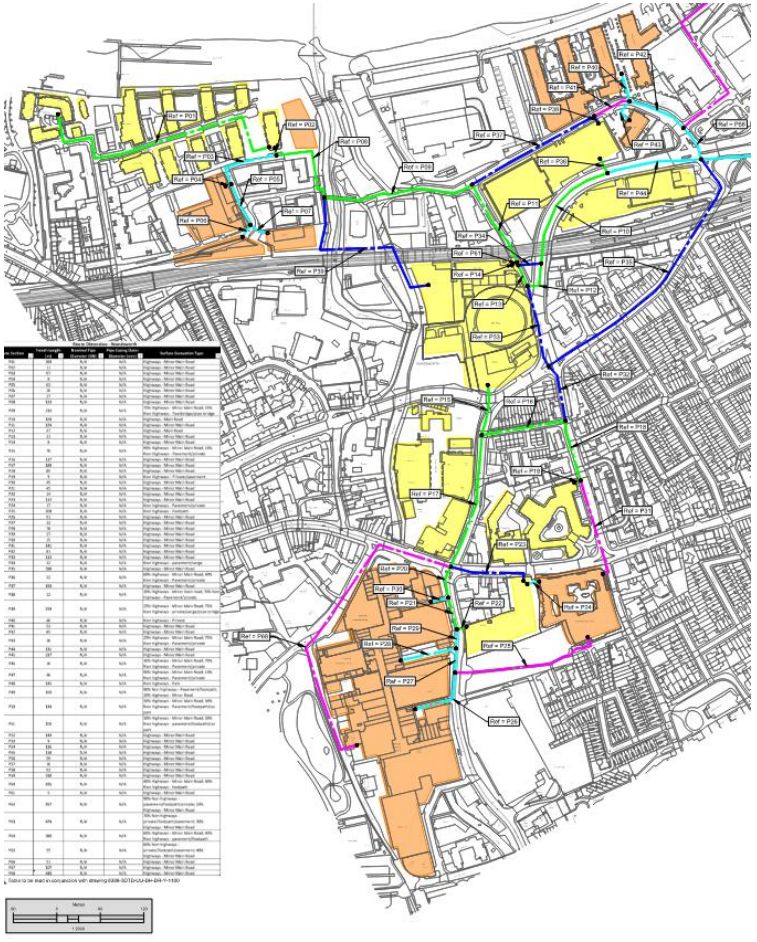
HEAT NETWORK PIPE SIZING
Summary

DN	Phase 1	Phase 2	Total
mm	m	m	m
80	-	83	83
100	-	111	111
125	31	571	602
150	14	103	117
200	333	242	575
250	45	836	881
300	319	610	929
350	132	-	132
TOTAL	**874**	**2,556**	**3,430**



HEAT NETWORK PIPE SIZING
Key Assumptions

- Pipe sizing based dT 30K -> 80 °C – 50 °C flow and return temperatures
- Design based on CP1 Heat Network Code of Practice
- Lengths based on preferred route (green in adjacent map)
- No on-plot network included. Assumed to be delivered by developer
- Pipe sizes calculated assuming all Ph1 and Ph2 building will be connected
- Therefore, in Ph1 pipe have future capacity



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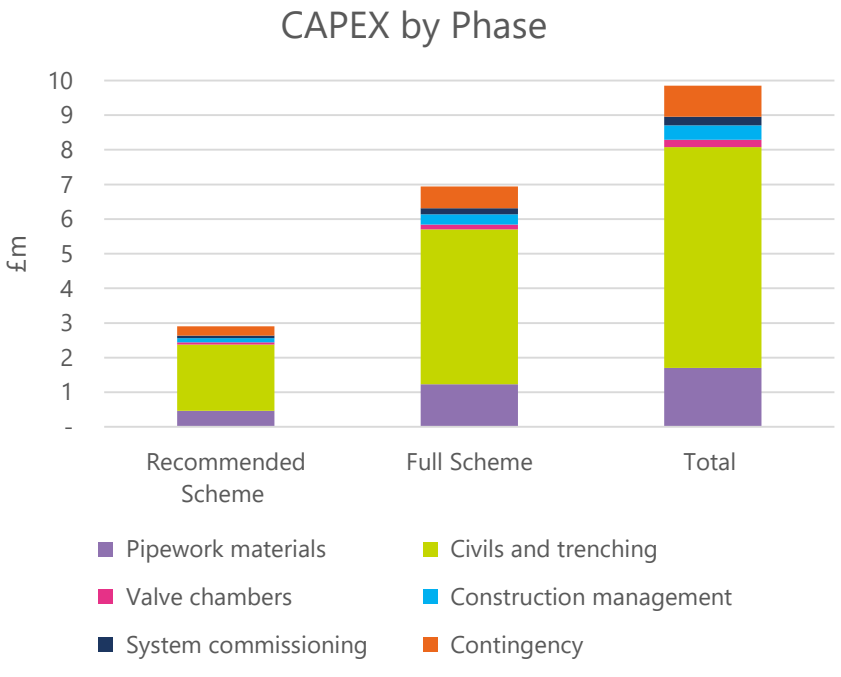
HEAT NETWORK CAPEX

Item	Cost £		
	Recommended Scheme	**Full Scheme**	**Total**
Pipework materials	466,300	1,234,500	1,700,800
Civils and trenching	1,909,700	4,470,100	6,379,800
Valve chambers	67,500	142,500	210,000
Construction management	122,200	292,400	414,500
System commissioning	73,300	175,400	248,700
Contingency	263,900	631,500	895,400
Total	**2,902,900**	**6,946,400**	**9,849,200**
Total Network Length m	874	2,556	3,430
Network Cost per unit length £/m	3,321	2,718	2,871



Notes –
1. Pipe bridging not included – depends on solution
2. Pipework within connected development areas not included

HEAT NETWORK CAPEX
Key Assumptions

Item	Notes
Pipework materials	• Based on Logstor 2020 budget prices for insulated steel pipes (Pipe Conti Nordic) • Potential 50% discount applicable as suggested by manufacturer (not currently applied)
Civils and trenching	• Based on all inclusive figures provided by 3D TD based on previous project experience including welding, sleeving, NDT, trenching, backfill and the different type of reinstatements • Different costs for different types of trenching considered (main road, pavement, minor road, soft dig, etc)
Valve chambers	• Based on typical cost per unit provided by 3D TD based on previous project experience • Total no. of valve chambers required equal to total no. of plot connection points plus number of supply points from energy centre. Potential additional valve chambers required included in contingency costs.
Construction management	• Allowance - 5%
System commissioning	• Allowance - 3%
Contingency	• Allowance - 10%

STAKEHOLDERS – NEXT STEPS FOR RECCOMENDED SCHEME

Stakeholder	Actions
SGN	• Continue early engagement for EC siting / sizing • Straight forward design integration for commercial benefit
UKPN	• Continue to engage to explore mutual benefit of heat offtake • Potential to access innovation funding? • Consider project development opportunity
Wandsworth Council	• Continue to engage planning departments – street works • Promote incentive of decarbonising their assets • Potential access to funding / future connection support
RAM Brewery	• Engage to determine commercial opportunity • Is there potential for cheaper low carbon heat?
L&G	• ESCo tender Smuggers Way / Swandon Way – still option to provide bulk supply if not awarded
L&Q	• Understand commercial proposition for STC

STRATEGIC CONSIDERATIONS
Implementation Plan – SGN based

SGN only

- **Primary EC @ SGN site**
- Coordinate with Design team to include EC for heat offtake beyond boundaries to South and North
- Initiate discussions re. river Wandle heat offtake with EA / CRT alternatively consider ASHP
- **Waste Heat offtake**
- Engagement with UKPN for heat offtake to SGN site

Bare Minimum Scheme

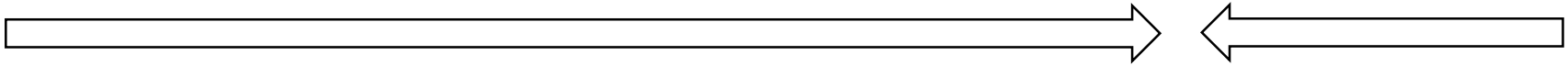
- **L&G - Swandon / Smugglers Way**
- Pursue strategy to connect to SGN site
- Consider Private Wire offtake to SGN heat pumps or omission of CHP from
- **Riverside Quarter**
- Connect to Riverside Quarter to share low carbon heat / peaking plant

Recommended Scheme – 3rd party connections

- Initiate discussions with **RAM** – can they be connected to in first instance?
- **Wandsworth Council**
- Civic Centre
- Council owned tower blocks
- Engage with **L&Q Energy** for STC connection

Long term interconnection

- Continue review of benefit of interconnection to Winstanley
- Continue to pursue development of a sitewide heating strategy with the potential for offsite export



Initial Network Rollout

Future Expansion

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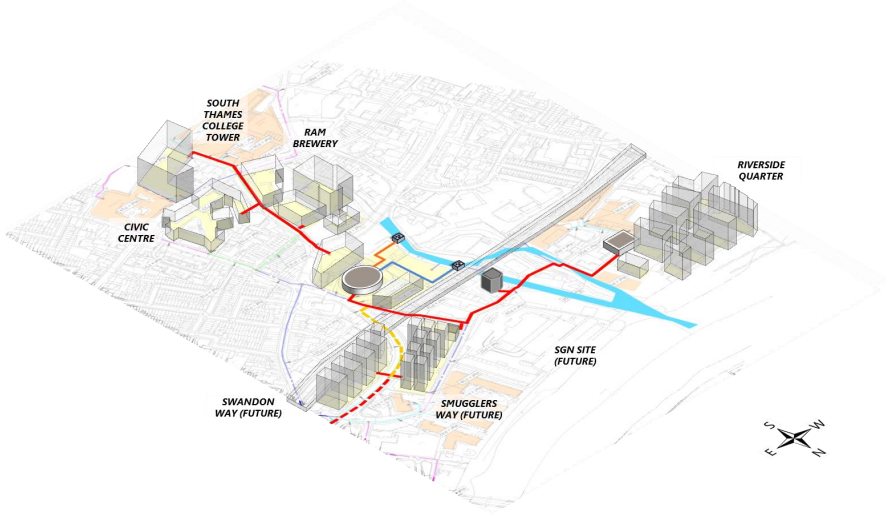
NEXT STEPS

- **Confirm commercial viability of recommended scheme**
  - SSE to model techno-economic benefit of recommended scheme
  - How much funding required
- **Techno-economic development (~£50-70k, 4 months)**
  - Further detailed techno-economic feasibility study to:
  - De-risk network routing – particularly high risk areas
  - Refine plant sizing & demands
  - Understand technical interfaces
- **Customer acquisition** - progress engagement
- **SGN Place** – continue development
  - Energy strategy to include DH offtake



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JUMP ON BOARD!

We'd love to hear from you

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