
# *NATIONAL GRID ELECTRICITY DISTRIBUTION*

## *FLEXIBLE OPERATION OF WATER NETWORKS ENABLING RESPONSE SERVICES (FLOWERS)*

## *FLOWERS D3-2 CASE STUDY SELECTION*

***VERSION 2 – 07/10/2022 (D. PENFOLD)***

# 1. TABLE OF CONTENTS



| **Document Control** | **Name** | **Date** |
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## 2. PROJECT OVERVIEW

The FLOWERS project will analyse the potential ability of South West Water's (SWW) network to embed energy flexibility capacity in the time difference (latency) between when drinking water and wastewater are pumped and stored, and when it is used by the system. It will explore methods of delivering latency flexibility and analyse the feasibility of implementing it on SWW's systems. It will define the regulatory compliance and commercial viability requirements for the creation of a latency flexibility product which can be embedded within Western Power Distribution's (WPD) electricity network control rooms. If appropriate, a recommendations document will be produced identifying the next steps for the development of latency flexibility capacity in ED2.

## 3. DOCUMENT PURPOSE

This document is one of several that will be published about the FLOWERS Project, which is primarily a desktop-based analysis that is designed to establish the efficacy and scale of potential innovations discussed in the previous section. The project will require the engagement of both water and electricity regulators to determine whether benefits will be permitted to go forward to BaU.

This specific document is intended to focus on the methodology used, and the outcome of, identifying SWW sites that could be used for desk top case studies in relation to implementing the initiatives identified as part of LFA 1.

The case studies will be used to determine the implementability, costs, energy capacity released, how long the capacity could be released and a benefit analysis for both SWW and WPD.

## 4. EXECUTIVE SUMMARY

The sites selected need to consider that most of the identified initiatives are based around pumping operations. Therefore, the sites selected need to be representative of the different types of operations that could implement the identified initiatives.

The criteria set out several "Must Haves" and "Nice to Haves" along with ensuring a spread of site types from Drinking Water Treatment (DW WT), Drinking Water Distribution (DW WD), Waste Water Sewage Treatment (WW ST) and Wastewater Distribution (WW MD) with at least one of each type needing to be identified.

For WW ST sites, and the understanding that energy demand is predominantly driven by rain events, the sites selected will potentially need to encompass sites that see on average more rainfall and sites that see less rainfall.

Table 4-1 identifies the sites proposed for the desktop case study.

| TYPE OF SITE | SITES |
|---|---|
| Wastewater - Sewage Treatment | Ashford – Barnstaple & Hayle (has AD Plant) |
| Wastewater - Mains Distribution | Pottington & Porthgwidden |
| Drinking Water - Water Treatment | Pynes |
| Drinking Water - Water Distribution | Dunsford Hill |

*Table 4-1 Sites Proposed*

# 5. PROBLEM STATEMENT

The specific problem, that this report is intending to resolve, is the development of a methodology to identify which sites would be representative of the SWW estate where the identified initiatives could be implemented.

As seen in table 5-7 below most of the initiatives are based on pumping operations therefore ideally the sites identified could implement these. The sites identified would also need to allow the project to identify potential costs and benefits to both SWW and WPD.

| LOW HANGING FRUIT | DRINKING WATER | | | WASTE WATER | | ENERGY DEMAND REDUCTION CATEGORY |
|---|---|---|---|---|---|---|
| Initiative | WATER TREATMENT (DW WT) | WATER DISTRIBUTION (DW WD) | POWER GENERATION (DW PG) | WASTE MAINS DISTRIBUTION (WW MD) | WASTE SEWAGE TREATMENT (WW ST) | |
| DWS & WWS - turndown/switch off of pumps | YES | YES | N/A | YES | YES | PUMPING |
| DWS & WWS - Review all set points are as needed for current demand and operating as expected | YES | YES | N/A | YES | YES | PUMPING |
| DWS & WWS - Produce pumping profile based on a model that creates a schedule for control room. | YES | YES | N/A | YES | YES | PUMPING |
| DWS - Drinking water reservoir pre-filling | YES | N/A | N/A | N/A | N/A | PUMPING |
| WWS - Re-Profiling levels of storage | N/A | N/A | N/A | N/A | YES | PUMPING |

| MORE CHALLENGING | DRINKING WATER | | | WASTE WATER | | ENERGY DEMAND REDUCTION CATEGORY |
|---|---|---|---|---|---|---|
| Initiative | WATER TREATMENT (DW WT) | WATER DISTRIBUTION (DW WD) | POWER GENERATION (DW PG) | WASTE MAINS DISTRIBUTION (WW MD) | WASTE SEWAGE TREATMENT (WW ST) | |
| WWS & DWS - Pump size increase and/or mismatch check verses volume requirements | YES | YES | N/A | YES | YES | PUMPING |
| WWS - Changing usage of infiltration pumping based on forecasting | N/A | N/A | YES | N/A | YES | PUMPING |

| WORTHWHILE WITH FOCUS | DRINKING WATER | | | WASTE WATER | | ENERGY DEMAND REDUCTION CATEGORY |
|---|---|---|---|---|---|---|
| Initiative | WATER TREATMENT (DW WT) | WATER DISTRIBUTION (DW WD) | POWER GENERATION (DW PG) | WASTE MAINS DISTRIBUTION (WW MD) | WASTE SEWAGE TREATMENT (WW ST) | |
| DWS - Pump Variable Speed Drives | YES | YES | N/A | N/A | N/A | PUMPING |
| WWS - Sea water infiltration pumping. | N/A | N/A | N/A | N/A | YES | PUMPING |
| WWS - Storm Tanks usage to hold off treatment works | N/A | N/A | N/A | N/A | YES | PUMPING |

| ENERGY MANAGEMENT EFFICIENCY | DRINKING WATER | | | WASTE WATER | | ENERGY DEMAND REDUCTION CATEGORY |
|---|---|---|---|---|---|---|
| Initiative | WATER TREATMENT (DW WT) | WATER DISTRIBUTION (DW WD) | POWER GENERATION (DW PG) | WASTE MAINS DISTRIBUTION (WW MD) | WASTE SEWAGE TREATMENT (WW ST) | |
| WWS & DWS Reducing energy usage with refurbished pumps | YES | YES | N/A | YES | YES | PUMPING |

*Table 5-1 Pumping Initiatives*

# 6. KEY CONTACTS – INTERNAL AND EXTERNAL

The key personnel interacted throughout the project so far are as follows:

| Name | Position | Company |
|---|---|---|
| **Project Team (Western Power Distribution WPD, Smart Grid Consultancy SGC & South West Water SWW)** | | |
| Angus Berry | Head of Energy | SWW |
| James Haigh | Energy and Generation Engineer | SWW |
| Jade Kennerley | Energy and Carbon Technician | SWW |
| David Penfold | Project Manager | SGC |
| Gary Swandells | Director | SGC |
| George Major | Data Analyst | SGC |
| Emma Burns | Consultant | SGC |
| Nick Devine | Weston Power Distribution Innovation Engineer | WPD |
| Stuart Fowler | Weston Power Distribution Innovation Engineer | WPD |
| **Drinking Water Services (DWS) Specialists** | | |
| Gary Furse | Resources & Production Operations Manager | SWW |
| Ben Morrell | Central Process Control Team Manager (DW R&P) | SWW |
| Richard Adams | Head of SWW DWS Networks | SWW |
| Tom Martin | DWS Network Area Manager | SWW |
| Haden Squire | | SWW |
| **Wastewater Services (WWS) Specialists** | | |
| David Helicon | Principal Scientist (WW R&T) | SWW |
| Nick Gardner | Scientist (WW R&T) | SWW |
| Paul Lakeman | Regional Maintenance Manager (WW R&T) | SWW |
| Daniel Woolf | WWS Recovery & Treatment Area Manager | SWW |

# 7 SELECTION CRITERIA

As previously discussed, the selection criteria set out several “Must Have” and “Nice to Have” along with ensuring a spread of site types from Drinking Water Treatment (DW WT), Drinking Water Distribution (DW WD), Waste Water Sewage Treatment (WW ST) and Wastewater Distribution (WW MD) with at least one of each type needing to be identified.

These must haves were split into 2 sets

1. **Generic** – All sites need to have in place
2. **By Site Grouping** – Specific to each type of site

## 7.1 Must Haves - Generic

Any site selected must have the following in place already

| | | |
|---|---|---|
| ✓ Be in a Constraint Management Zone | ✓ Half Hourly Main Meter | ✓ Historic Energy Data Available (Min 1 Year) |

### 7.2 Must Haves: Wastewater - Sewage Treatment (WW ST)

Any WW ST site must have the following in place already

| | | | |
|---|---|---|---|
| ✓ Remote Pumping Control | ✓ Pumping Set Points Management System | ✓ Water flow measurement | ✓ Aeration control system |

### 7.3 Must Haves: Wastewater - Mains Distribution (DW WT)

Any WW MD site must have the following in place already

| | | |
|---|---|---|
| ✓ Remote Pumping Control | ✓ Pumping Set Points Management System | ✓ Water flow measurement |

### 7.4 Must Haves: Drinking Water – Water Treatment (DW WT)

Any WW MD site must have the following in place already

| | | |
|---|---|---|
| ✓ Remote Pumping Control | ✓ Pumping Set Points Management System | ✓ Water flow measurement |

### 7.5 Must Haves: Drinking Water – Water Distribution (DW WD)

Any WW MD site must have the following in place already

| | | |
|---|---|---|
| ✓ Remote Pumping Control | ✓ Pumping Set Points Management System | ✓ Water flow measurement |

### 7.6 Nice to Have

The selection criteria then included several “Nice to Have” with the understanding that if these were not in place this would not preclude the site from being selected. The below are the nice to haves that were identified as being important for the case study selection.

| | | |
|---|---|---|
| ⇒ Solar PV Installed | ⇒ Solar PV Planned | ⇒ Existing Submetering |
| ⇒ Onsite CHP | ⇒ Onsite Hydro | ⇒ Ammonia Treatment |

### 7.7 Locational Criteria

The case study criteria also included needing to identify sites that had the following differences as these were deemed as being a potential impact on energy demand

| | | |
|---|---|---|
| ⇒ Urban | ⇒ Rural | ⇒ Coastal |
| ⇒ Seasonal Population Growth | ⇒ Topographically Hilly Catchment | ⇒ Topographically Flat Catchment |

### 7.8 SWW Site Selection Criteria Ranking

The next step in the site selection process was to identify all SWW sites and determine which sites fulfilled the selection criteria in priority order as below. Sites were then ranked by the level of compliance with the highest compliance sites being added to a case study shortlist.

Priority 1 – Must Haves Generic
Priority 2 – Must Haves By Site Grouping

Priority 3 – Nice to Haves

The shortlisted sites were then visited and discussed with the local Area Managers to conclude if the sites would be suitable for the case study, then any follow up physical trial.

# 8 SOUTHWEST WATER SHORTLIST CASE STUDY SITES

This section details the shortlisted sites which have more than average maximum demand of the specific site category. The yellow highlighted sites are within current constraint management zones and the red highlighted sites are the proposed desktop case study sites.

## 8.1 Wastewater – Sewage Treatment

The following sites have above the average Max Demand of 186kW for this type of sites.

| SITE NAME | POSTCODE | Current Max Demand (kW) | Max Flex (kW) | IN A CMZ |
|---|---|---|---|---|
| HAYLE_STW_HAYLE | TR27 6LA | 1,735 | 677 | Constraint Management Zone Facing |
| ASHFORD_STW_BARNSTAPLE | EX31 4BR | 795 | 310 | Constraint Management Zone Facing |
| CAMBORNE_STW_CAMBORNE | TR14 0BN | 505 | 197 | Constraint Management Zone Facing |
| LORDS MEADOW_STW_CREDITON | EX17 1ER | 333 | 130 | Constraint Management Zone Facing |
| HELEBRIDGE_STW_BUDE | EX23 0JA | 259 | 101 | Constraint Management Zone Facing |
| ILFRACOMBE_STW_ILFRACOMBE | EX34 9QG | 188 | 73 | Constraint Management Zone Facing |
| CENTRAL_STW_PLYMOUTH | PL4 0PX | 2,661 | 1,038 | |
| COUNTESS WEAR_STW_EXETER | EX2 7RZ | 1,915 | 747 | |
| BROKENBURY QUARRY_STW_TORBAY | TQ5 0LL | 1,753 | 684 | |
| NEWQUAY_STW_NEWQUAY | TR8 4QD | 830 | 324 | |
| BUCKLAND_STW_NEWTON ABBOT | TQ12 4SA | 774 | 302 | |
| CAMELS HEAD_STW_PLYMOUTH | PL2 2JH | 585 | 228 | |
| FALMOUTH_STW_FALMOUTH | TR11 4NJ | 578 | 225 | |
| MARSH MILLS_STW_PLYMPTON | PL7 1YB | 501 | 195 | |
| PAR_STW_ST AUSTELL | PL24 2SQ | 472 | 184 | |
| NEWHAM_STW_TRURO | TR1 2SU | 455 | 178 | |
| ERNESETTLE_STW_PLYMOUTH | PL5 2SA | 431 | 168 | |
| MENAGWINS_STW_ST AUSTELL | PL26 7AP | 355 | 138 | |
| CORNBOROUGH_STW_BIDEFORD | EX39 5BE | 325 | 127 | |
| DARTMOUTH_STW_DARTMOUTH | TQ6 9HU | 293 | 114 | |
| MAER LANE_STW_EXMOUTH | EX8 5DB | 284 | 111 | |

| SITE NAME | POSTCODE | Current Max Demand (kW) | Max Flex (kW) | IN A CMZ |
|---|---|---|---|---|
| NANSTALLON_STW_BODMIN | PL31 2QX | 262 | 102 | |
| TOTNES_STW_TOTNES | TQ9 6LS | 216 | 84 | |
| RADFORD_STW_PLYMOUTH | PL9 9DF | 212 | 83 | |
| HILL BARTON_STW_OKEHAMPTON | EX20 2RT | 207 | 81 | |

### 8.2 Wastewater – Mains Distribution

The following sites have above the average Max Demand of 171kW for this type of site.

| SITE NAME | POSTCODE | Current Max Demand (kW) | Max Flex (kW) | IN A CMZ |
|---|---|---|---|---|
| CHYANDOUR_SPST_PENZANCE | TR18 2NG | 851 | 766 | Constraint Management Zone Facing |
| PORTHGWIDDEN_SPST_ST IVES | TR26 1PP | 612 | 551 | Constraint Management Zone Facing |
| POTTINGTON ESTUARY_SPST_BARNSTAPLE | EX31 1NP | 511 | 460 | Constraint Management Zone Facing |
| NORTHAM FSCN_SPST_WESTWARD HO | EX39 1TW | 460 | 414 | Constraint Management Zone Facing |
| BRIDGE_SPST_PORTREATH | TR16 4NF | 435 | 391 | Constraint Management Zone Facing |
| CASTLE_SPST_BUDE | EX23 8LG | 251 | 226 | Constraint Management Zone Facing |
| MAER ROAD_SPST_EXMOUTH | EX8 2DB | 632 | 569 | |
| ILSHAM VALLEY_SPS_TORQUAY | TQ1 2PN | 610 | 549 | |
| BIDEFORD FSCN_SPST_BIDEFORD | EX39 2QN | 603 | 543 | |
| NEWHAM ROAD_SPST_TRURO | TR1 2DP | 512 | 460 | |
| MAYORS AVENUE_SPST_DARTMOUTH | TQ6 9NG | 361 | 325 | |
| FLEET WALK_SPS_TORQUAY | TQ2 5SR | 288 | 260 | |
| OXEN COVE_SPST_BRIXHAM | TQ5 8AR | 277 | 249 | |
| FORDE ROAD_SPS_NEWTON ABBOT | TQ12 4AE | 276 | 248 | |
| BLUE BALL_SPS_EXETER | EX2 7JL | 230 | 207 | |
| GANNEL_SPST_NEWQUAY | TR7 2HS | 199 | 179 | |
| PORTH TOURIST PARK_SPS_NEWQUAY | TR7 3NB | 183 | 164 | |
| CLENNON VALLEY_SPS_PAIGNTON | TQ4 5JR | 179 | 161 | |
| SALTASH ROAD_SPS_PLYMOUTH | PL2 1QT | 176 | 159 | |
| TOWAN HEAD_SPS_NEWQUAY | TR7 1HS | 172 | 155 | |
| THE HAM_SPST_SIDMOUTH | EX10 8BG | 162 | 146 | |

### 8.3 Drinking Water – Water Treatment

The following sites have above the average Max Demand of 183kW for this type of site.

| SITE NAME | POSTCODE | Current Max Demand (kW) | Max Flex (kW) | IN A CMZ |
|---|---|---|---|---|
| PYNES_WTW_EXETER | EX5 5EQ | 1,549 | 465 | Constraint Management Zone Facing |
| DRIFT_WTW_PENZANCE | TR19 6AA | 341 | 102 | Constraint Management Zone Facing |
| PYNES_PRI_BRAMPFORD SPEKE | EX5 5DY | 245 | 74 | Constraint Management Zone Facing |
| RESTORMEL_WTW_LOSTWITHIEL | PL22 0EE | 3,752 | 1,126 | |
| LITTLEHEMPSTON_WTW_LITTLEHEMPSTON | TQ9 6LZ | 2,007 | 602 | |
| GUNNISLAKE_PRI_GUNNISLAKE | PL19 8JG | 1,621 | 486 | |
| CROWNHILL_WTW_PLYMOUTH | PL6 5DA | 1,534 | 460 | |
| ROADFORD DAM_RWPS_BROADWOODWIDGER | PL16 0SW | 1,289 | 387 | |
| LOPWELL_TPS_TAMERTON FOLIOT | PL5 4NH | 846 | 254 | |
| DOTTON_WTW_NEWTON POPPLEFORD | EX10 0JY | 729 | 219 | |
| ALLERS_WTW_TIVERTON | EX16 7QT | 714 | 214 | |
| STITHIANS_WTW_STITHIANS | TR3 7AW | 561 | 168 | |
| WIMBLEBALL_IRES_BAMPTON | TA22 9NS | 523 | 157 | |
| MAYFLOWER_WTW_PLYMOUTH | PL6 7RS | 518 | 156 | |
| NORTHCOMBE_WTW_OKEHAMPTON | EX20 4LL | 464 | 139 | |
| MELDON DAM_RWPS_MELDON | EX20 4LU | 379 | 114 | |
| ST CLEER_WTW_LISKEARD | PL14 6EQ | 360 | 108 | |
| BOLHAM_PRI_TIVERTON | EX16 7RL | 304 | 91 | |
| KENNAL VALE INTAKE_TWPS_KENNAL VALE | TR3 7HL | 286 | 86 | |
| TAMAR LAKES_WTW_KILKHAMPTON | EX22 7LB | 242 | 72 | |
| TOTTIFORD_WTW_BOVEY TRACEY | TQ13 9PD | 232 | 70 | |

### 8.4 Drinking Water – Water Distribution

The following sites have above the average Max Demand of 145kW for this type of site.

| SITE NAME | POSTCODE | Current Max Demand (kW) | Max Flex (kW) | IN A CMZ |
|---|---|---|---|---|
| DUNSFORD HILL_WPS_EXETER | EX2 9PJ | 438 | 394 | Constraint Management Zone Facing |
| PILTON_WPS_BARNSTAPLE | EX31 1QL | 210 | 189 | Constraint Management Zone Facing |
| BLAKEWELL PUMP_WPS_BARNSTAPLE | EX31 4ET | 130 | 117 | Constraint Management Zone Facing |
| WILLAND_WPS_CULLOMPTON | EX15 2QH | 457 | 412 | |
| LANGRIDGE CROSS_WPS_TOTNES | TQ9 7PP | 263 | 237 | |
| SIDFORD_WPS_SIDMOUTH | EX10 9PL | 133 | 120 | |