Overview	
Project Title	**Felixstowe Options Appraisal**
Project Manager	**John Pawson**
The Suffolk Holistic Water Management, Felixstowe Project Sub Group wants to investigate the possibilities of using the surface water collected at the Kings Fleet for spray irrigation in an area where no water resources are available, instead of pumping it into the river Deben. Runoff is mainly produced during winter while agricultural demand is concentrated in summer. Therefore, some storage is needed in combination with a pumping and main distribution scheme. The aim of this assignment is to identify the most cost-effective option at a preliminary design stage.	
Financial Data (see supporting spreadsheet for details)	
Purchase Order	
Staff costs	£34,755.00
Expenses	£165.00
Total value of expected works	£34,920.00
Cost risks (at project planning stage)	
Programme Data (see supporting Programme for details)	
Expected start Date	12/12/16
Expected duration of works	3 months
Critical dependencies	Data input from Suffolk Holistic Water Management Project (HWMP) group including; • Best information available on agriculture demand zones • Best estimate of demand profile • Hydrological model report • Upstream abstractions and environmental requirements • Existing screens at Kings Fleet
Programme risks (at project planning stage)	Risk of delay in data collation – abstraction data and model run results.
Technical Data	**(see supporting Project Scope)**
Purpose of task	Option appraisal for storage and distribution of water in the lower Deben catchment to supplement water resources for agriculture. Review opportunities to trade water to AW from Mill River abstractions.
Expected output(s)	1. Option concepts report for review 2. Options Appraisal Reports to compare 3 options a. Storage at Kings Fleet and distribution to agricultural demand hubs indicated on Figure 1 of the scope. There will be limited on-farm storage with this option.

	b. Storage at both Kings Fleet and Agricultural Reservoirs, and distribution network. c. Storage at Agricultural reservoirs and distribution network 3. Costing appraisal for options a - c 4. Review of potential trade of water for Mill River PWS abstractions
Scope of related works	Output of the works will include specifying pump capacity and configurations required for the new pipeline. This will feed into the IDB's review of pumping station options at the Kings Fleet and Falkenham, with respect to environmental concerns and discharge into the River Deben.
Technical risks (at project planning stage)	• Assumptions made on irrigation regimes will be made on peak demand data, this will be issued in the concept report for review by farm operators. The summer demand profile will be refined to weekly rates using EA 'abstat' data. • Any other assumptions made will be stated in the reports.
Assumptions	• It is assumed that 5 l/s is required to be pumped into the Deben for environmental purposes and that this can be met using water from the low level catchment to the south of the Kings Fleet or possibly the Falkenham Brook. • We will adopt a LoS for agricultural SI at being able supply demand in the driest year in 20 in accordance with ESWAG/EA reports.Environmental assessments are not within MM's scope of works. • It is assumed that there will only be 4 farm reservoir locations. • Flow series for the Kings Fleet catchment will be provided by the EA and no recalibration will be required. • Current estimation of Kings Fleet's storage capacity is of 23 Ml. • Upstream abstractions data will be provided • Changes in the operation of the current drainage pumps are out of the scope of this assignment. • MM will estimate the power needed to operate the supply pumps but a general indication of how this will be provided will be produced. • All information as stated in the 'Critical Dependencies' section will be available at the beginning of the project. (12/12/16) • Limited on-farm storage capacity for option A will be 2x maximum daily peak demand.
Scope of Works	Concept Development

	The aim of this phase is to establish the required infrastructure and operation for the three options to be analysed. It will comprise the following tasks: 1. Confirmation of initial hypotheses from information submitted by HWMP team: • Flow series of the Kings Fleet catchment • Quantities of upstream abstractions • Environmental flow requirements • Demand profile to be served • Required level of service • Constraints at the Kings Fleet effecting potential storage areas 2. Water balance model: allocation of water resources to irrigation will be assessed by a water balance model (built within a spreadsheet) with daily time step (monthly profiles will be evenly distributed) The model will run for 45 years (from oct-1970 to sep-2015). The three key variables to be established for each option are: • Storage capacity at Kings Fleet • Maximum pumping capacity • Storage capacity at the farms' reservoirs 3. Sizing: for the three analysed options sizing will be done to meet the target LoS. If there is only minimal on farm storage with the majority of storage at Kings Fleet the pumping capacity must be equal to the peak irrigation demand, whereas if all storage is located at the farms, the required capacity will be determined first by assuming no pumping restriction, and the maximum pumping capacity will be established later in order to maintain the LoS. Finally, when storage is distributed between the farms and the Kings Fleet, the following two scenarios will be simulated to constrain the possible solution: • Minimum storage at Kings Fleet, associated with a pumping capacity equal to Q5 inflow. • Maximum storage at Kings Fleet, associated with a pumping capacity between Q5 inflow and the peak irrigation demand. The Q5 (flow that is only exceeded a 5% of the time) is considered a reasonable upper limit but will be confirmed when option A and option C flows are determined to ensure a middle value is used. Increasing the pumping capacity over Q5 would require larger and more expensive pumps with little benefits in terms of the potential abstracted water, above all when some volume is available to store the surplus inflow in high water periods.

	In each case, the range and frequency of operation of the pumps will be estimated. This will optimise the pipe size and pump capacities by balancing flows and storage. 4. The resilience of the system will be verified by calculating the supply amount during the worst drought in the 45 years of record. 5. Layout: demand points or farms' reservoirs will be defined based on the distribution of agricultural land. Pumping geometric height will be then obtained. 6. Reporting <u>Option Development</u> The aim of this phase is to produce a high-level scope for each option with a degree of detail capable of ensuring a reliable costing. It will comprise the following tasks: 1. Confirmation of initial hypotheses: • Reservoir lining • Piping material • Bill of quantities template: units and rates. 2. High-level scope for reservoirs: basic geometric design and estimation of main units. 3. High-level scope for distribution system: • Definition of the most suitable pipeline route based on the presence on the location of utilities, urban areas, roads/river crossings, protected zones and land available. • Calculation of the optimum diameter for a given route based on the vertical profile and required flow rates. • Estimation of expected head losses and hydraulic profile. 4. High-level scope for supply pumps: • Pump sizes and configuration will be defined to meeting the range of flows. • Selection of pump sizes and their configurations based on the range of flow rates, hydraulic head and frequency of operation. • Space requirements including provision for control and power supply facilities. • Estimation of required power and likely grid connection • Intake and screening arrangements • High level control philosophy for combined pump and pipelines systems 5. CAPEX and OPEX of different options and selection of the most cost-effective solution in terms of Average Incremental Costs. For generic reservoir costing model we

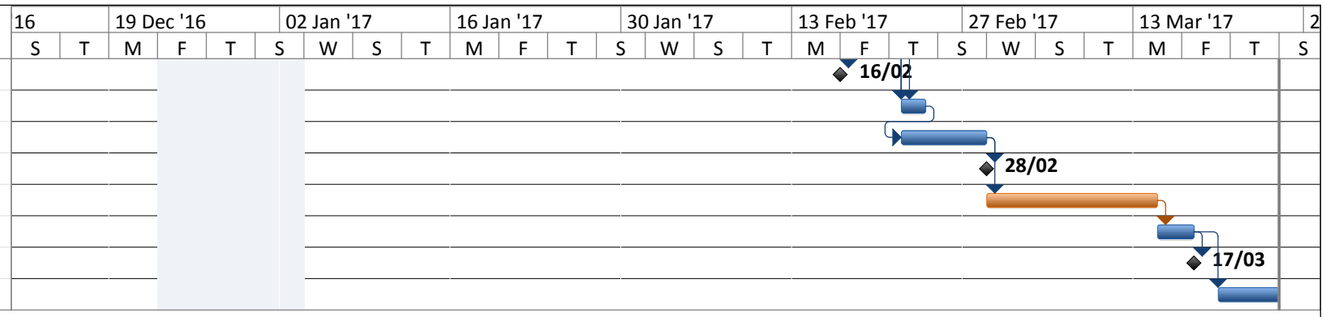
	will use the recommendations included in Defra's 'Water for Agriculture: Collaborative approaches and on-farm storage, FFG1112' (Weatherhead, Knox, Daccache, Morris, Kay, Groves and Hulin, 2014). 6. Evaluation of opportunities for trading water between HWMP and AW regarding the current abstractions for irrigation that will become unused. Estimation of water availability using the CAMS assessments and potential use for AW based on Water Resource Management Plan 2014 and ongoing work for PR19 7. Reporting

ID	Task Name	Duration	Start	Finish	Predecessors
1	**CONCEPT DEVELOPMENT**	**22 days**	**Mon 12/12/16**	**Fri 20/01/17**	
2	Review of EA model report and outcomes	1 day	Mon 12/12/16	Mon 12/12/16	
3	**Water Balance Model**	**17 days**	**Tue 13/12/16**	**Mon 16/01/17**	
4	Confirmation of initial hypotheses	2 days	Tue 13/12/16	Wed 14/12/16	2
5	Model building	10 days	Thu 15/12/16	Mon 09/01/17	4
6	Sizing for each scenario	4 days	Tue 10/01/17	Fri 13/01/17	5
7	Checking resilience of the system	1 day	Mon 16/01/17	Mon 16/01/17	6
8	Basic layout of options	4 days	Tue 17/01/17	Fri 20/01/17	7
9	**OPTION DEVELOPMENT**	**22 days**	**Mon 23/01/17**	**Tue 21/02/17**	
10	**Reservoirs**	**22 days**	**Mon 23/01/17**	**Tue 21/02/17**	
11	Agree lining options	10 days	Mon 23/01/17	Fri 03/02/17	1
12	Develop BoQ template	10 days	Mon 23/01/17	Fri 03/02/17	1
13	Confirm rates used in BoQ with HWMP team	10 days	Mon 06/02/17	Fri 17/02/17	12
14	Basic Geometry design	15 days	Mon 23/01/17	Fri 10/02/17	8
15	Finalise BoQ for reservoirs	5 days	Mon 13/02/17	Fri 17/02/17	14
16	CAPEX, OPEX and AIC	2 days	Mon 20/02/17	Tue 21/02/17	15
17	**Development of pipeline route using GIS methodology**	**16 days**	**Mon 23/01/17**	**Mon 13/02/17**	
18	Map locations of proposed reservoirs on GIS	1 day	Mon 23/01/17	Mon 23/01/17	8
19	Develop GIS pipeline routing method: Utilities, AW mains, Urban areas, road/river crossings, land available	5 days	Tue 24/01/17	Mon 30/01/17	18
20	Run GIS to determine pipeline route	1 day	Tue 31/01/17	Tue 31/01/17	19
21	Rationalise Route: including an assessment of synergies with cable route	1 day	Wed 01/02/17	Wed 01/02/17	20
22	Develop hydraulic profile and determine head losses	2 days	Wed 01/02/17	Thu 02/02/17	20
23	BoQ for pipelines	5 days	Fri 03/02/17	Thu 09/02/17	22
24	CAPEX, OPEX and AIC	2 days	Fri 10/02/17	Mon 13/02/17	23
25	**Specifing Pumps**	**8 days**	**Fri 03/02/17**	**Tue 14/02/17**	
26	Selection of Pumps	3 days	Fri 03/02/17	Tue 07/02/17	22
27	Estimation of required power	1 day	Wed 08/02/17	Wed 08/02/17	26
28	BoQ for pumps	2 days	Thu 09/02/17	Fri 10/02/17	27
29	CAPEX, OPEX and AIC	2 days	Mon 13/02/17	Tue 14/02/17	28
30	**Opportunities for trading**	**5 days**	**Mon 23/01/17**	**Fri 27/01/17**	
31	Determine mechanisms for trading	5 days	Mon 23/01/17	Fri 27/01/17	8
32	Estimation of water availability and potential alternative uses	2 days	Mon 23/01/17	Tue 24/01/17	8
33	**REPORTING**	**40 days**	**Mon 23/01/17**	**Fri 17/03/17**	
34	Draft Concept Report	6 days	Mon 23/01/17	Mon 30/01/17	8
35	Submit Draft Concept Report	0 days	Mon 30/01/17	Mon 30/01/17	34
36	Comments	10 days	Tue 31/01/17	Mon 13/02/17	34
37	Final Concept Report	3 days	Tue 14/02/17	Thu 16/02/17	36

Project: Project1 Felixstowe Optio
Date: Fri 11/11/16

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

ID	Task Name	Duration	Start	Finish	Predecessors
38	Submit Concept Report	0 days	Thu 16/02/17	Thu 16/02/17	37
39	Option Evaluation	2 days	Wed 22/02/17	Thu 23/02/17	29,24,16
40	Draft Option Appraisal Report	5 days	Wed 22/02/17	Tue 28/02/17	39FS-2 days
41	Submit Draft Option Appraisal Report	0 days	Tue 28/02/17	Tue 28/02/17	40
42	Comments	10 days	Wed 01/03/17	Tue 14/03/17	40
43	Final Report	3 days	Wed 15/03/17	Fri 17/03/17	42
44	Submit Final Option Appraisal Report	0 days	Fri 17/03/17	Fri 17/03/17	43
45	**PROJECT CLOSE**	5 days	Mon 20/03/17	Fri 24/03/17	43



Project: Project1 Felixstowe Optio
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Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

Personnel Name		Andrew Kirby	John Pawson	Tim Brown	Bridget Bosworth	Jordi Carreno Berlanga	Jack Eades	Conan Easson					
Personnel Job Title		Senior dams engineer	Project Manager	Mechanical Engineer	Hydrologist	Dams engineer	GIS consultant	CAD Technician					
Project Role		**Technical Director**	**Consultant**	**Technical Expert B**	**Consultant**	**Junior Consultant**	**Consultant**	**Technician**					
Unit Rate (per day)		£ 800.00	£ 440.00	£ 725.00	£ 440.00	£ 365.00	£ 440.00	£ 305.00	**Travel**	**Subsistence**	**Other Expenses**	**Task Total**	**Nr of Meetings**
Task	**Ref**								**Expenses (£ per task)**				
PROJECT MANAGEMENT													
Progress Meetings (assumed 3 meetings)	A1		3.00						£ 165.00	£ -	£ -	£ 1,485.00	3
Project management	A2	1.00	2.00						£ -	£ -	£ -	£ 1,680.00	
									£ -	£ -	£ -	£ -	
CONCEPT DEVELOPMENT												£ -	
Review of EA model report and outcomes	B1	0.25	0.50		1.00				£ -	£ -	£ -	£ 860.00	
Water balance model												£ -	
Confirmation of initial hypotheses	B2		1.00		1.00				£ -	£ -	£ -	£ 880.00	
Model building	B3		2.00		6.00				£ -	£ -	£ -	£ 3,520.00	
Sizing for each scenario	B4		1.00		4.00				£ -	£ -	£ -	£ 2,200.00	
Checking resilience of the system	B5				0.50				£ -	£ -	£ -	£ 220.00	
Basic layout of options	B6		0.25		0.50	0.50	1.00		£ -	£ -	£ -	£ 952.50	
												£ -	
OPTION DEVELOPMENT												£ -	
Confirmation of initial hypothesis												£ -	
Agree reservoir lining and piping material	C1	0.25		0.50	1.00				£ -	£ -	£ -	£ 927.50	
Develop BoQ template	C2	0.25	0.50	0.50	1.50				£ -	£ -	£ -	£ 1,330.00	
Confirm rates used in BoQ with HWMP team	C3		0.50						£ -	£ -	£ -	£ 220.00	
Reservoirs												£ -	
Basic geometric design	C4	0.25	1.00		2.00			5.00	£ -	£ -	£ -	£ 2,895.00	
BoQ for reservoirs	C5		0.50		3.00			2.00	£ -	£ -	£ -	£ 1,925.00	
Development of pipeline route using GIS methodology												£ -	
Map locations of proposed reservoirs on GIS	C6		0.25			0.50	0.50		£ -	£ -	£ -	£ 512.50	
Develop GIS pipeline routing method: Utilities, AW mains, Urban areas, road/river crossings, land available	C7			0.25			2.50		£ -	£ -	£ -	£ 1,281.25	
Run GIS to determine pipeline route	C8						0.50		£ -	£ -	£ -	£ 220.00	
Rationalise Route: including an assessment of synergies with cable route	C9		0.25				0.50		£ -	£ -	£ -	£ 330.00	
Develop hydraulic profile an determine head losses	C10			0.25					£ -	£ -	£ -	£ 181.25	
BoQ for pipes	C11	0.25	2.00						£ -	£ -	£ -	£ 1,080.00	
Specifying pumps									£ -	£ -	£ -	£ -	
Selection of pumps	C12		0.25	2.00					£ -	£ -	£ -	£ 1,560.00	
Estimation of required power	C13			0.50					£ -	£ -	£ -	£ 362.50	
BoQ for pumps	C14		0.25	0.50					£ -	£ -	£ -	£ 472.50	
Outline Control Philosophy	C15			0.50								£ 362.50	
CAPEX, OPEX and AIC	C16	0.25	1.50						£ -	£ -	£ -	£ 860.00	
Opportunities for trading water												£ -	
Determine mechanisms for trading water	C1	0.50							£ -	£ -	£ -	£ 400.00	
Estimate water availability and potential alternative uses	C2	0.50	1.00		1.00				£ -	£ -	£ -	£ 1,280.00	
REPORTING												£ -	
Draft Concept Report	D1	0.25	1.00	0.50	2.00		0.25	0.50	£ -	£ -	£ -	£ 2,145.00	
Final Concept Report	D2	0.25	0.50		1.00				£ -	£ -	£ -	£ 860.00	
Draft Option Appraisal Report	D3	0.25	1.00	0.50		3.00	0.25	1.00	£ -	£ -	£ -	£ 2,512.50	
Final Report	D4	0.25	0.50			1.00			£ -	£ -	£ -	£ 785.00	
												£ -	
PROJECT CLOSE	E1	0.50	0.50						£ -	£ -	£ -	£ 620.00	
Total staff days		**5.00**	**21.25**	**6.00**	**17.00**	**12.50**	**5.50**	**8.50**					
Cost and Activity Total		**£ 4,000.00**	**£ 9,350.00**	**£ 4,350.00**	**£ 7,480.00**	**£ 4,562.50**	**£ 2,420.00**	**£ 2,592.50**	**£ 165.00**	**£ -**	**£ -**	**£ 34,920.00**	

Total Labour Fees	**£ 34,755.00**	Travel Allowance			Cost per return trip
Total Direct Costs	**£ 165.00**	Cambridge to Suffolk	63	miles	**£ 55.00**
Total	**£ 34,920.00**	*Rate*	*£ 0.44*	*per mile*	