RiverOak Strategic Partners

5.2-7 Environmental Statement Volume 7: Appendices 7.3 – 8.1

TR020002/APP/5.2-7

Project Name:	Manston Airport Development Consent Order
Regulation:	Regulation 5(2)(a) and 5(2)(e) (Appendix 8.2) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, as amended
Date:	July 2018

Appendix A
Minutes of meetings with Environment Agency and Southern Water

Minutes

Date: 11 April 2016 13.30

Meeting at: The Environment Agency, Orchard House, Endeavour Park, London Road, Addington, Kent, ME19 5SH

Subject / purpose:

38199 - Manston Airport DCO EIA - Pre-Scoping Consultation and Meeting

Attendees:

Jo Beck (JB) – Environment Agency (EA)
Lisa Westcott (LW) – EA

Suzanne Burgoyne (SB) – Amec Foster Wheeler (AFW)
Oliver Gardner (OG) – AFW
Vanessa Dahmoun (VD) – AFW
Joanne Gavigan (JG) – AFW

Apologies:

Minutes: **Action by:**

1 Introductions were made, SB explained that Amec Foster Wheeler had been appointed by RiverOak Investment Corp LLC to prepare an EIA as part of the application for development consent. RPS have been appointed to prepare the airport masterplan and provide planning advice, Osprey appointed as civil aviation advisers.

JB stated that the EA was aware of the site and were currently working with other developers looking at their proposals for the site. Historically there has been a lot of interest in the site and the wider area due to the location of the aquifer and its importance with regards public water supply. There is also a lot of local interest in protecting the aquifer with active vocal campaigned groups.

Groundwater is a key consideration for the EA and they need to have confidence the site is well understood.

2 RiverOak will be submitting an application for a Development Consent Order under The Planning Act 2008, supported by an Environmental Statement. It was the view of RiverOak that the project will constitute a Nationally Significant Infrastructure Project and meet the much needed demands for additional air freight capacity in the

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No. 2190074

south-east by providing an airport with a capacity for 10,000 airfreight air traffic movements (ATM) per year.

SB gave a brief overview of the DCO process and explained the importance of early consultation and engagement as part of the DCO. JB stated that both she and LW had some experience of DCO projects, they had both worked on the Richborough Connection project.

The programme for the project is currently being finalised but SB stated that is was the client's intention to make a submission to the Planning Inspectorate in Autumn 2016. A scoping report will be submitted to PINS in May 2016, followed by a consultation exercise in Summer 2016 which would include a Preliminary Environmental Information Report (PIER)

3 SB tabled a copy of the draft airport master plan, it was explained that this was a first draft and that AFW have already been had a workshop with the master plan designers to review the potential environment impacts and to ensure environmental considerations are being taken into account through the design process and mitigation included within the designs from the outset.

OG explained that the DCO red-line boundary would include all of the current airport site. Additional areas, such as highways to create new access, might be added to the red-line boundary subject to need.

There was a discussion on the different areas/uses identified in the master plan. SB stated it was important to remember that the master plan is being designed to allow the airport to meet the 10,000 air freight ATM per year.

The draft master plan tabled represents the site in 2035 when fully developed, however the development would be phased with construction and improvements completed over a period of 15 years. In the first instance the airport would re-use as much of the existing infrastructure as possible. The EIA will take into account the phasing of the development this phased development.

4 OG explained that as RiverOak do not own the site it has not been possible to undertake site visits. However meetings and discussions are being held with the current landowner to agree access, and it is expected that site visits will be undertaken in May 2016.

5 JG outlined the AFW approach to the surface and ground water assessments and knowledge of the site.

AFW will produce and Groundwater & Surface Water chapter for the ES. This will be supported by a Flood Risk Assessment (FRA), groundwater risk assessment, and Water Framework Directive (WFD) assessment. All assessment will be undertake in line with GP3.JG stated that AFW hoped to be able to use existing data sources of GW quality for the baseline. LW stated that Southern Water undertake quarterly monitoring of the four Southern Water PWS boreholes, and that they share the data with the EA. Southern Water hold data on the groundwater quality and will have additional information on the

hydrogeology of the area, in particular the construction details of the adit that feeds the Lord of the Manor public water supply.

There are also 3 privately owned boreholes on the Isle of Thanet that the EA collects groundwater quality samples at. KCC had a programme of monitoring during the construction of the East Kent Access (A299). However, it is the view of the EA that as there aren't any boreholes on the site there isn't enough existing data available relating to GW quality.

LW stated that the site is well known to the EA and they have over a number of years worked with Southern Water to address issues arising from the site. In summary:

- Site is above the Thanet Aquifer, adit running under runway at approx. 0m A.O.D, diameter potentially quite large, not know if there are additional shafts associated with it
- Delineation of SPZ around adit quite crude (50m buffer), EA consider SPZ1 could potentially be larger, EA would not require further GW modelling for SPZ
- SUDS is suggested would need careful consideration and only be allowed outside SPZ1
- All fuel storage and other facilities would need to be outside SPZ1

AFW

- Source is mixed and treated due to nitrate issues
- The WFD rates this water as Poor, in past have been issues with hydrocarbons and solvents

Important that AFW contact Southern Water as early as possible as they will have a lot more data and information on the site. OG stated that have already emailed Southern Water and that AFW have good contacts and relationships from other projects, including working for them on GW modelling.

6 VD outlined AFW approach to the land quality assessment and knowledge of the site.

AFW will produce a Land Quality chapter for the ES. In support of this a Phase 1 assessment is being produced. Initial data searches have been made and AFW are seeking additional information.

A number of potential contamination sources have been identified from the desk study including:

- Fuel farms
- Infilled chalk pits
- Landfills

LW stated that there were many unknowns across the site and rumours and anecdotal evidence for sources of contamination including:

- Rumours of trenches around the runway to burn fuel
- Rumours of pits where old machinery and vehicles were buried
- There was a leak at the fuel farm, clean up on surface but unknown if it entered the groundwater
- Unknown if any underground tanks on site
- Runway thought to be very thick and removal of this may cause issues with opening up new pathways and turbidity

It was agreed that there is a lot of information and data gaps for the site, for example from OS maps, and the history of use under the RAF and USAF is unknown as information not in public domain.

Phase 1 will be followed up with a Phase 2 assessment, however at present due to limits on site access it might be difficult to undertake intrusive investigations pre-DCO application.

LW explained that there would be concerns that any intrusive investigations undertaken as part of the Phase 2 would open up new pathways for contaminants into the ground water. Therefore any intrusive works would need to be agreed in advance with the EA and Southern Water and appropriate control and mitigation measures agreed.

7 There was a discussion on the production of a Construction Environmental Management Plan (CEMP) for the development and operation of the site. JB stated that given the issues with groundwater any construction activities would need to be properly managed. OG stated that AFW would prepare a CMP and EMP for the project.

LW also stated that the on-going operation of the airport would need to include suitable controls. For example the EA previously had an agreement that the airport would notify them in advance of any spraying, and that they were limited in the types of insecticide they could use. The previous airport incident response and drainage plans would contain information on these issues.

8 JG led a discussion on the current water discharge arrangements for Manston Airport.

Drainage is partially to ground and partially captured. For this application drainage to ground would not be allowed in areas where potentially polluting substances are in use or there is fuel (e.g. new taxi-ways and aprons).

Previously there was a discharge permit, this discharged into Pegwell Bay via a pipeline from the site. Status of pipe and any pre-treatment was unknown, JB suggested contacting Thanet District Council as there have been planning applications in past relating to water treatment for the site. It is unknown if the pipe collected all water from the site, i.e. from northern area, or if it was just for the runway.

LW stated that EA previously had some concerns that the status of the pipe and is security where unknown, for example it is possible

that other connections could have been made to the discharge pipe along its length without the knowledge or agreement of the EA, airport operator/permit holder.

OG asked if EA would be happy for water to be discharged via this pipe, JB agreed this could be considered as long as an assessment of the water quality and discharge rates was undertaken as part of the drainage strategy, AFW need to contact Natural England as the discharge site is a SSSI.

9 JB explained the EA cost recovery system that is now being implement. Any pre-application advice would need to be paid for, this includes attendance at meetings, travel to/from meetings (if not at EA office), preparation for meetings, correspondence, document/information review, and any other time spent on a specific project.

EA would be happy to review drafts of documents before they are submitted. And would also appreciate being sent copies of documents at the same time as the submission are made to PINS to prevent delays. AFW

AFW to provide a list of deliverables and programme, with estimated number of meetings

10 SB suggested that future meetings could be held jointly with AFW, EA and Southern Water. It was agreed that this would be of use.

Minutes

Date: 03 November 2017 11:00 **Meeting at:** Environment Agency Addington

Subject / purpose:

Manston Airport DCO

Attendees:

Jonathon Atkinson (Environment Agency)
George Yerrall (RiverOak)
Niall Lawlor (RiverOak)
Tony Freudman (RiverOak)
Rob Grinnell (RiverOak)
Chris Johnson (RPS)
Ben Fretwell (Wood)

Apologies:

Jennifer Wilson (Environment Agency)

Minutes: **Action by:**

1 **Update/discussion on fuel farm design to incorporate innovative design measures**

CF presented maps showing that the location of fuel farm was largely in SPZ2 with only a small piece in SPZ1. All fuel infrastructure is in SPZ2.

JA commented that in terms of groundwater protection there was little difference between SPZ1 and SPZ2 and that there was uncertainty regarding the location of SPZ1.

CF stated that the fuel farm layout had been refined to comply with regulations and as a result of discussions at previous meeting. The main changes were that design details had been developed around: bund construction, specification of double bunded tanks, bund to be underlain by impermeable membrane (e.g. visqueen). Joints to be sealed with a hydrophobic sealant to prevent leakage and concrete to include self-sealing material (e.g. xypex).

Concrete to be specified to water impermeable standard with additional reinforcement to limit cracks to <0.2 mm.

JA would like to see examples of materials used in similar applications i.e. hydrocarbon spills. RPS – examples

CJ presented details of below ground ducts for drainage and fuel lines. All ducts and pipes sealed with flanges etc.

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	In the bunded area, sump drainage will be to a low point from where it will be manually pumped into the drainage system (if clean) or to tanker if contaminated.	
	JA stated didn't want to see below ground fuel lines. Also, didn't want any penetrations of the bund for pipe work so all pipes to go over the bund wall.	RPS to confirm in design
	JA happy that drainage ultimately discharges to Pegwell Bay following treatment via interceptors etc.	
	JA want fuelling system to include automatic shut off of drainage system whilst vehicles on refuelling stand.	
	JA asked about firewater – CJ stated that firewater will be retained in site drainage pipes through provision of oversized pipes with automatic shut off to prevent discharge to Pegwell Bay.	
	CJ queried whether JA considered the details provided for fuel farm drainage and bunding were sufficient. JA confirmed that he was happy with the level of detail shown for the Fuel Farm and that no specific additional details were requested. JA did stress that his acknowledgement of this wasn't confirmation that no further comments would be made.	
2	**Updated drainage strategy to include confirmation of works for old taxiway/runway**	
	CJ outlined need for runway drainage for operational part of existing runway to maintain runway free of surface water and also need for electrical ducting for lighting. This will require penetrations through the existing runway. Areas of non -operational runway will be joint sealed and covered with 50 mm permeable asphalt.	
	Drainage to filter drain would be best at edge of operational runway and to airside of main electrical ducts to avoid runoff entering electrical ducts – investigation would take place in advance of works to prove thickness and determine if contamination present.	
	Drains and ducts need to penetrate the runway, which is estimated to be 600 mm thick – drains likely to be up to 1.2 m deep. Drains to be sealed with visqueen liner.	
	Electrical ducting needs to <50 m from centre line of operational runway (probably closer) due to restrictions on length of cable that can be pulled.	
	JA would prefer that penetrations are limited where runway overlies adit. He questioned the need for penetrations and would like to see solutions that minimise penetration.	
	Discussion over how electrical routing could be undertaken to avoid penetrations over adit location and to minimise number of penetrations of runway – CJ to look at routing options including taking cables around end of runway to avoid subrunway crossing but certain number of locations required to meet CAA standards etc.	RPS

CJ noted ducts likely to be 1.5 m deep to account for runway loading.

JA wants to see details of how penetrations will be constructed to avoid creating pathway for drainage. RPS

CJ concrete would be removed by sawcut and then lifting in layers.

CJ to provide details of penetrations to JA prior to DCO submission. RPS

BF asked if EA concerns applied outside of adit / SPZ1– and whether the unnecessary parts of the runway in those areas could be removed.

JA – EA's main concern is protection of the adit accepted that they were less concerned outside the adit .

CJ indicated CEMP would seek removal of contamination if found. JA stated that EA would only require removal where there was a clear risk – if not unacceptable risk would be better to leave in place – didn't want to see chasing of contamination if this meant removal of runway unless risk-based. Wood to check ES wording / alter

Action: update CEMP with risk-based approach.

JA reiterated benefits of harina or similar material as a safeguard against contamination penetrating through drainage channels.

CJ asked whether JA would be happy for the penetrations within the redundant pavement in SPZ1 / SPZ2 to be to the same level of detail as the fuel farm and JA confirmed this was acceptable.

3 **Updated hydrogeological risk assessment**

BF outlined results of additional modelling, which modelled Lord of the Manor at a higher rate (estimated long-term maximum). This shows a similar pattern to the version presented at the previous meeting. Groundwater flow is still largely from north to south beneath the fuel farm. However, a small (but higher proportion of flow than at recent actual) from south of adit flows to the adit in the higher flow scenario.

JA emphasised importance of modelling in supporting the assessment of risk. Takes some comfort from indication that flow is largely to the south.

BF noted that the approach being taken is groundwater flow modelling – no contaminant transport modelling will be undertaken. The risks to groundwater will be assessed in a qualitative risk assessment and emphasis placed on mitigation measures to avoid spills to ground. JA accepted this point.

Minutes

Date: Monday 7 November 10.00

Meeting at: The Environment Agency, Orchard House, Endeavour Park, London Road, Addington, Kent, ME19 5SH

Subject / purpose:

38199 - Manston Airport DCO EIA – Baseline Data Collection Methodology and PEIR Meeting

Attendees:

Jennifer Wilson (JW) – Environment Agency (EA)
Lisa Westcott (LW) – EA

Oliver Gardner (OG) – Amec Foster Wheeler (AFW)
Tim Haines (TH) – AFW
Barry Mitchson (MB) – AFW

Apologies:

Suzanne Burgoyne - AFW

Minutes: **Action by:**

1 Introduction were made and OG thanked all for attendance. OG gave an overview of the project, the role of Amec Foster Wheeler, the RiverOak proposals for Manston Airport, and the current programme for the DCO.

Work has commenced on the baseline surveys and the preparation of the Preliminary Environmental Information Report (PEIR), currently programme is for PEIR to be completed Q1with the six weeks statutory consultation to follow.

Access to the site has still not been agreed, but RiverOak are in discussions with PINS and the landowner over access for the environmental surveys.

2 OG thanks EA for the response to the scoping report and the Scoping Opinion. AFW welcome an on-going dialogue with the EA and other consultees over the scope of the assessment through the project in order to ensure that the EIA is focused on the potentially significant effects.

3 TH and LW led a discussion around Groundwater; it was recognised that the EA, Southern Water (SW) and RiverOak have the same aims, that the proposed development does not make the situation on site any worse, and that improvements are included in the development to achieve environmental benefits.

There was a brief discussion on the groundwater baseline on site:

The site is above the Thanet Chalk aquifer, there is an adit at approx. 0m AOD (40-50m BGL) below the runway which feeds the Lord of the Manor (LOM) public water supply borehole located to the southeast of the airport. Recharge is known to be very rapid to the Thanet Chalk, matter of hours and days but is variable. The rate of recharge under Manston is not known. .

Primary concern is the water quality; issues across the Thanet Chalk are with nitrates (persistent issue), solvents and pesticides (both intermittent). This is also true for the LOM source. LW stated that it wasn't known if there was a historic issue with hydrocarbons as SW didn't provide any information on these, BM/TH stated that if they were present in large quantities it would be possible to smell and/or taste them and so SW would be aware if there was an issue.

EA stated RiverOak would need to ensure that the proposed development did not make the quality issues worse. It was acknowledged that there was another large adit to the east feeding LOM from the area below Ramsgate, which may also contribute to poor water quality.

It was acknowledge due to the rapid recharge rate for the aquifer that the 30-40m of unsaturated zone should not be taken as providing a high level of protection; but also that with the likely fast travel times (especially along the adit) then any pollution reaching the water table may have passed through to LOM some time ago (unless it is persistent and/or ongoing).

It was agreed that the conceptual understanding of the site is well known and therefore there wasn't a need for any further work to establish this. Although the conceptual understanding will still need to be presented and discussed in any site report to ensure an accurate conceptual model (source, pathway, receptors) is established.

However the EA would need to understand the distribution of contaminants across the site so that future work didn't result in their mobilisation.

EA would not want to see intrusive works near the adit or within SPZ1, and acknowledge the desire of SW for the minimum level of intrusive work so as to avoid mobilising contaminants and creating pathways through the unsaturated zone. However some boreholes (in target areas) would be needed to the water table to see if any pollution/contamination is reaching the water table. The desk study and other site investigations will be used to inform the need for any boreholes; it was agreed to undertake further discussions in the future to establish what is suitable for intrusive investigations in different areas of the site.

AFW proposed using WQ data from SW and if needed additional samples from the source would be collected and analysed, possibly by SW, it was agreed that AFW should look into this option with SW. — LH contact SW to request WQ data

4 BM led a discussion around Land Quality. AFW have completed desk studies and following a site visit will finalise the Phase 1 report. — BM finalise Phase 1 report

	This has identified potential sources of contaminated related to previous use as an airport, but BM stated in many years' experience working on former RAF sites rumours of buried aircraft and other heavily contaminated material where generally false.	
	BM proposed that AFW will undertake shallow investigations, trial pits for example, at the known potential sources of contamination in order to characterise the risk. But at this stage AFW not going to propose systematic grid across the site as there is a lot of historic information, including the MOD survey from the late 1990s and a targeted approach was more appropriate. BM also noted there may be a number of sources (such as glycols) which could be excluded at an early stage due to their high solubility and rapid degradation. JW/LW agreed to targeted investigations provide this was justified and agreed to review the scope of the site investigations; EA would want to see at least a preliminary risk assessment as part of the application.	BM to prepare scope of works for Phase 2 investigations
	The EA would expect to see a plan for investigation work with a justification for why some things were not included (if that is the case).	BM to review East Kent Access Road SI data
	LW discussed other potential sources on contamination within the vicinity of the site, these include the Jentex site, and a former petrol station in Cliffs End. LW also stated that phenols had been detected during the SI for the East Kent Access Road to the south of the airport but that the source was unknown, BM stated these unlikely to be related to the airport but that AFW will review information from this development in the phase 1.	
5	OG stated that work on refining the airport master plan is ongoing, although the overall scale of development will be similar to that shown in the scoping report. The development will be phased with initial work aimed at putting in new taxiway and sufficient aprons/stands/hangers for first phase of operation. The drainage and water treatment network would be done during the first stage.	OG to feedback design issues to RPS
	OG stated that RiverOak at looking at different options for the location of a new fuel farm for the airport. These include the Jentex Fuels site located to the southeast of the airport; although RiverOak will need to look into costs and implications of remediation and/or construction at this site. EA stated that this site has long been a concern, especially given the location close to the SPZ; the EA would be unlikely to approve site for bulk fuel storage due to location within SPZ1.	
	EA stated that they would request that any fuel tanks located anywhere on site are to be located above ground, TH stated that it was common practice now to use buried tanks due to safety considerations. LW stated that there are precedents locally at Tesco where above ground fuel tanks have been required.	
6	TH led a discussion on the proposals for surface drainage. The proposals are for all new areas, taxiways, aprons, aircraft stands and hangers, to be connected to drainage; two balancing ponds (one 'clean' and one 'dirty') with water treatment and	OG to feedback drainage design issues to RPS

interceptors/traps, discharge will be via the existing discharge to Pegwell Bay. OG stated that SW were also keen to be able to use the existing discharge to Pegwell Pay when they need to pump to waste from LOM they have to use tankers.

Any existing drainage, e.g. for runway, would be bought up to modern standards and connected to new system. OG stated that in early discussions with Southern Water they indicated they were not concerned about potential effects to the recharge rate to the aquifer, and they did not want to see any SuDS or similar schemes. Currently none are was proposed at this stage.

LW and JW stated concept was acceptable with following caveats:

- Ponds would need to be properly constructed with sufficient operational control measures
- Ensure 'dirty' water lagoon wasn't a potential source for odour
- Condition survey of pipe to Pegwell Bay, also check if there are any other connections to this pipe;
- New discharge consent would be needed (JW will contact EA consents team to discuss)
- Also need details of the operational procedure and controls to show the system will be properly managed
- EA would like to see water saving measures implemented, for example grey water use, re-use of run off from roofs.

The status of the former MOD foul sewer on site was unknown, AFW to check on status with SW and also ask for any information on the foul sewerage capacity on or in the vicinity of the site.

A WFD assessment might be required for discharge

7 There was a discussion on what work would be required as part of the DCO application and what documents/studies the EA would like to see.

As noted above AFW will undertake target intrusive investigations and produce a preliminary risk assessment with an outline/timeline for further investigations. EA are happy with this approach and will seek to secure conditions to the application for a programme of further intrusive investigation.

OG stated that a draft Construction Environmental Management Plan (CEMP) would be produced, but this would be high level given that constriction was to be phased and that construction techniques would not be finalised; JB/LW agreed that at this stage a full CEMP wasn't needed and that the EA would seek to secure conditions to the application for a CEMP.

LW also stated that the DCO application should include sufficient information on the operational procedures for the airport, for example the use of pesticides to control insects, locations was de-

	icing and washing of aircraft, emergency procedure and spill response.	
8	OG said that AFW would like to work with the EA to prepare a Statement of Common Ground (SoCG); a draft template for the SoCG has been prepared and will be submitted to the EA for review.	OG draft SoCG
	AFW will prepare minutes of meeting (MoM) for this and other meetings and submit to the EA for review comment. These MoM can then form the basis for the SoCG. All agreed to the benefit of this approach.	OG MoM
9	TH proposed that ongoing consultation would be via email and phone, with meetings held when there was reports/data to review. The next date will be a possible meeting to discuss the draft PEIR/baseline data.	
	JW requested that at the next meeting could the airport master planners (RPS) attend to present more detail on the plans and in particular the drainage strategy. OG stated they would be available and would attend.	
	It was agreed by all that a joint meeting with EA and Southern Water, once plans were sufficient well developed, would be of use.	

Minutes

Date: Friday 29 April 2016 11.00

Meeting at: Developer Services, Southern Water, Southern House, Sparrowgrove, Otterbourne, Hampshire, SO21 2SW

Subject / purpose:

38199 - Manston Airport DCO EIA - Pre-Scoping Consultation and Meeting

Attendees:

Chantal Bland (CB) – Southern Water (SW)
Stuart Ward (StW) – SW
Austen Buck (AB) – SW
John Moore (JM) – SW
Marta Karpezo (MK) – SW

Simon Quinn (SQ) – Amec Foster Wheeler (AFW)
Oliver Gardner (OG) – AFW

Apologies:

Suzanne Burgoyne - AFW

Distribution:

Confidential. All attendees, apologies and Tony Freudmann (RiverOak).

Minutes: **Action by:**

1 Introductions were made, OG explained that Amec Foster Wheeler had been appointed by RiverOak Investment Corp LLC to prepare an EIA as part of the application for development consent. RPS have been appointed to prepare the airport masterplan and provide planning advice, Osprey appointed as civil aviation advisers.

2 OG explained that RiverOak will be submitting an application for a Development Consent Order under The Planning Act 2008, supported by an Environmental Statement. It was the view of RiverOak that the project will constitute a Nationally Significant Infrastructure Project and meet the much needed demands for additional air freight capacity in the south-east by providing an airport with a capacity for 10,000 airfreight air traffic movements (ATM) per year.

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An airport had existed on the site since 1915 and had been operating as a commercial airport since 1998 when the MOD sold the site. Figures available for ATM from the Civil Aviation Authority show that in 2005, the busiest year, ATM were 4600, most recent full year (2013) they were 1600.

RiverOak do not currently own the site and discussions are being undertaken to arrange access for AFW to undertake surveys as part of the EIA.

3 The programme for the project is currently being finalised but OG stated that is was the client's intention to make a submission to the Planning Inspectorate before the end of 2016. A scoping report will be submitted to PINS in May 2016, followed by a consultation exercise in Summer 2016 which would include a Preliminary Environmental Information Report (PIER).

4 OG led a discussion around the site and the current groundwater conditions. This included:

The adit running under the runway is one of longest in country, measures approx. 2x2m in cross section, the adit is at sea level (therefore approx. 40-50mbgl), and possibly dates from the 1930s. The spatial orientation of the adit is unconfirmed; delineation of SPZ1 is therefore regarded as approximate. JM stated that SW have some plans of the adit which they can provide to AFW, but they will need to check if there are any restrictions on their use. SW

The Lord of the Manor Public Water Supply (PWS) shaft is located to the east of the site. The source is currently not in use but is one of four that supply drinking water to Thanet. Sources are currently blended with imported water. There are recorded incidents of turbidity (generally caused by large changes in groundwater table elevation after heavy rainfall), plus there have been historical issues with high levels of nitrate and TCE. There are currently no facilities in place to remove TCE and the increases in use at the airport may result in increases in the levels of TCE, therefore SW would require mitigation measures which minimise the use of, or target the interception of TCE's.

5 OG tabled a copy of the draft airport master plan, it was explained that this was a draft and that AFW have already held a workshop with the master plan designers to review the potential environmental impacts and to ensure environmental considerations are being taken into account throughout the design process. Appropriate mitigation measures are to be included within the designs from the outset.

A new version of the master plan including the site drainage layout is being prepared by RPS in consultation with AFW. It is proposed to re-use the existing surface water discharge pipeline which runs from the site to Pegwell Bay but with new infrastructure, such as attenuation ponds, silt traps, interceptors etc. to ensure the quality is at least the same as the current discharged water.

The site is private so SW have limited information on the existing drainage. There were previous applications to install new drainage pipes and an interceptor but not know if installed. If existing pipe network was to be reused a condition survey should be undertaken first to ensure that is fit for purpose/use. If there were any pumps needed the design and location of these would need to be considered to reduce risks.

JM stated that SW would not want to see any sort of ponds or water storage tanks on the site due to risks to groundwater. Any water storage on site should be minimised. The fuel farm should be designed to include sufficient safeguards, e.g. above grounded bunded tanks, and should be located outside of groundwater source protections zones (SPZ) 1 and 2 are far as practically possible away from the adit.

AFW

StW requested that an estimate of the water usage for the airport be provided, there is currently issues with capacity in Thanet and the proposed increase in flights would likely require more water.

StW requested that the DCO should include details of how waste water and surface water will be managed. SW stated that existing foul water connections could be used provided flow rates for sewerage are no greater than current, capacity checks for the existing infrastructure should also be undertaken. Nothing should be discharged to ground on the site.

OG stated that the DCO will also include information on the airports operational procedures and systems, for example how spills will be mitigated and any incidents managed.

SQ asked if SW would be worried about changes to aquifer recharge rate due to new airport concrete infrastructure, JW confirmed it was not a concern for SW in relation to this proposal.

StW stated that big issue for SW is around the construction activities, for example deep pilling. Any foundations should be designed to avoid deep pilling where possible, SW should be notified of any works ahead of time, there should be no use of anti-freeze within pilling operations. If the PWS borehole was knocked out and had to be pumped to clear waste SW would charge a developer. There is currently no easy way to undertake run to waste for the Lord of the Manor borehole and adit, there was a discussion about potentially using the airport Pegwell Bay discharge pipeline.

6 There was a discussion about existing and historical groundwater quality data for the site, as the site is private SW hold no monitoring data from within the site but do have data from the PWS boreholes around the site. If AFW wanted to install any new monitoring well they would need to be away adit and designed to minimise risk, particular issue is turbidity. SW would need to be notified in advance of any drilling.

AB presented some of the historical data, SW are able to provide the data from the boreholes around the site, AB/JM to review to see

SW

what data is available. JM will need to check first with the Environment Agency if they can provide the data, there may be some restrictions on publication.

7 AB presented the online maps of sewers and other SW infrastructure around the site. There are two rising mains crossing the southwest of the site, exact location not known as the records are old. They will need to be protected, no excavation within 6m either side, hand digging to identify services if required.

SW can provide the digital data for SW infrastructure in and around the site. SW

8 OG asked if SW would like to be sent a copy of the scoping report once submitted to allow them to review if there is a delay in receiving from PINS. CB confirmed this would be very useful. AFW

The point of contact between AFW and SW for the project will be CB who will coordinate with other departments and teams within SW. Once a planning application is submitted it will be handled by MK, StW will ensure that other MK is the only SW planner dealing with the project to avoid confusion.

Minutes

Date: Tuesday 14 March 2017 14.00 **Meeting at:** The Environment Agency, Orchard House, Endeavour Park, London Road, Addington, Kent, ME19 5SH

Subject / purpose:

38199 - Manston Airport DCO EIA – Pre-PEIR and Consultations Meeting

Attendees:

Lisa Westcott (LW) – Environment Agency (EA)

Oliver Gardner (OG) – Amec Foster Wheeler (AFW)
Ben Fretwell (BF) – AFW
Geoff Dewick (GD) – RPS

Apologies:

Jennifer Wilson (JW) – EA
Suzanne Burgoyne – AFW

Minutes: **Action by:**

1 Introduction were made and OG thanked all for attendance. OG gave an overview of the project, the role of Amec Foster Wheeler, the RiverOak proposals for Manston Airport, and the current programme for the DCO.

The PEIR is currently in preparation and the Section 42/47 statutory consultations are planned to commence in May 2017 for a period of 6 weeks. The draft Land Quality Phase 1 report has been shared with EA, and a Hydrogeological Risk Assessment (HRA) is also in production and will be shared.

Site visits have been undertaken in February 2017 by AFW and RPS in support of the ES. These included teams looking at ground conditions and contamination, and surface water, drainage and flood risk.

2 GD led a discussion around surface water and drainage, including the proposals for the project.

A non-intrusive assessment of the existing infrastructure was undertaken as part of the site visit, the aim of the project was to re-use and, if needed, upgrade the existing infrastructure.

The route of the existing surface water outfall from the site boundary to the Pegwell Bay discharge was traced. A CCTV survey of the outfall is planned within the next few weeks to look at the conditions, capacity and confirm the route. Subject to the results of the survey GD stated he was confident that with some minor improvements that this outfall can be reused for the project.

The proposed surface water capture and treatment system was discussed. All surface water will be captured, positive drainage would be used to send to the treatment facility to be located on the north side of Manston Road. There would be silt traps, oil separators and other infrastructure in the system. It is proposed that there are two ponds which will be sized according to assessed need. From the ponds the water will be pumped to the existing discharge pipe located in the south-eastern part of the airport site.

There are two options, either to re-use an existing drainage network around the western end of the runway, or to install a new network around the eastern end. From the discharge pipe all drainage is positive.

GD confirmed that the drainage and surface water treatment system would be installed during the first phase on construction, before the reopening of the airport. LW welcomed this approach.

LW asked if Southern Water (SW) had adopted the airport sewer network, OG stated that SW had said they had not. LW requested that the project confirm with SW the capacity, condition and ownership of the foul water network on the site; OG confirmed they would. OG also confirmed that as part of the project an assessment would be made of the clean water requirements; a sustainability/resources strategy will be submitted as part of the DCO.

All agreed that a three-way meeting with the project team, EA and SW should be arranged for the future.

3 The requirements for a discharge permit for the outfall were discussed. LW confirmed an application for a permit was made by a previous airport owner/operator but that this was never granted due to changes in ownership.

LW stated she would like to discuss this with JW and colleagues in the permitting team. Usually surface water discharges do not require a permit, but as this was a unique case it was likely that a bespoke permit would be required.

BF/GD stated that the contaminants of concern would be hydrocarbons and de-icer from airport operations. LW/JW to look into discharge permit and likely requirements with colleagues and to confirm with GD in order that this can feed into the design. JW also to confirm is there are likely to be any restrictions on discharge rate as well as on quality.

There was a discussion on the use of SuDS on site. It was agreed that these were not preferred on site given the groundwater issues/risks. LW stated that this would need to be discussed and agreed with others such as TDC/KCC, and a justification provided as to why they are not being used.

4 BF led a discussion on the draft Land Quality Phase 1 report which has been produced and shared with the EA. This is based primarily on historical information, with some limited Phase 2 works

undertaken on site or within the vicinity by other projects/developments.

BF stated that a number of potential sources of contamination have been identified, but that there was no real evidence on site for any leaks. The water quality monitoring data from SW was also reviewed, this provided no evidence for hydrocarbon or other contamination resulting from the airport. There is also no evidence for any unexpected risks.

LW stated that there a number of potential contamination sources that have been missed including such as glyphosate/pesticide storage and use, sewers and sewer integrity (due to nitrates), old soakaways within taxiway and apron (specifically what may be in the bases) and also an acknowledgement of the rumours of buried military waste across site. LW will provide detail of these in comments.

GD stated that as part of the construction, material will need to be imported to create a new raised building platform for the cargo aircraft stands and taxiway. It was proposed to reuse as much excavated material as possible from elsewhere on the site, but where imported material is needed this would be clean and suitable for use.

BF stated that SW, and AmecFW working for SW, have done a lot of work on a conceptual model for the site. SW have confirmed that they are happy for the project to use this information, therefore it is proposed that no additional work is needed to develop a conceptual model for the site. The EA accepted that the SW information represented the best information available and that they would not expect additional information to be collected.

A high level scope for Phase 2 Investigations will be included as part of the Phase 1. BF asked what level of detail EA would like to see in the PEIR/ES; LW confirmed that details and plans for proposed Phase 2 Investigations are sufficient and that these works can be undertaken after the application. It was agreed that these works should be phased, the 1st phase can be shallow investigations, with a 2nd targeted phase of deeper investigations based on the results of the first.

LW to review and provide comments on the Phase 1.

5 BF led a discussion on ground water and the Hydrogeological Risk Assessment (HRA). This is being finalised and has not yet been provided for review, but will be submitted as part of the water chapter in the PEIR. It is proposed that mitigation will be put in place following the assessment to reduce the risk. The HRA will not be quantitative but more qualitative following an EIA type approach to assessment. It will be based primarily on information from SW.

LW requested that the LQ Phase 1 and the HRA are linked and cross-referenced where appropriate. BF confirmed this was being done, and that once ready the HRA would be issued to EA for review.

LW stated that Thanet is a priority area for groundwater, with the main issue being nitrates. Therefore the EA have put a lot of effort in to engaging with farmers, industrial sites, the local authority and others to make them aware of risks and to follow up with information and actions to be taken. The EA would therefore seek to similarly engage with the operators of Manston Airport.

OG/BF stated that the project would proposed to use in-built (embedded design) mitigation to reduce risks. This would include developing airport management procedures, including spill response and wildlife management (including spraying for weeds/insects), and that the EA would be involved in their design. LW requested that is be a condition that all documents and reviewed and signed off by all relevant consultees.

6 BF led a discussion around the Flood Risk Assessment (FRA) and Drainage Strategy (DS). The entire site is in Flood Zone 1, and all surface water drainage is going to be discharged into the sea. Therefore it is considered that the flood risk for the site is low. It is proposed that a FRA and DS will not be prepared for the PEIR, but will be submitted as part of the ES. BF also stated that, because drainage is to sea, the drainage system does not need to include flood attenuation measures.

LW will liaise with relevant colleagues in the EA as to whether or not a FRA and DS will be required for the PEIR.

7 There was a discussion on the proposed fuel farm for the site. OG confirmed that the client was now looking to acquire the Jentex site and develop this as the fuel farm for the project. Previously other options were being looked at, but this site had a number of operational and environmental advantages.

The site has an existing bulk fuel storage site, it would have its own separate access (from Canterbury Road West), it would keep fuel delivery separate from other site traffic, and the fuel farm would be located airside without the need for fuel bowsers to pass through security to enter the airport.

LW stated that the EA have concerns about the use of the site as it is located in/adjacent to SPZ1. There have been a history of application to redevelop the site, however nothing has ever been taken forward. BF stated that AFW have reviewed a number of site investigation reports produced for a planning application on the site as part of the Phase 1, and these have identified no history of incidents from the site.

LW stated that the EA would need to understand what the approximate bulk fuel storage needs are for the site as part of the proposals.

LW stated that new EA ground water protection policies (published 14 March 2017) state that the EA will not support any ‘new’ bulk fuel storage in SPZ1. LW directed the team to look at the new polices and position statements as these would be the EAs default view in relation to these proposals. OG stated that this will not be new, and

that the site is only partly within SPZ1, but agreed to review the new guidance.

LW stated that the biggest risk was the sitting and location of the bulk fuel storage, and that the current proposed location was considered as the most sensitive on the site.

BF provided an example of another similar bulk fuel storage facility that was built recently at Bristol Airport. This was similarly close to SPZ1, and was designed in a way that was able to satisfy the EA and local authority.

8 OG proposed to arrange another meeting for before the start on the consultations once the PEIR and supporting technical appendices are completed. This was agreed.

LW will be on maternity leave by then, but JW will coordinate for the EA. LW will also advise of who will provide cover for technical issues for the EA.

Minutes

Date: Wednesday 22 February 2018 11.00

Meeting at: Southern House, Sparrowgrove, Otterbourne, Hants SO21 2SW

Subject / purpose:

38199 - Manston Airport DCO EIA - Pre PEIR Consultation Meeting

Attendees:

Chris Neslon (CN) - Senior Technical Manager Southern Water
Marta Karpezo (MK)- Development Coordinator, Southern Water
John Moore (JM) - Hydrogeologist, Southern Water
Tim Haines (TH) Amec Foster Wheeler (AFW)
Geoff Derwick (GD) RPS Planning & Development (RPS)

Apologies:

Stuart Ward - Southern Water

Minutes: **Action by:**

1 Introductions were made and TH thanked all for attendance

2 TH and GD gave an overview of the project, the role of Amec Foster Wheeler and RPS in the RiverOak proposals for Manston Airport, and the current programme for the DCO.

A scoping report had been issued for consultation in June 2016. It was noted that through some administrative oversight that Southern Water had not commented on the Scoping report, although earlier meeting between AFW and Southern Water had taken place. AFW will remind SW of the relevant references. — AFW to provide planning ref

The PINS Scoping Opinion was received in August 2016.

Work has subsequently commenced on the baseline surveys and the preparation of the Preliminary Environmental Information Report (PEIR), currently programme is for the PEIR to be completed during Q2 2017, with six weeks statutory consultation to follow in early summer 2017.

As part of the PEIR work consultation was taking place with key stakeholders on those aspects identified as needing to be addresses. The groundwater impact and drainage aspects of the

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development are identified as important together with any potential land quality issues. Meetings have already taken place with the Environment Agency, and another meeting is planned for March 2017.

As RiverOak do not own the site access has been subject to separate negotiations and access was authorised by PINS under Section 53 of the Planning Act 2008 in December 2016. A walk over survey took place on the 7-9 February 2017 and was conducted by AFW and RPS and included land quality and water teams. The authorisation from PINS allows for further access, if required, to do further environmental surveys.

3 GD explained that work on refining the airport master plan is ongoing, although the overall scale of development will be similar to that shown in the scoping report. The proposals and t the work required was essentially reinstating the use as an airport so no significant change in use but new infrastructure would be required in order to allow the airport to handle, as a minimum, 10,000 air refight traffic movements (flights) per year. The development would be over a number of phases driven by growth in use of the airport over a 20-year period. The initial phase would see a refurbishment of onsite infrastructure, installing a new taxiway and sufficient aprons/stands/hangers for first phase of operation. The drainage and water treatment network would be done during the first stage. Subsequent phasing would see additional hangars and freight handling facilities.

In the current area immediately to the north new light industry and commerce units associated with the airport would be developed as needed.

4 CN welcomed the opportunity to be briefed on proposed development. SW have been involved in discussions with two other separate development options for the site.

SW emphasised that the airport site required special consideration due to the presence of the western adit feeding the Lord of the Manor (LOM) source. The LOM source was one of few potable water supplies feeding North East Kent and water supplies in the area were limited and therefore any threat to the deployable output of this source would have serious implications.

Plans of the adit alignment and diagrams of the LOM pumping wells were handed over.

5 Hydrogeological Conceptual Model – it was agreed that given the level of previous studies that the overall conceptual model was well understood and that there was no requirement for any additional field investigations to improve the confidence in the conceptual understanding.

Primary concern is the water quality; issues across the Thanet Chalk are with nitrates (persistent issue), solvents and pesticides (both intermittent). This is also true for the LOM source. TH stated

that it wasn't a historic and persistent issue with hydrocarbons and JM agreed given the absence of GAC treatment.

TH mentioned that AFW were undertaking a separate piece of work for SW (Mike Packman) on the definition of a Safeguard Zone for the LOM source. Mike had agreed than any relevant information and conclusions from that work could be used to inform the conceptual model for the hydrogeological risk assessment needed for the Manston development EIA.

A need for on-site fuel storage tanks was discussed. HSE guidance in light of the Buncefield incident is that below ground storage tanks were preferable. SW would not countenance below ground storage. TH indicated that this issue was known to the EA and they stated that there are precedents locally at Tesco where above ground fuel tanks have been required. However, there may be size implications.

GD stated that RiverOak at looking at different options for the location of a new fuel farm for the airport. These could include the Jentex Fuels site located to the southeast of the airport which was previously used. The EA have indicated that this site may be a concern given the location close to the SPZ.

JM indicated that the current SPZ designation could not be regarded as definitive given the nature of flow through the Chalk but they would not want to see any new works in the area designated as SPZ 1.

JM said SW would not accept any intrusive works near the adit or within SPZ1, and emphasises the desire of SW for the minimum level of intrusive work so as to avoid mobilising contaminants and creating pathways through the unsaturated zone.

TH mentioned that the EA would be looking for a degree of land quality classification and this would require a degree of SI work and intrusive work.

CN hoped that the development would not suffer from a cumulative impact of all three potential developments doing separate SI programmes – would be better if one was done and the results shared.

6 GD led the wide-ranging discussions on the existing and proposed surface water drainage. The main points were:

- Current drainage is considered to be positive with runway, hand standing and building drainage leading to an underground tank in the NW corner. Storm water is then collected and pumped to the western end of the runway and then gravity drains to the eastern end of the site to outfall via a 1200mm main to Pegwell Bay.
- The current drainage from the more recent passenger terminals and car part area is not known but is understood to

GD to submit capacity check

connect via interceptors to the existing surface water network.

request for foul sewer

- The arrangement for foul sewerage from the site is not known and is assumed to be to the north. SW indicated that if a formal "capacity check" request is made then they could indicate if the local foul sewer has the capacity to meet future demands.

GD to send plan of route of Pegwell Bay discharge main

- GD mentioned the new sewer being installed to the SW of the site that it looks like it may cross the Pegwell main discharge pipe. GD to send details of the route of the latter to MK so that this can be checked.

- Going forward the existing drainage network would be surveyed, repaired, upgrade or replaced as needed with water collected in an attenuation pond located on the north side of the site (again a topographic low) with an adjacent and linked treatment pond (e.g. aeration). From there water would be pumped the Pegwell Bay outfall main either directly or possibly using the existing route if the latter is appropriate.

- An important requirement will be to get a new discharge consent to Pegwell Bay

- All the drainage would be positive so in effect most of the rainfall/recharge across the site would be collected and drained off site. Discussion with the EA indicated that they would like to see more sustainable use of water, soakaways, green roofs, grey water recycling etc.

- CN note that normally they would put soakways of roof drainage etc. as their preferred solution but given the special circumstance of this site they would not advocate the use of soakaways. MK said that water recycling would be acceptable.

- Existing areas of grass remain mostly untouched. There is possibility that some of the overly wide runway would be excavated to create some recycled aggregate for building work. SW would prefer the runway to be left alone give the proximity to the adit and high risk of water quality failure due to turbidity and if work was necessary then to be properly designed to ensure no damage to the adit due to ground shaking etc.

- The airport would have to have both firefighting facilities (hydrants etc.) and a fire fighting training area. It would need to be identified if this could be supplied by main water or if storage tanks are needed across the site. GD to put in a capacity check request with respect to the mains water supply.

GD to submit capacity check request for mains water

CN indicated that SW would be comfortable with a design that captured all rainfall and runoff and took it off site.

BM proposed that AFW will undertake shallow investigations, trial pits for example, at the known potential sources of contamination in order to characterise the risk. But at this stage AFW are not going to propose systematic grid across the site as there is a lot of historic information, including the MOD survey from the late 1990s and a targeted approach was more appropriate. BM also noted there may be a number of sources (such as glycols) which could be excluded at an early stage due to their high solubility and rapid degradation. JW/LW agreed to targeted investigations provide this was justified and agreed to review the scope of the site investigations; EA would want to see at least a preliminary risk assessment as part of the application.

The EA would expect to see a plan for investigation work with a justification for why some things were not included (if that is the case).

LW discussed other potential sources on contamination within the vicinity of the site, these include the Jentex site, and a former petrol station in Cliffs End. LW also stated that phenols had been detected during the SI for the East Kent Access Road to the south of the airport but that the source was unknown, BM stated these unlikely to be related to the airport but that AFW will review information from this development as part of the Land Quality Phase 1 assessment.

7 The forthcoming PEIR document is to provide preliminary environmental information for the statutory (Section 42 of the Planning Act) consultations, and also to reflect the current round of consultation and to scope the development so the number of potential issues are reduced and therefore the breath of the subsequent EIA can be limited to those remaining issues with a potential significant effect.

The views of SW would influence the development and the details put forward. There will be further iteration with the EA and possibly is advantageous a three-way meeting with AFW/EA/SW.

CN supported a meeting and confirmed that the minutes of this meeting could be shared with the EA.

As part of the DCO application AFW will undertake target intrusive investigations and produce a preliminary risk assessment with an outline/timeline for further investigations. The EA were happy with this approach and will seek to secure conditions to the application for a programme of further intrusive investigation.

The DCO application will include sufficient information on the operational procedures for the airport, for example the use of pesticides to control insects, locations were de-icing and washing of aircraft, emergency procedure and spill response

8 A brief discussion was had on the works during development:

- GD explained that to add the new taxi-way and aircraft stands and to meet aviation regulations some land raising

was necessary to flatten the gradient. This would be a cut and fill exercise. CN indicated that such work would have to demonstrate no risk to the adit (i.e. no increase in turbidity of the water).

- Geotechnical SI work will be required of new building/foundations. At this stage the need for piling was not known. CN emphasised the need for any piling methods to minimise ground disturbance.
- SI for land quality assessment will be as least intrusive as possible (subject to any requirements form the EA).
- Long-term requisite surveillance may be required by the EA but the need for this will be the subject of further discussions.

9 TH said that AFW would like to work with SW to prepare a Statement of Common Ground (SoCG); a draft template for the SoCG has been be prepared and will be provided once these minutes had been finalised. — AFW to draft SoCG

10 AOB

TH mentioned next meeting with EA is on 6 March and the discharge to Pegwell Bay would be on the agenda.

The possible use of the existing discharge pipe to Pegwell Pay by SW when they need to pump to waste from LOM remains something to be considered.

It was agreed by all that a joint meeting with EA and Southern Water, once plans were sufficient well developed, would be of use.

Appendix B
Flowsource Analysis of Catchment to Lord of the Manor

Technical note:
Flowsource analysis of catchment to Lord of the Manor

1. Introduction

This technical note describes the results of numerical analysis carried out to determine the relative significance of flow to a Chalk groundwater source from the aquifer to the south of the source, relative to flow from the aquifer to the north of the source. The analysis is based on results from the East Kent regional groundwater model and the Flowsource tool to predict the volume of flow entering an adit to the source from the north and from the south, and has been carried out to support an assessment of the risk to the source from a proposed fuel farm associated with Manston airport.

2. The Lord of the Manor groundwater source

The Lord of the Manor PWS abstraction is operated by SWS and is located just off the Lord of the Manor roundabout to the west of Ramsgate, Kent.

The source consists of two wells: Lord of the Manor and Whitehall (disused and sealed). The source has a daily abstraction licence of 14.77 Ml/d and an annual licence of 4091 Ml/a.

There are three adits at the source; the Eastern, Western and South-Western Adit, constructed in the 19th and early 20th century. The construction detail is summarised as follows:

- The Western Adit is regularly dewatered. It is 3,013 m long and at an elevation of 2.8 mAOD to -0.71 mAOD;
- The Eastern adit has only been partially dewatered on a few occurrences (namely 1992 and 1998). The Eastern Adit is 2410 m long and connects to Whitehall , extending for a further 1000 m east, and with a total elevation range of 0.96 mAOD to -0.81 mAOD; and
- The South Western Adit is 475.5 m long. The elevation of this adit is not known.

The WRMP14 peak deployable output (PDO) is 2.75 Ml/d and the minimum deployable output (MDO) 1.50 Ml/d. For WRMP19, PDO was assessed at 2.1 Ml/d and MDO at less than 1 Ml/d under a 1 in 200 year design drought, and in a “normal year” PDO at 5.2 Ml/d and MDO at 2.8 Ml/d.

Information from SWS indicates that although the source has not been used in the last few years, actual abstraction rates before then were typically 3.5 Ml/d. Daily abstraction in the 1990’s peaked at over 9 Ml/d and in the 2000’s at over 8 Ml/d.

Water treatment at the source includes a nitrate removal plant and phosphate dosing for plumbosolvency before being boosted into the Fleete-Deal main.

Table 2.1 Lord of the Manor Source construction details and pump test information (after Aquaterra 2007)

Borehole	Depth (mbgl)	Ground Level (mAOD)	Rest Water Level (mAOD)	Comments
BH1	40.9 m	35.46 (datum at 33.01 mAOD at the Chamber Floor)	0.6 mAOD (Oct 1957)	Eastern Adit (3410 m) from 0.96 mAOD to -0.8 mAOD depth (height of 1.76m) Constructed in 1925 -Western Adit (3103 m) Ceiling 2.8 mAOD to floor 0.71 mAOD (height of 2.1m) South western Adit 475.5 m long Ceiling 0.96 mAOD and floor -0.8 mAOD (height of 1.76m)

*Chamber floor level

3. The East Kent Regional Groundwater Model

The East Kent regional groundwater model was constructed by Mott MacDonald for the Environment Agency and other stakeholders in 2006.

The model covers an area between the Chalk scarp east of Ashford to the coast around the Isle of Thanet and includes the catchments of the rivers Great Stour below Wye, and all of the Little Stour, Wingham Stream, Dour, North – South Streams and various rivers and streams flowing in areas of Palaeogene strata. The model has 3 layers (two for the Chalk and one for overlying strata), 178 rows and 146 columns of regular 250 m cells orientated 40° W and covers the period January 1970 to mid-2006 in half monthly stress periods. There are 31,020 active cells. The orientation and coverage of active cells has been matched with the North Kent model grid. The model is built on the MODFLOW-VKD code and uses the Environment Agency's in-house recharge code.

The Lord of the Manor (LoTM) source is represented in the East Kent model as 30 abstraction wells including the borehole and the eastern, western and south-western adits. Each abstraction well pumps at the same rate.

Analysis is presented of outputs from two model runs. In the Recent Actual (RA) model each well pumps at 116.7 m^3/d, representing the average rate at which the source was pumped in recent years. The total abstraction for all 30 wells that represent the source is thus 3500 m^3/d. In the Peak Deployable Output (PDO) model each well pumps at 173.3 m^3/d, and hence the total abstraction for the 30 wells is 5200 m^3/d. These rates are shown in Table 3.1.

Table 3.1 Pumping rates for the Lord of the Manor source in each model

Model	Pumping rate in each abstraction cell	Total pumping rate for the source
Recent Actual (RA)	116.7 m^3/d	3.5 Ml/d
Peak Deployable Output (PDO)	173.3 m^3/d	5.2 Ml/d

4. Flowsource

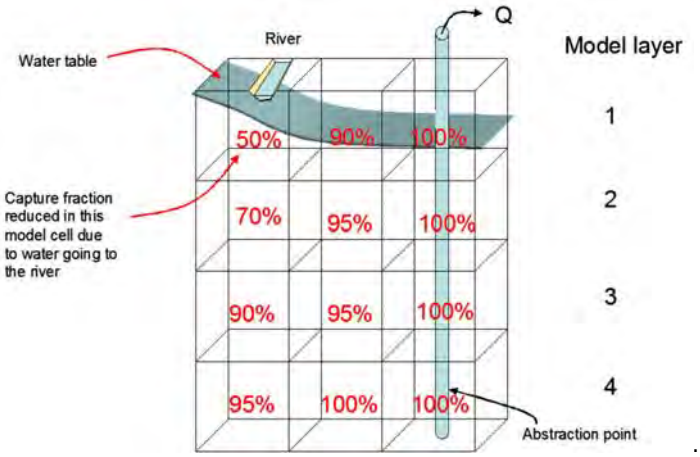
The Flowsource software package (Foley and Black, 2013) has been used to quantify the contributions of water from different parts of the Chalk aquifer to the Lord of the Manor source. This programme uses the groundwater heads and flows in each model cell, during each modelled stress period and calculates the following outputs:

- Capture Fraction (CF) - The fraction of water within each model cell captured by (or ending up at) a specified model cell (e.g. the cell hosting an abstraction). The water travels between the model cells either under the driving head from drawdown due to pumping at borehole pumps or the regional driving head in the aquifer.
- Volume From (VF) - The volume of water input to each model cell by model boundary conditions (i.e. recharge, riverbed leakage, release from aquifer storage) that is captured by or ends up at a specified model cell.
- Volume Through (VT) - The volume of water which flows through the faces of each model cell that is captured by or ends up at a specified cell, based on the capture fraction and the total volume of water flowing through the faces of the model cell.
- Age of waters - The time of travel from individual model cells to the abstraction cell. This calculation is based on the calculation of the time of travel of particles released **at the water table**, from the centre of each model cell, to the abstraction cell (using the MODPATH method of calculation of flow through permeable **saturated** media). This value does not include travel through the unsaturated zone.

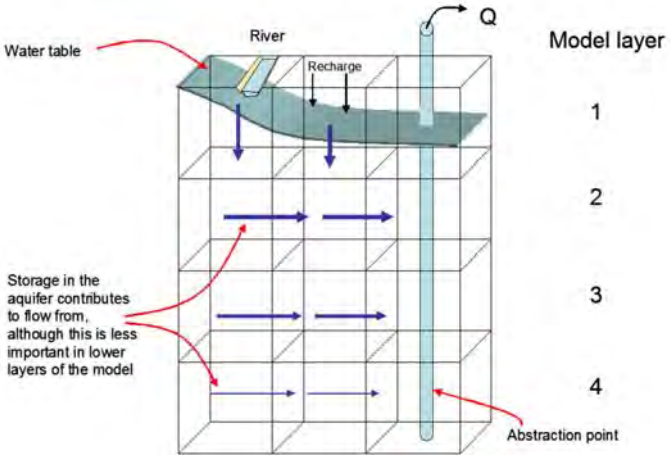
Note that the “Volume Through” output will, in an homogenous aquifer, display the same spatial variability as the Capture Fraction output. In the interests of brevity Volume Through output is not further presented here.

Visualisation of the Flowsource calculations is shown in Figure 4.1 below.

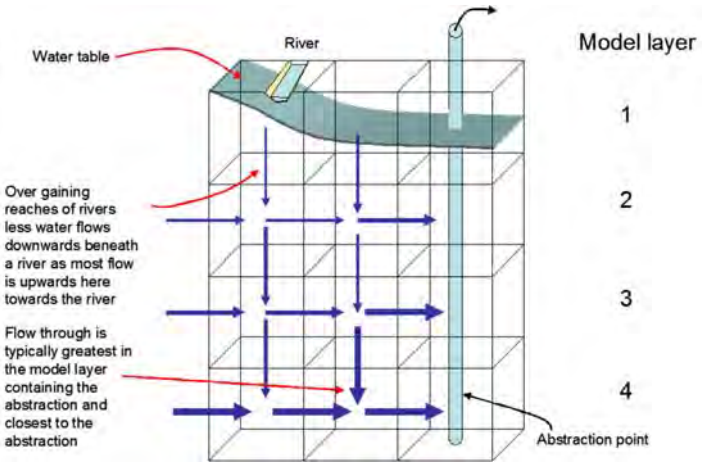
Figure 4.1 Conceptualisation of Flowsource outputs in a simple four layered model



Capture Fraction, i.e. the proportion of water in model cells that is taken by the abstraction Q.



Volume From i.e. the volume of water originating in model cells that is taken by the abstraction Q.



Flow Through i.e. the volume of water flowing through the faces of a model cell from other cells that is taken by the abstraction Q.

5. Methodology

Regional groundwater flow in the catchment is roughly north-south, and so for this exercise we are principally interested in the flow in the catchment along a line north south which passes through the proposed fuel farm location. Values have been extracted from Flowsource output grids in each of the model cells which underlies this line, extending across the entire catchment from the north, through the western adit and on to the southern boundary of the catchment. Results are presented for two model runs: the Recent Actual (RA) model with the Lord of the Manor source pumping at 3.5 Ml/d, and the Peak Deployable Output (PDO) model with the Lord of the Manor source pumping at 5.2 Ml/d (and all other sources pumping at their recent actual rates, as in the RA model).

Although the line for which we have extracted model output runs due north-south, because the model is on a rotated grid this does not align directly with a single column of model cells. The output values have been calculated by interpolation of the values on the underlying rotated model grid.

Results are presented in an Excel workbook as a series of charts in Appendix A (RA model) and Appendix B (PDO model). In each case, a blue line represents the numerical quantity of interest (Capture Fraction, Volume From, travel time) along a line south-north through the proposed fuel farm location (marked with an orange line). The adit is at approximate location 165500 on these charts.

Outputs are provided for long term average conditions (an average over the 37 year duration of the model run), for high water level conditions (stress period 123; Feb 1975) and for low water levels (stress period 547; October 1992).

We also present spatial figures showing grids of Flowsource output layers for the entire catchment to the LoTM source, on the rotated model grid, together with the line north-south for which individual cell values have been extracted. The purpose here is to illustrate the variations in Flowsource flow values across the catchment, and the uncertainty due to the model grid resolution and interpolation during processing. Results for the RA model are presented in Appendix C and for the PDO model in Appendix D.

Finally, we present vector plots showing the magnitude and direction of groundwater flow in the catchment to the LoTM source under high water level conditions (stress period 123; Feb 1975) and for low water levels (stress period 547; October 1992). Results for both the RA and PDO model runs are presented in Appendix E.

6. Results

6.1 Volume From

In the RA model, in the long term average only one model cell to the south of the adit contributes any flow to the adit, and this contribution is approximately 3m^3/day, or about 1.2% of the total flow to the adit (Figure A1). Under high water level conditions, less than 0.5 m^3/day is predicted to flow to the adit from the south, or about 0.14% of the total (Figure A2). Under low water level conditions this proportion is about 1.5% (Figure A3).

In the PDO model, in the long term average three cells to the south of the adit contribute flow, totalling about 4.2% of the total flow to the adit (Figure B1). Under low water level conditions the proportion of the total flow to the adit from the south increases to 5.3% (Figure B2) and under high water level conditions it drops to about 0.2% (Figure B3).

Figures C1 to C3 show the spatial variation in Volume From, under long term average, high water level and low water level conditions, respectively for the RA model. The proposed fuel farm location lies on the very edge of the contributing catchment area (although there is some uncertainty given the 250 m model grid resolution).

Figures D1 to D3 show corresponding maps of Volume From for the PDO model. As expected, the increased pumping rate of the source in the PDO model causes an increase in catchment area, and the predicted catchment increases in extent to the south by one model row (equal to 250 m). The catchment thus includes the location of the proposed fuel farm.

6.2 Time of travel

Figure A4 shows predicted time of travel to the adit from each point to the north and south across the catchment in the RA model. The time of travel from all points to the south of the adit is predicted to be very long (>1,000 years) and this reflects the fact that the predicted position of the zone of stagnation lies close to the adit. Again, this is uncertain due to the coarse model resolution.

Figure B4 shows predicted times of travel in the PDO model. In this model there is a small amount of flow from the south of the adit with predicted time of travel of around 200 days (although the uncertainty in this figure is substantial).

Figure C4, for the RA model, shows that the model predicts very long times of travel from all points to the south of the adit at the longitude of the proposed fuel farm, although some shorter times of travel to the adit from locations to the east and west of the fuel farm location.

Figure D4, for the PDO model, shows shorter times of travel from the cells immediately adjacent to the proposal fuel farm location, with one cell south of the adit having a time of travel in the range 50-400 days (as noted above) and a few cells further west now contributing flow with time of travel of order 10 years (which in the RA model had times of travel greater than 1,000 years. Again, this is as expected given the greater pumping rate of the source in the PDO model.

6.3 Capture Fraction

Figures A5 to A7 show predicted capture fraction under long term average, high water level and low water level conditions, respectively for the RA model. Capture fraction at the adit is high, as expected, but drops away very sharply to the south while remaining high to the north. This is as expected, and is consistent with the model prediction that the overwhelming majority of the flow to the adit is from the catchment to the north.

Figures B5 to B7 show corresponding values for the PDO model. These show a similar pattern, with capture fractions at the adit in the catchment to the north being high and falling away sharply to the south. However, capture fraction does not fall away as sharply as in the RA model, and has a value of around 0.3 at the proposed fuel farm location. It should be borne in mind, however, that this still represents a small flow volume.

Figures C4 to C7 show the extent of the catchment to the LoTM source under long term average, high water level and low water level conditions, respectively for the RA model. In all three cases, the proposed fuel farm location lies on the edge of the modelled catchment; the model cells immediately to the south of are predicted to lie outside the catchment to the source.

Figures D4 to D7 show corresponding output for the PDO model. As noted above, in this model the catchment to the source extends slightly further to the south, and an additional row of model cells to the south of the “Recent Actual catchment” contribute flow to the source.

6.4 Flow Vectors

Figures E1 and E2 show groundwater flow vectors for the RA model and the PDO model, under high and low water level conditions, respectively. Note that these figures are plotted with the model grid orientation aligned with the page, not taking account of the rotation of the East Kent model grid. North is therefore aligned 40° anti-clockwise from vertical on the page, and for this reason the western adit (shown shaded yellow) appears to be orientated southwest-northeast. This does not affect the model results and is merely a presentational issue.

In each case, there is some suggestion of a very small east to west component of flow as groundwater flows towards and past the adit, although the dominant flow direction is clearly north to south. This small east-west component is perhaps slightly greater in the RA model.

7. Summary

7.1 Summary

The results of the analysis are summarised as follows:

- A very small fraction of the flow to the western adit of the LoTM source is predicted to originate from the aquifer to the south of the adit. In the long term average, the proportion of flow originating from the south is about 1.2% (RA model) to 4.2% (PDO model).
- Under high water levels, this proportion is further reduced to about 0.1% to 0.2%. Under low water levels, the proportion is about 1.5% (RA model) to 5.3% (PDO model).
- This contribution, whilst very small, is not zero.
- In the RA model the flow that does reach the adit from the south is predicted to have very long times of travel in the saturated zone. This is due to the predicted zone of stagnation being to the south of the adit and close to it.
- In the PDO model there is a small area to the south of the adit with predicted time of travel of about 200 days, i.e. the predicted zone of stagnation is now slightly further to the south, as would be expected.
- In the RA model the proposed fuel farm location lies on the very edge of the modelled catchment. The model cells immediately to the south of the proposed location are predicted to lie outside the catchment.
- In the PDO model the catchment extends one additional model cell to the south and thus includes the proposed location.
- In both models there is a very small predicted component of saturated groundwater flow east-west near the adit. The dominant direction of flow is north-south however.

7.2 Uncertainty

There are a number of uncertainties in the modelled results:

- The model is based on a 250 m grid, and as such all output represents average values over a 250 m square.
- Where there are sharp gradients in Flowsource outputs, such as close to the catchment boundary to the south, there will be significant uncertainty in the values at a precise location.
- The Flowsource flow values are the result of interpolation from the rotated model grid. Whilst this is a robust procedure, it introduces further uncertainty into the results.
- Small scale hydrogeological features, such as the precise location of the zone of stagnation and the detail of the cone of depression around the source are unlikely to be precisely represented by the model.

8. References

Aquaterra, 2007. Lord of the Manor Constraints Investigation (Desk Study). Prepared for Southern Water pp. 42.

Foley, C. and Black, A., 2013. Efficiently delineating volumetric capture areas and flow pathways using directed a cyclic graphs and MODFLOW; description of the algorithms within FlowSource. *MODFLOW and More*, pp.2-5.

Author	Reviewer
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Management systems

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Appendix A
Linear Flowsource output – Recent Actual model

Figure A1 Volume From (long term average)

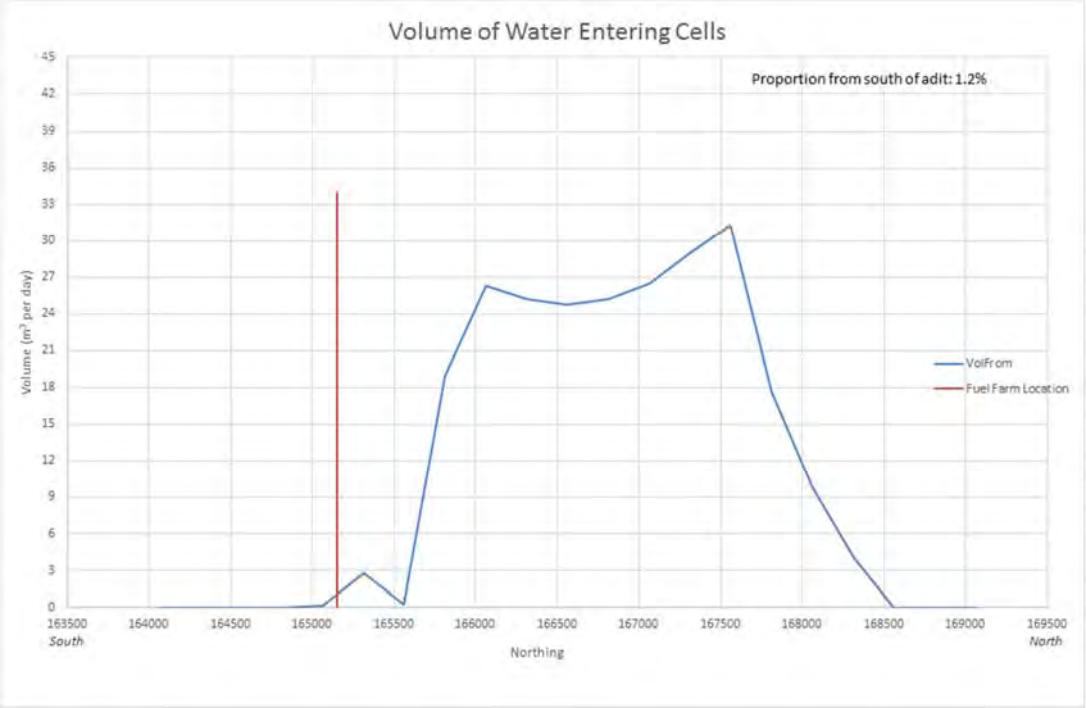


Figure A2 Volume From (high water levels)

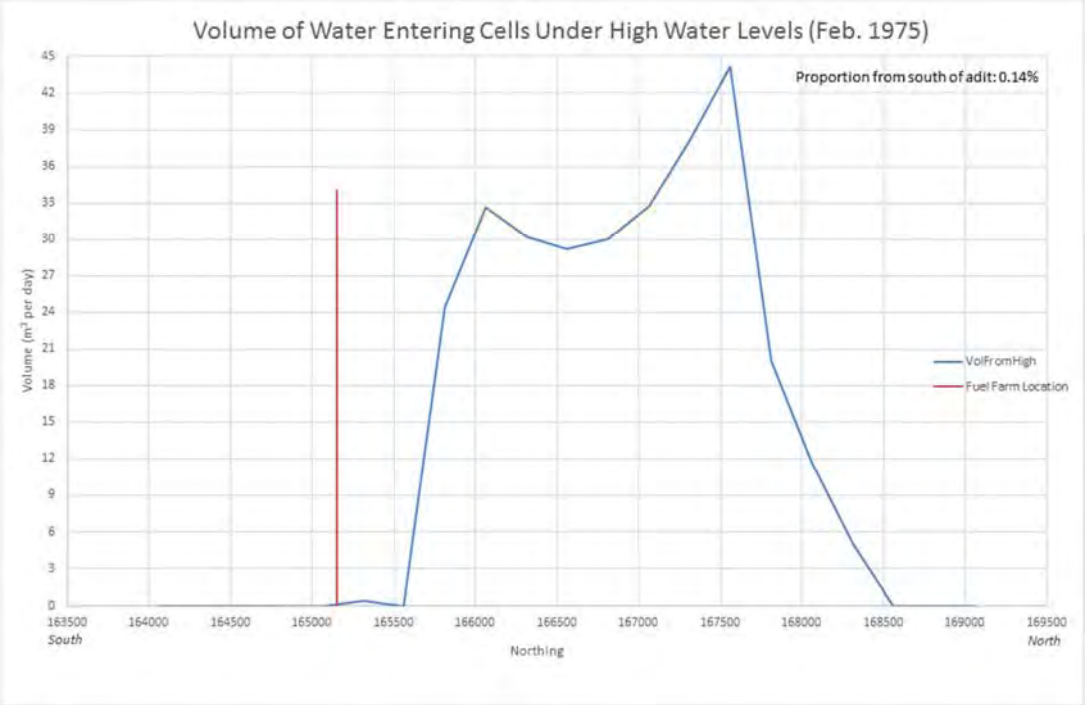


Figure A3 Volume From (low water levels)

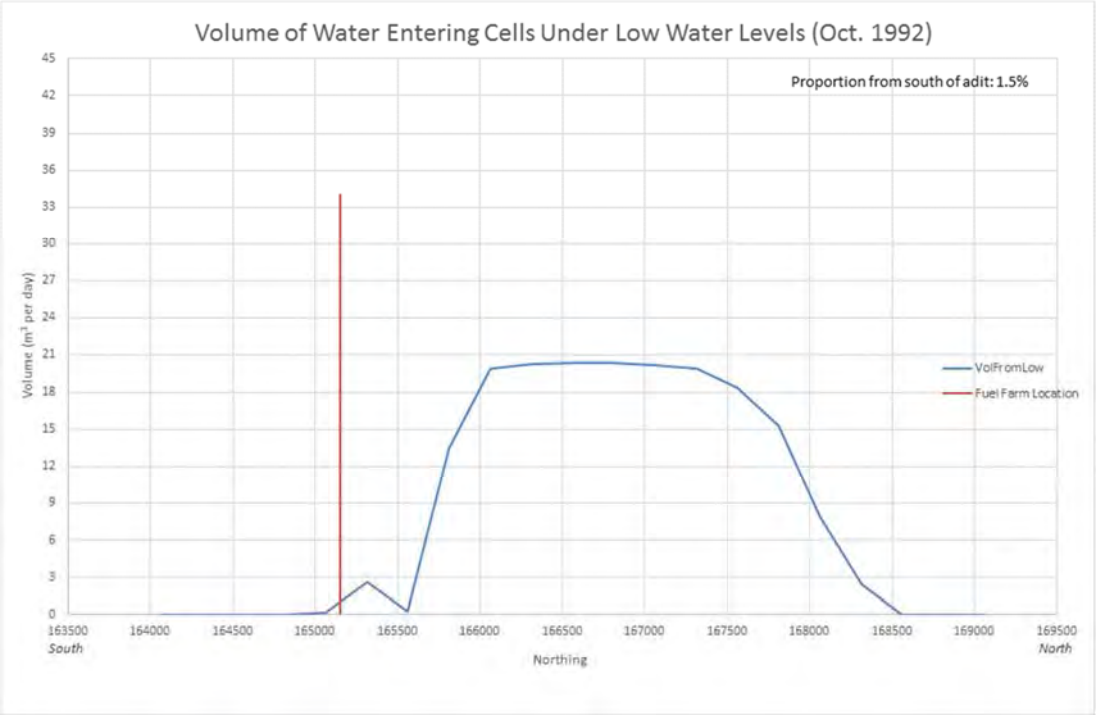


Figure A4 Time of Travel (long term average)

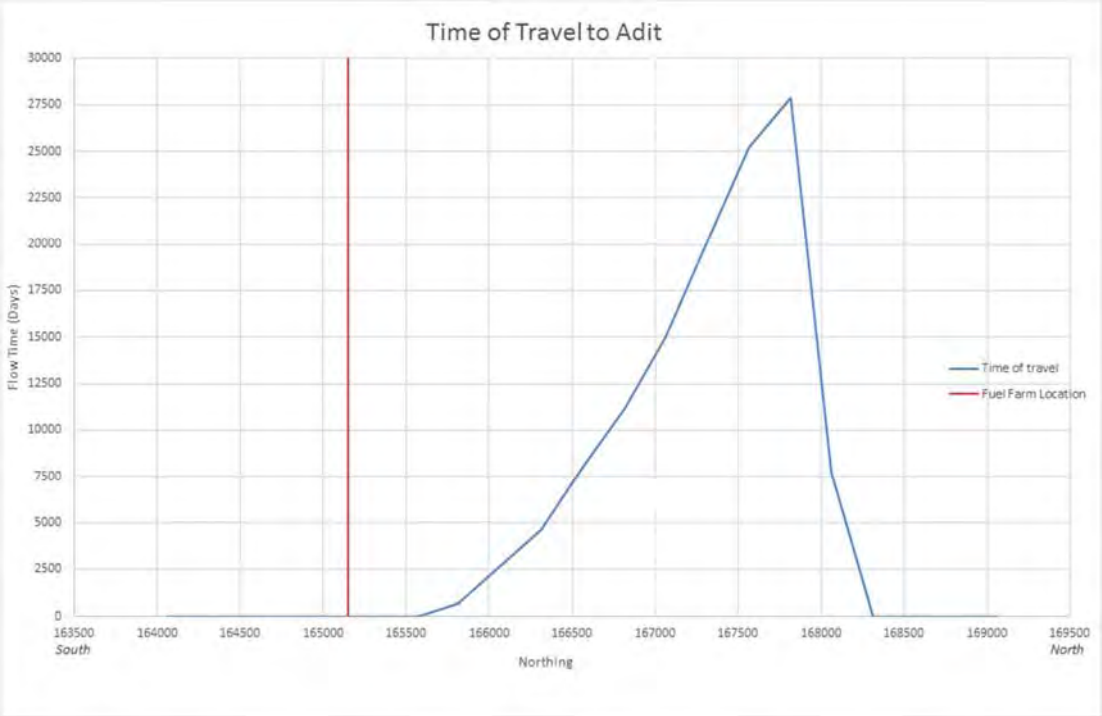


Figure A5 Capture Fraction (long term average)

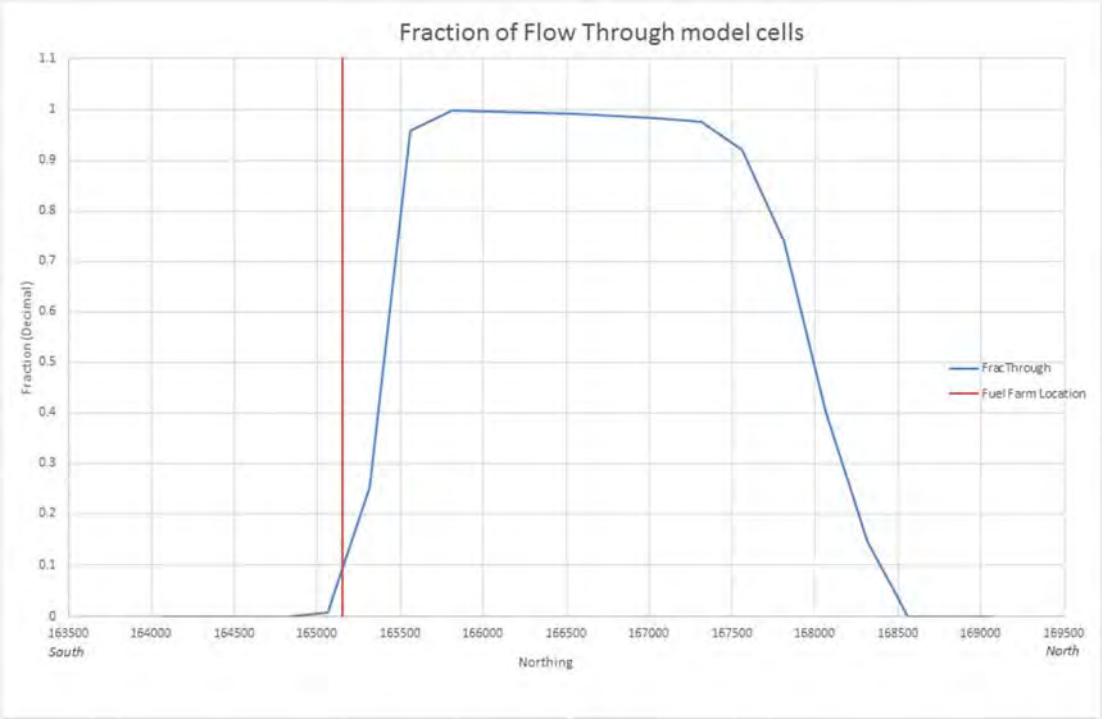


Figure A6 Capture Fraction (high water levels)

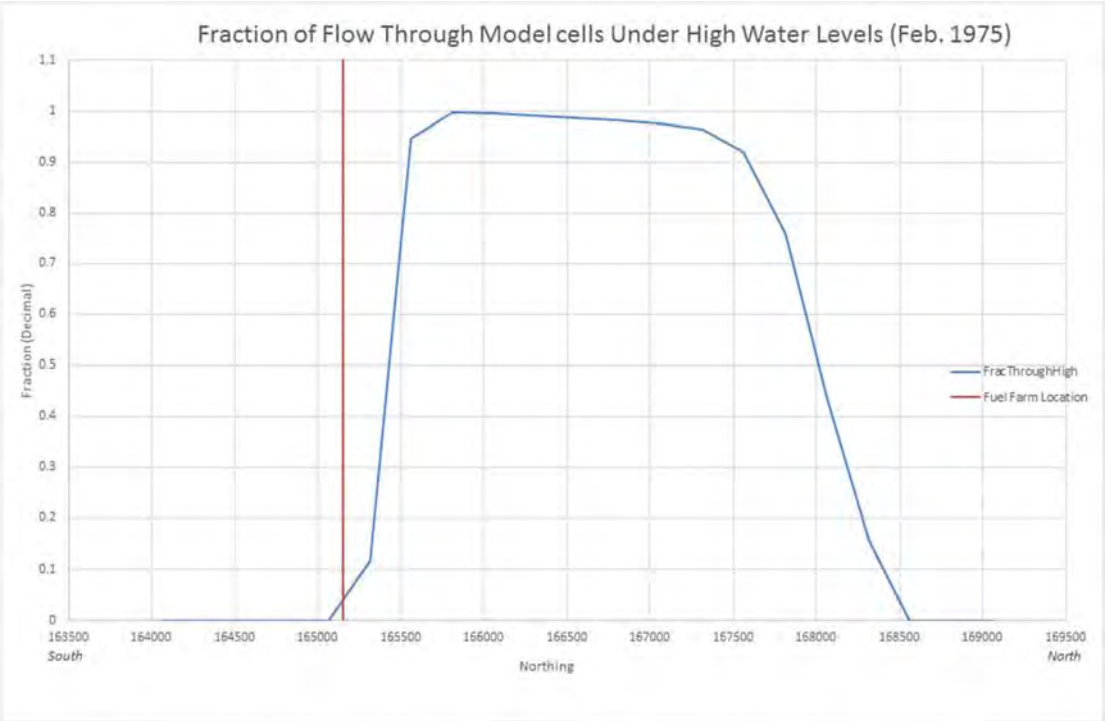
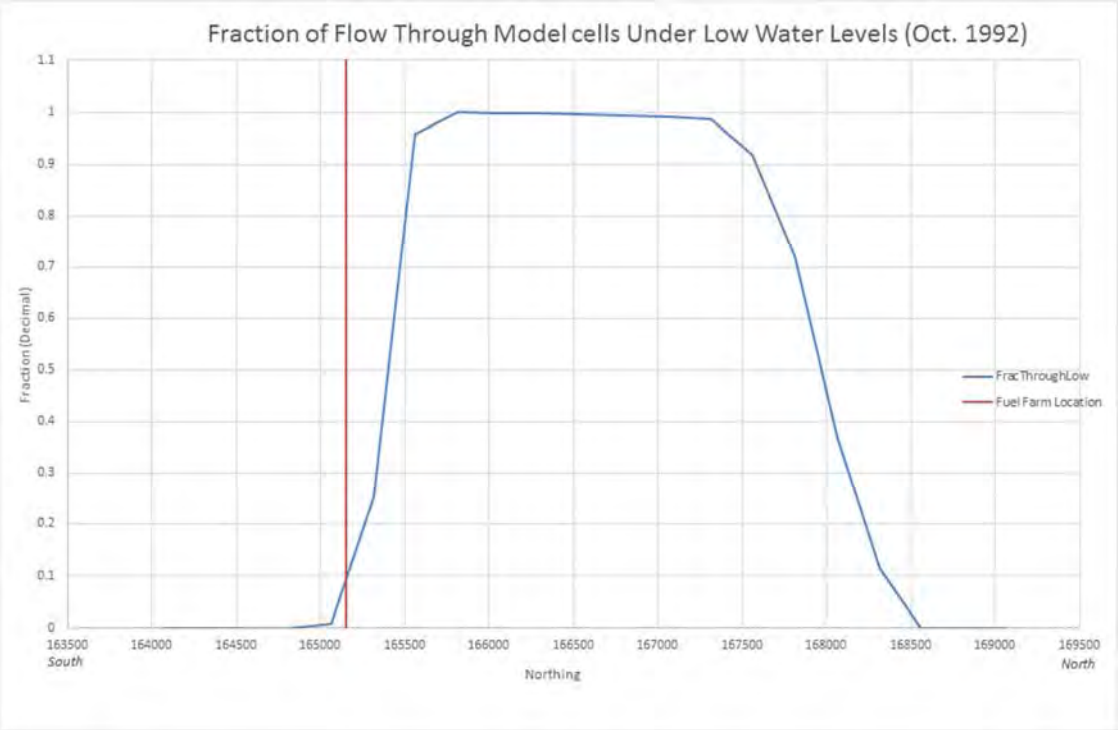


Figure A7 Capture Fraction (low water levels)



Appendix B
Linear Flowsource output – PDO model

Figure B2 Volume From (long term average)

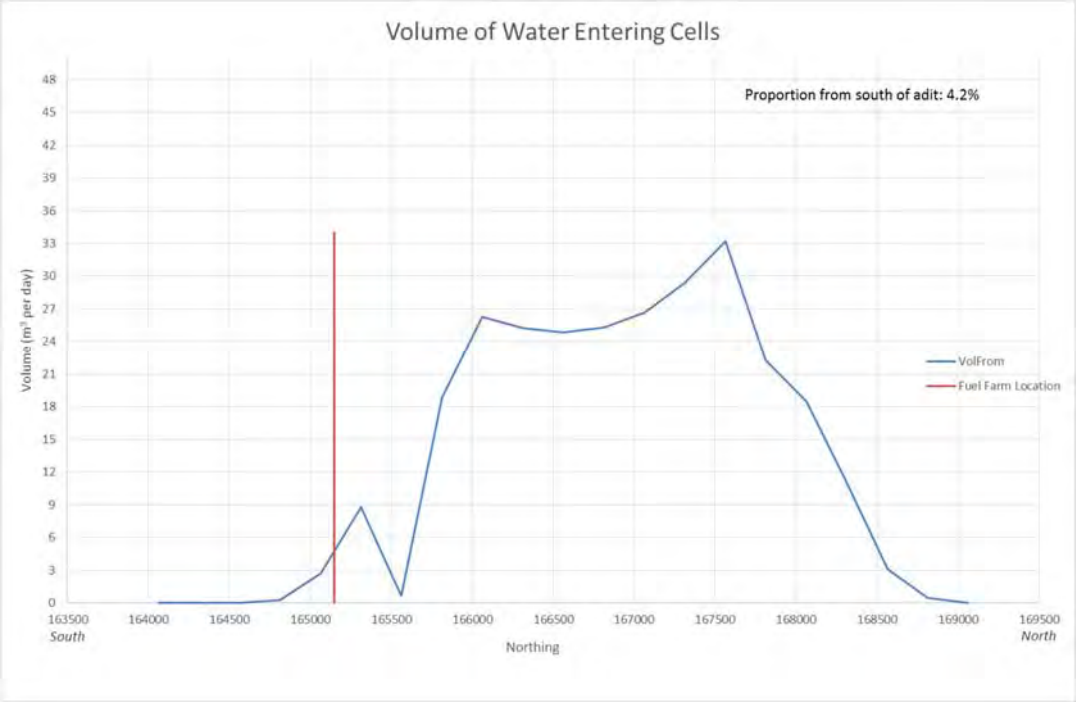


Figure B2 Volume From (high water levels)

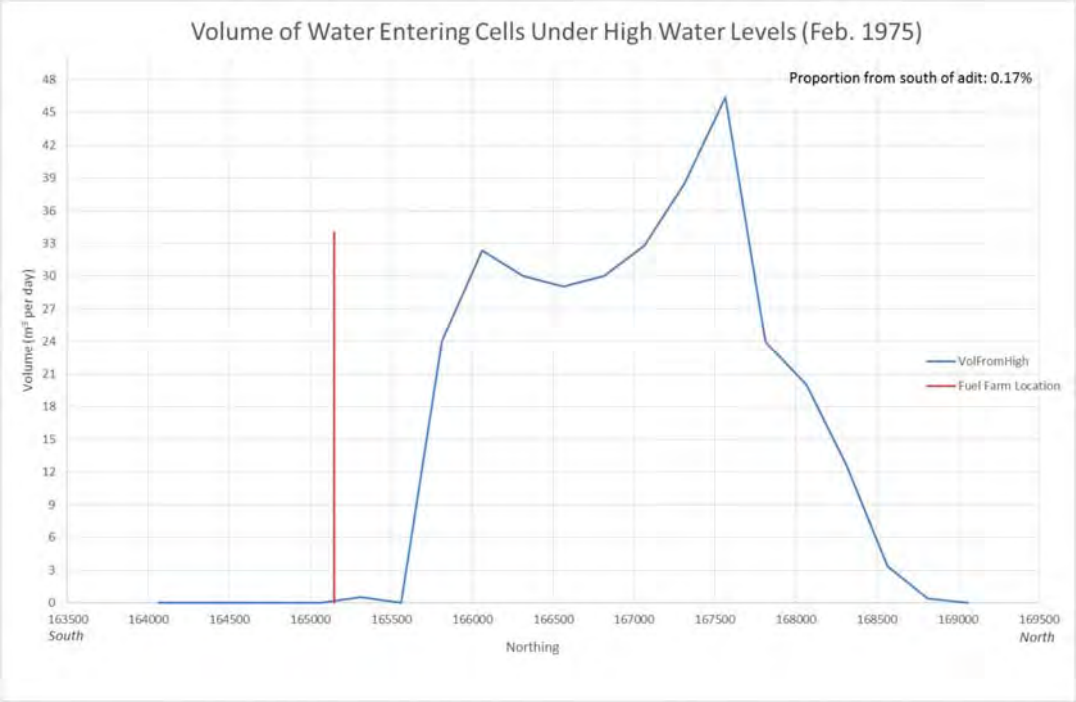


Figure B3 Volume From (low water levels)

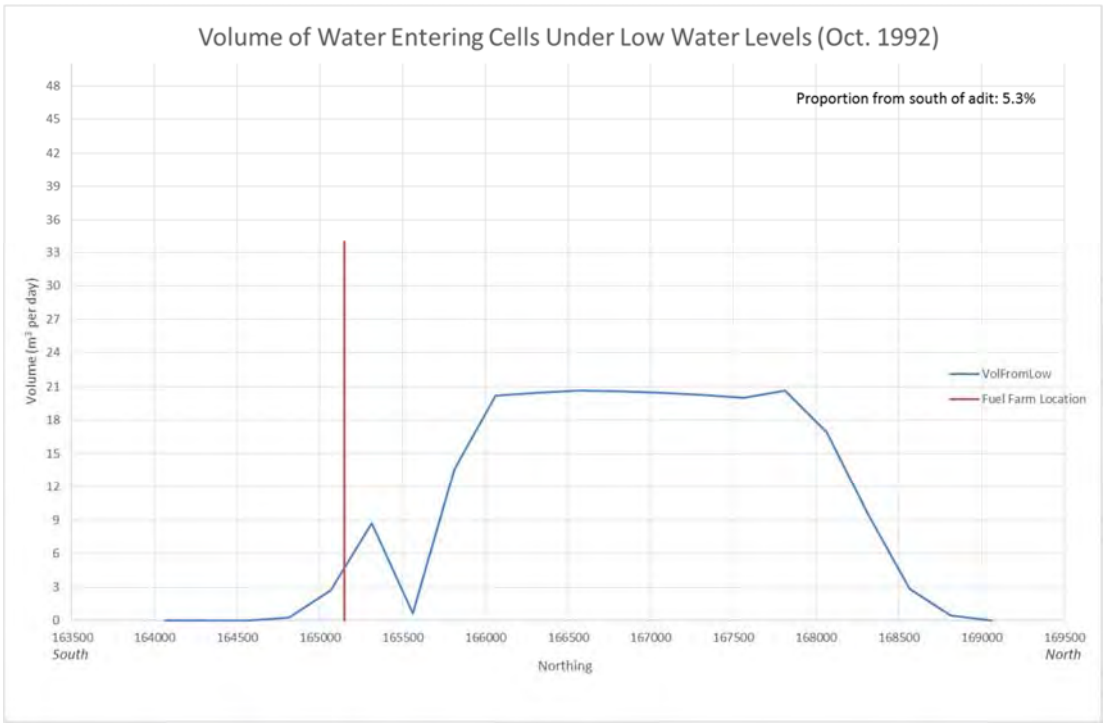


Figure B4 Time of Travel (long term average)

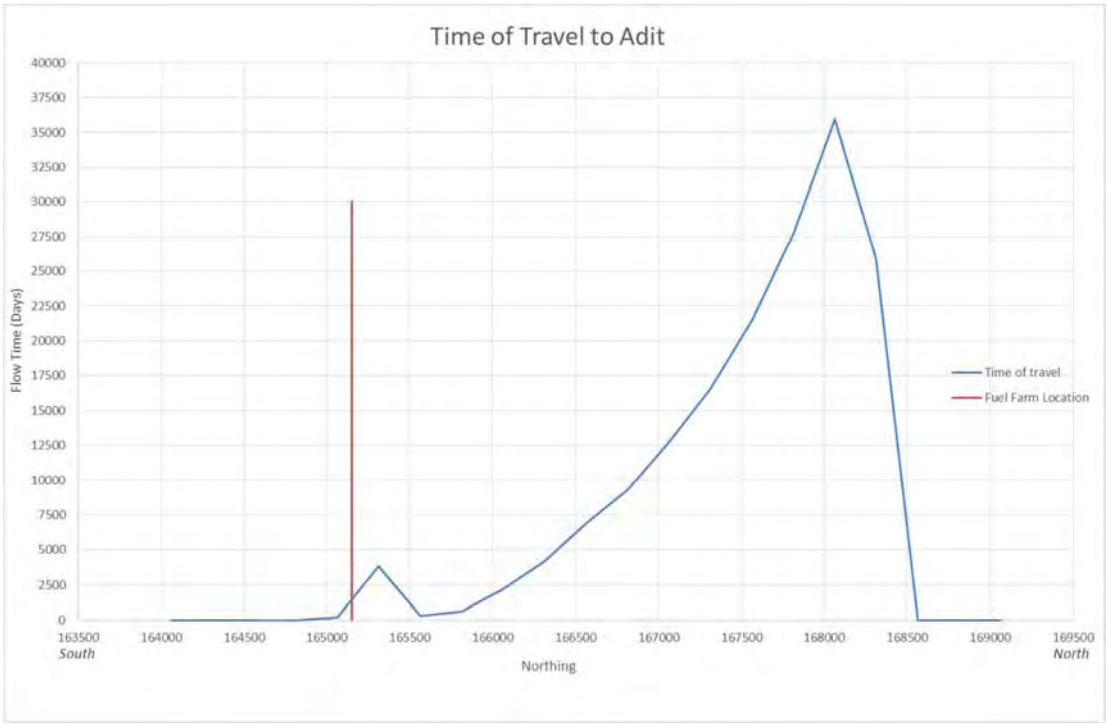


Figure B5 Capture Fraction (long term average)

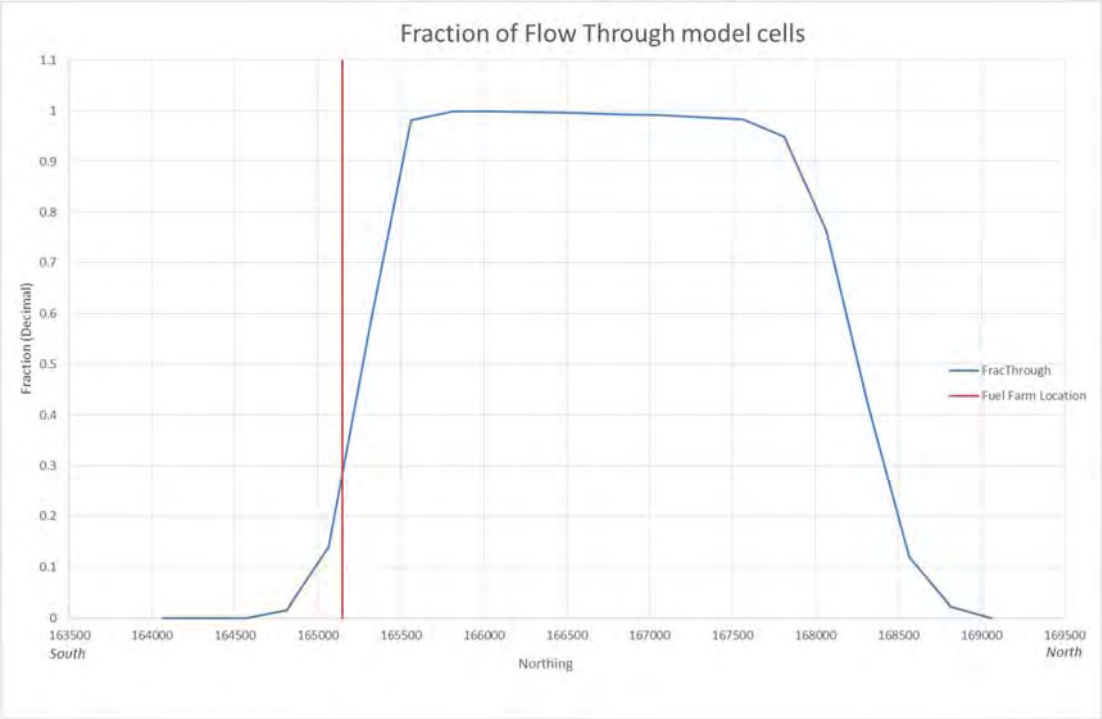


Figure B6 Capture Fraction (high water levels)

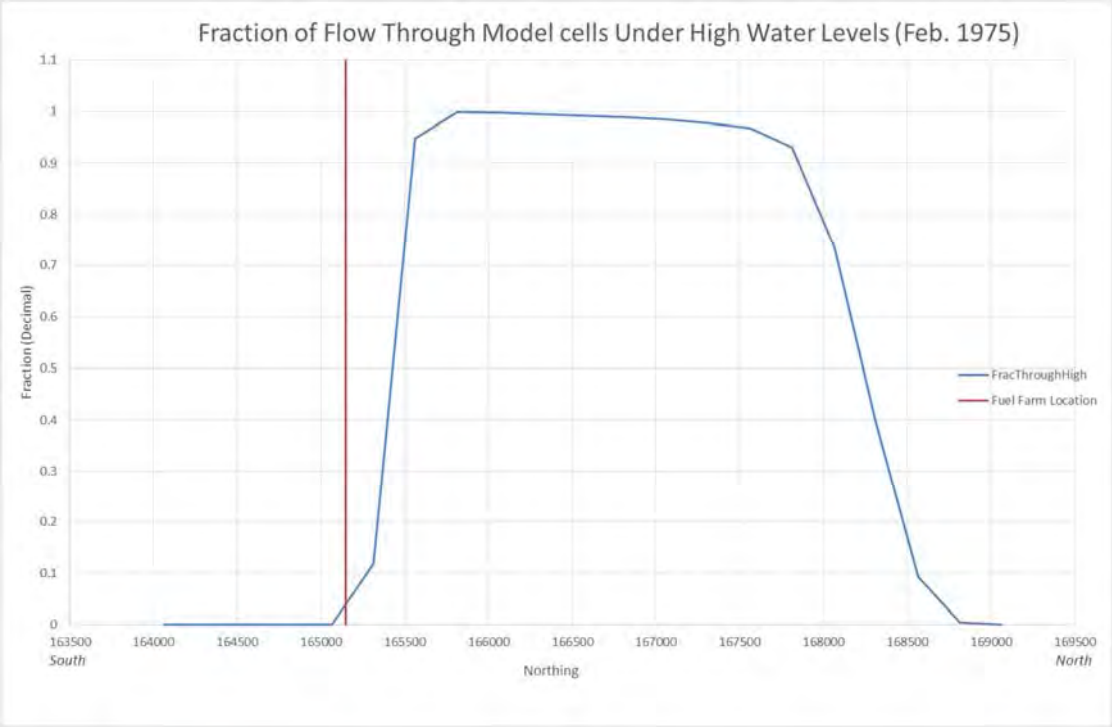
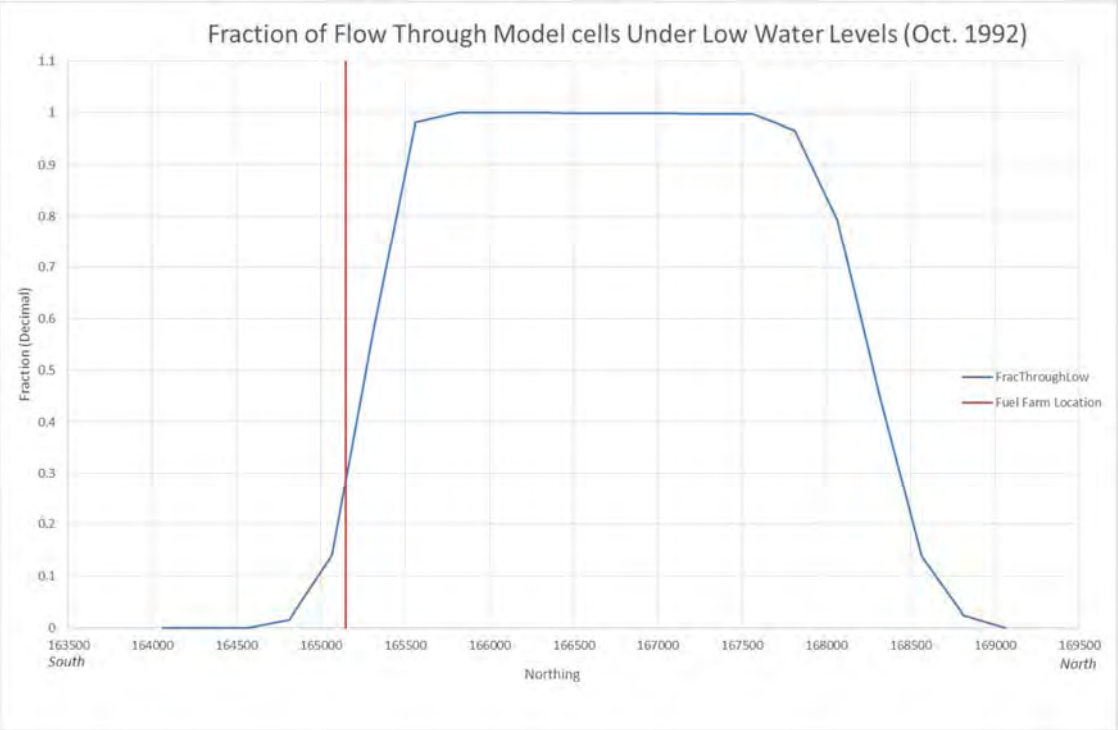
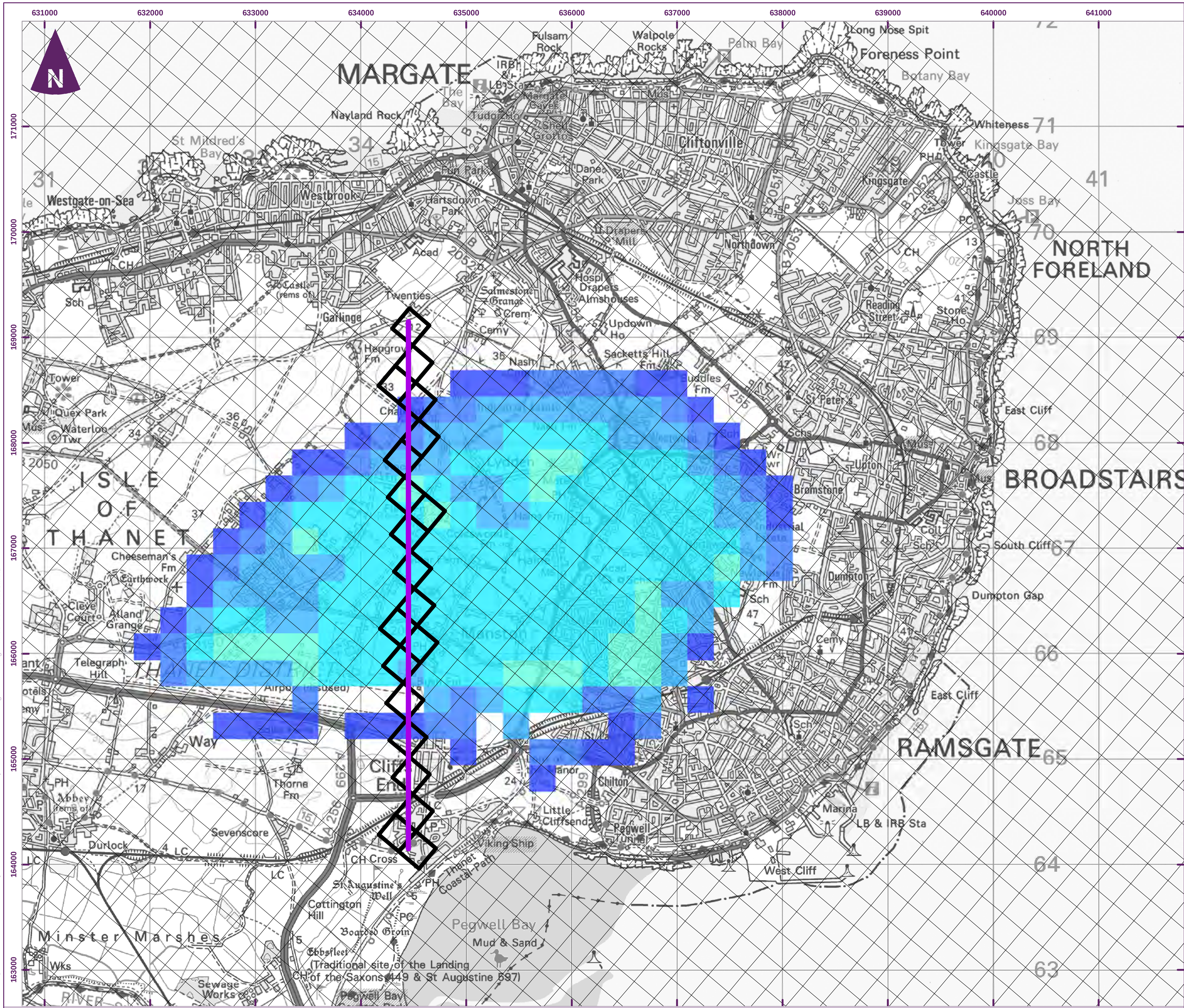


Figure B7 Capture Fraction (low water levels)



Appendix C
Spatial Flowsource output figures – Recent Actual model



631000
632000
633000
634000
635000
636000
637000
638000
639000
640000
641000
171000
170000
169000
168000
167000
166000
165000
164000
163000
N
MARGATE
Cliftonville
Westgate-on-Sea
Westbrook
Kingsgate
NORTH FORELAND
BROADSTAIRS
RAMSGATE
ISLE OF THANET
Foreness Point
Botany Bay
Long Nose Spit
Palm Bay
Kingsgate Bay
Joss Bay
Whiteness
East Cliff
South Cliff
Dumpton Gap
Bromstone
St Peter's
Northdown
Garlinge
Twenties
Nayland Rock
St Mildred's Bay
Minster Marshes
Pegwell Bay
Mud & Sand
Cliffs End
Sevenscore
Durlock
Cottington Hill
Viking Ship
West Cliff
Marina
LB & IRB Sta
Thanet Coastal Path
Manston

Key

250m model grid	
250m model grid (used for interpolated values)	
North - South Line	

Volume From (m^3)

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100
- 100 - 150
- 150 - 300

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

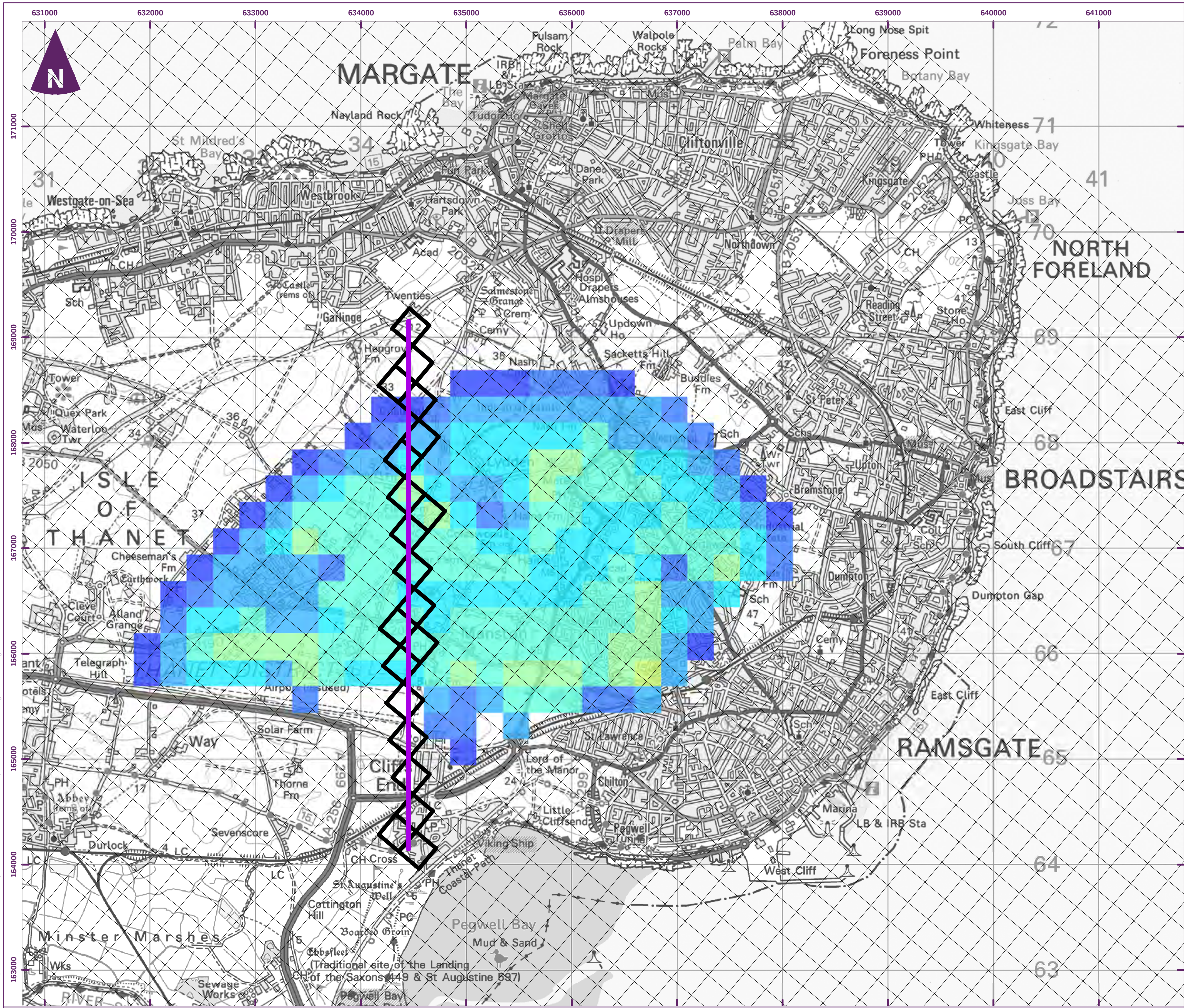
Client

RSP

Manston Airport DCO EIA

amec foster wheeler

C1 Manston Flowsource
Lord of Manor- Volume From LTA
Layer 2



Key

250m model grid

250m model grid (used for interpolated values)

North - South Line

Volume From (m^3)

	0 - 2
	2 - 5
	5 - 10
	10 - 20
	20 - 30
	30 - 40
	40 - 50
	50 - 60
	60 - 70
	70 - 80
	80 - 90
	90 - 100
	100 - 150
	150 - 300

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

Client

RSP

Manston Airport DCO EIA

amec foster wheeler

C2 Manston Flowsource
Lord of Manor- Volume From Layer 2
Time 123

September 2017 38199-Lon131.mxd eastr

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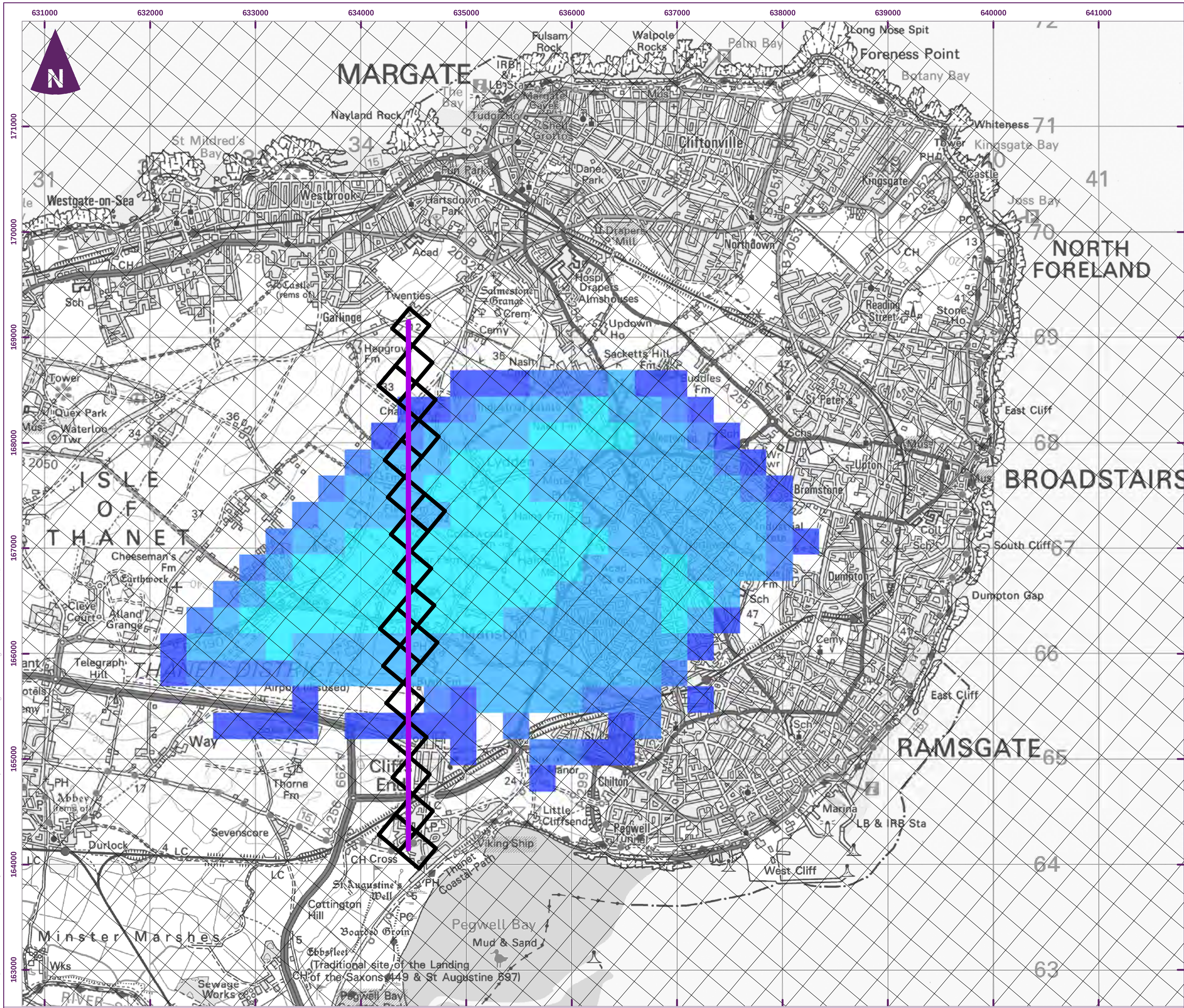


Key

- 250m model grid
- 250m model grid (used for interpolated values)
- North - South Line

Volume From (m³)

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100
- 100 - 150
- 150 - 300

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

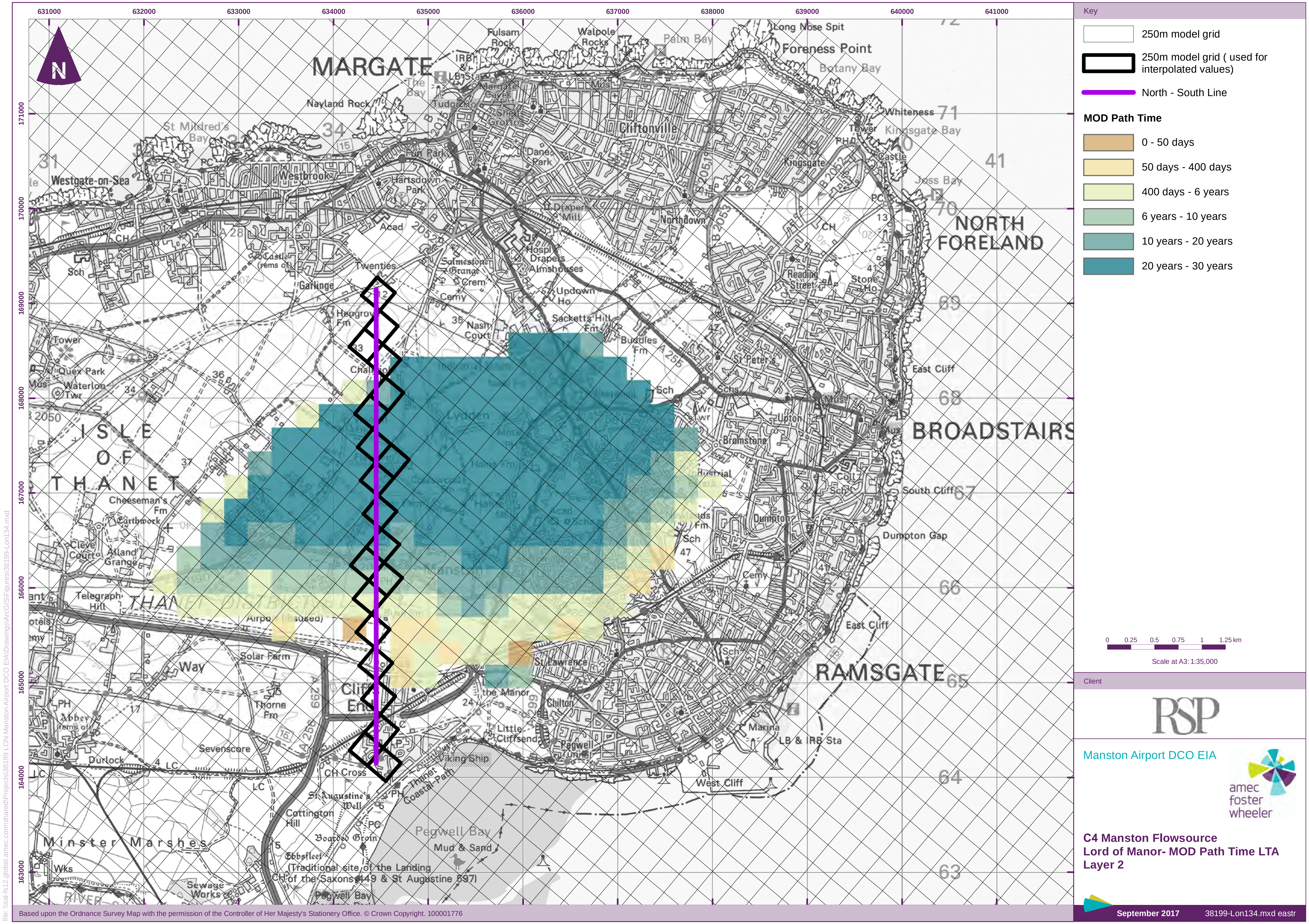
Client

RSP

Manston Airport DCO EIA

amec foster wheeler

C3 Manston Flowsource
Lord of Manor- Volume From Layer 2
Time 547



Key
250m model grid
250m model grid (used for interpolated values)
North - South Line
MOD Path Time
0 - 50 days
50 days - 400 days
400 days - 6 years
6 years - 10 years
10 years - 20 years
20 years - 30 years
0 0.25 0.5 0.75 1 1.25 km
Scale at A3: 1:35,000
Client
RSP
Manston Airport DCO EIA
amec foster wheeler
C4 Manston Flowsource
Lord of Manor- MOD Path Time LTA
Layer 2
September 2017
38199-Lon134.mxd eastr
MARGATE
BROADSTAIRS
RAMSGATE
NORTH FORELAND
ISLE OF THANET
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631000 632000 633000 634000 635000 636000 637000 638000 639000 640000 641000

171000 170000 169000 168000 167000 166000 165000 164000 163000

MARGATE
Fulsam Rock
Walpole Rocks
Long Nose Spit
Foreness Point
Palm Bay
Botany Bay
Nayland Rock
St Mildred's Bay
Westgate-on-Sea
Westbrook
Hartsdown Park
Cliftonville
Dane Park
Whiteness
Kingsgate
Kingsgate Bay
Joss Bay
Northdown
Draper's Mill
NORTH FORELAND
Twenties
Garlinge
Salmestone Grange
Hospl Draper's Almshouses
Updown Ho
Reading Street
Stone Ho
East Cliff
ISLE OF THANET
Tower
Quex Park
Waterloo
Cheesema
Cleve Court
Telegraph Hill
Minster Marshes
Wks
Sewage Works
BROADSTAIRS
Dumpton
Dumpton Gap
South Cliff
Cliff End
Thorne Fm
Abbey (rems of)
Sevenscore
Dun Lock
CH Cross
St Augustine's Well
Cottington Hill
Viking Ship
Thanet Coastal Path
Little Cliffsend
Pegwell Bay
Mud & Sand
Ebbsfleet (Traditional site of the Landing of the Saxons 449 & St Augustine 597)
Pegwell Bay
RAMSGATE
Marina
LB & IRB Sta
West Cliff
East Cliff

Key

250m model grid

250m model grid (used for interpolated values)

North - South Line

Frac Through

0 - 0.01
0.01 - 0.02
0.02 - 0.05
0.05 - 0.1
0.1 - 0.15
0.15 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

Client

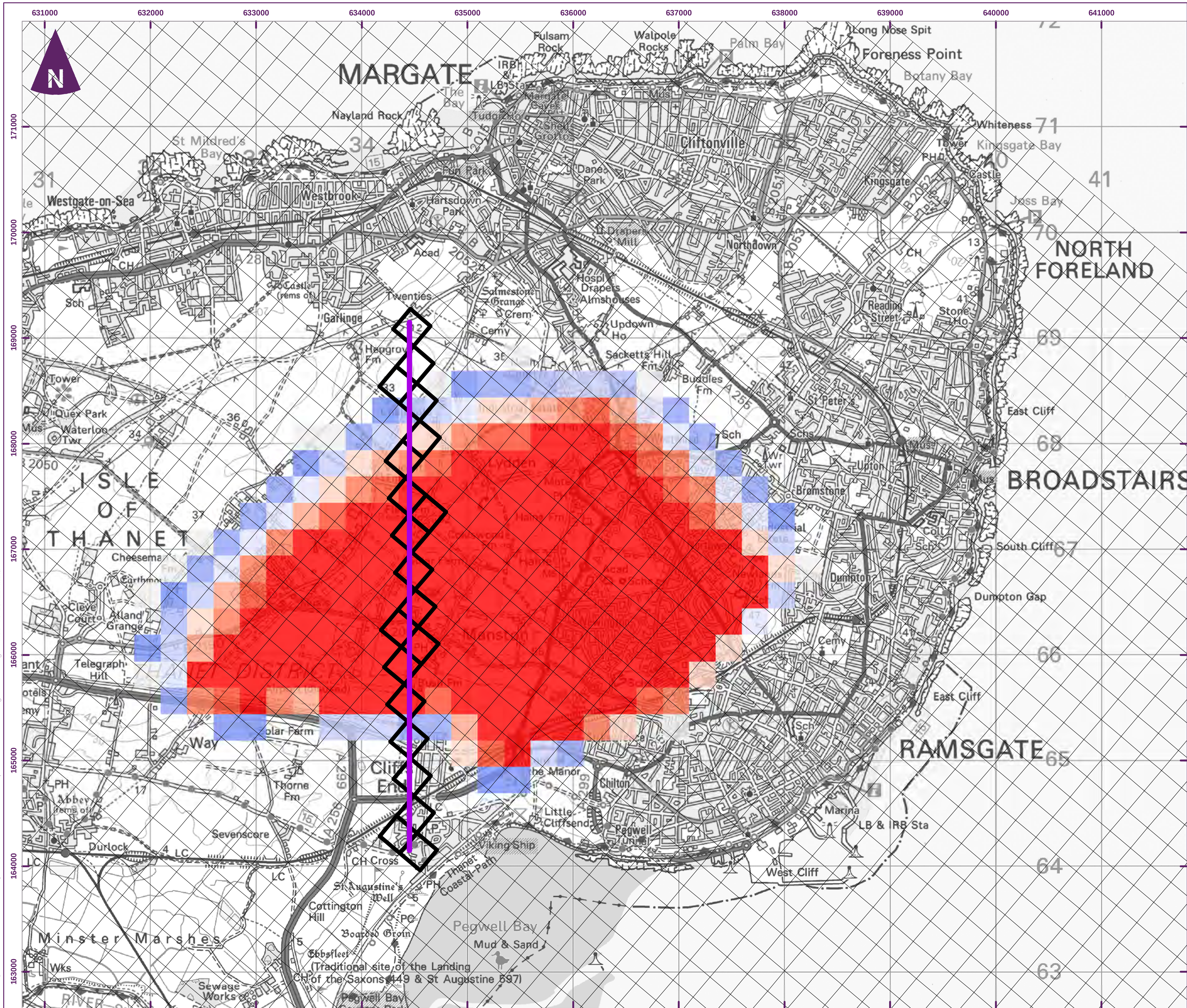
RSP

Manston Airport DCO EIA

amec foster wheeler

C5 Manston Flowsource
Lord of Manor- Frac Through LTA
Layer 2

September 2017 38199-Lon133.mxd eastr



Key

250m model grid

250m model grid (used for interpolated values)

North - South Line

Frac Through

0 - 0.01

0.01 - 0.02

0.02 - 0.05

0.05 - 0.1

0.1 - 0.15

0.15 - 0.2

0.2 - 0.3

0.3 - 0.4

0.4 - 0.5

0.5 - 0.6

0.6 - 0.7

0.7 - 0.8

0.8 - 0.9

0.9 - 1

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

Client

RSP

Manston Airport DCO EIA

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C6 Manston Flowsource
Lord of Manor- Frac Through Layer 2
Time 123

September 2017 38199-Lon127.mxd eastr

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631000 632000 633000 634000 635000 636000 637000 638000 639000 640000 641000

171000 170000 169000 168000 167000 166000 165000 164000 163000

N

MARGATE
Fulsam Rock
Walpole Rocks
Long Nose Spit
Foreness Point
Palm Bay
Botany Bay
Nayland Rock
St Mildred's Bay
Westgate-on-Sea
Westbrook
Hartsdown Park
Cliftonville
Dane Park
Whiteness
Kingsgate
Kingsgate Bay
Joss Bay
Northdown
Draper's Mill
Hospl Drapers Almshouses
Salmestone Grange
Cemy
Updown Ho
Twenties
Garlinge
Reading Street
Stone Ho
NORTH FORELAND
BROADSTAIRS
East Cliff
Quex Park
Waterloo
ISLE OF THANET
Cheeseman's Fm
Cleve Court
Telegraph Hill
Minster Marshes
Cliffs End
Thorne Fm
Sevenscore
Dumpton
Dumpton Gap
South Cliff
RAMSGATE
Marina
LB & RB Sta
Little Cliffsend
Pegwell Tunnel
Viking Ship
CH Cross
St Augustine's Well
Cottington Hill
Thanet Coastal Path
West Cliff
Pegwell Bay
Mud & Sand
Ebbsfleet
(Traditional site of the Landing of the Saxons 449 & St Augustine 597)
Sewage Works

Key

- 250m model grid
- 250m model grid (used for interpolated values)
- North - South Line

Frac Through

- 0 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.15
- 0.15 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

Client

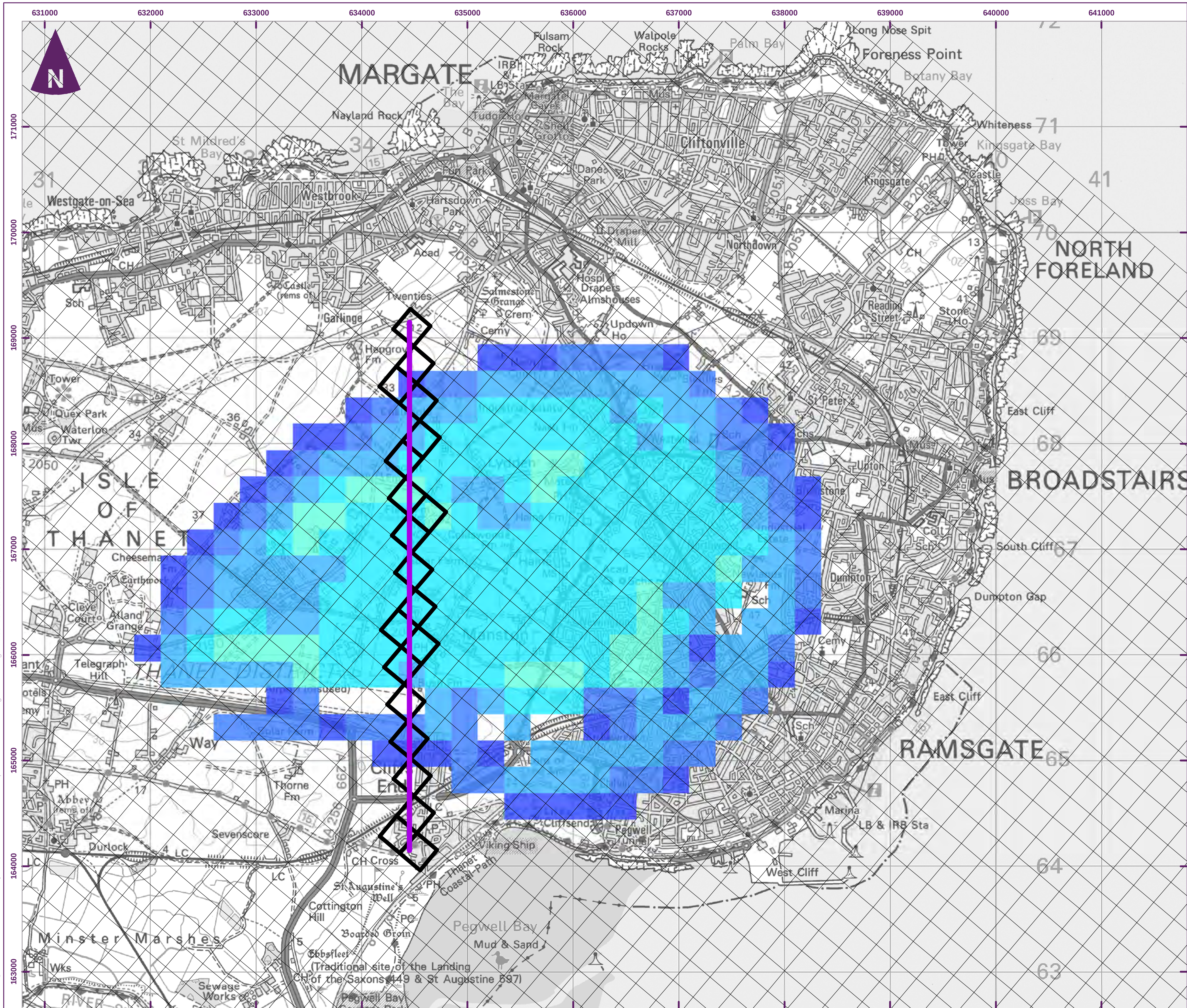
RSP

Manston Airport DCO EIA

amec foster wheeler

C7 Manston Flowsource
Lord of Manor- Frac Through Layer 2
Time 547

Appendix D
Spatial Flowsource output figures – PDO model



Key

250m model grid

250m model grid (used for interpolated values)

North - South Line

Volume From (m^3)

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100
- 100 - 150
- 150 - 300

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

Client

RSP

Manston Airport DCO EIA

amec foster wheeler

D1 Manston Flowsource
Lord of Manor- Volume From LTA
Layer 2 (PDO)

October 2017 38199-Lon153.mxd eastr

file: \\sal-fs12.global.amec.com\shared\Projects\38199 LON Manston Airport DCO EIA\Drawings\ArcGIS\Figures\38199-Lon153.mxd

631000 632000 633000 634000 635000 636000 637000 638000 639000 640000 641000

171000 170000 169000 168000 167000 166000 165000 164000 163000

MARGATE
Fulsam Rock
Walpole Rocks
Long Nose Spit
Foreness Point
Palm Bay
Botany Bay
Nayland Rock
St Mildred's Bay
Cliftonville
Whiteness
Kingsgate Bay
Westgate-on-Sea
Westbrook
Hartsdown Park
Dane Park
Kingsgate
Joss Bay
Northdown
NORTH FORELAND
Twenties
Garlinge
Updown Ho
Reading Street
Stone Ho
Tower
Quex Park
Waterloo
East Cliff
ISLE OF THANET
Cheesemans Green
Cartbridge
Cleve Court
Telegraph Hill
Dumpton
Dumpton Gap
BROADSTAIRS
South Cliff
Solar Farm
Way
Thorne Fm
Sevenscore
Durlock
CH Cross
St Augustine's Well
Cottington Hill
Minster Marshes
Ebbsfleet
(Traditional site of the Landing CH of the Saxons (449 & St Augustine 597)
Pegwell Bay
Mud & Sand
St Lawrence
RAMSGATE
Lord of the Manor
Chilton
Little Cliffsend
Pegwell
Viking Ship
Thanet Coastal Path
Marina
LB & IRB Sta
West Cliff
Sewage Works

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Key

- 250m model grid
- 250m model grid (used for interpolated values)
- North - South Line

Volume From (m^3)

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100
- 100 - 150
- 150 - 300

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

Client

RSP

Manston Airport DCO EIA

amec foster wheeler

D2 Manston Flowsource
Lord of Manor- Volume From Layer 2
Time 123 (PDO)

October 2017 38199-Lon151.mxd eastr

file: \\sal-fs12.global.amec.com\shared\Projects\38199 LON Manston Airport DCO EIA\Drawings\ArcGIS\Figures\38199-Lon151.mxd

631000 632000 633000 634000 635000 636000 637000 638000 639000 640000 641000

171000 170000 169000 168000 167000 166000 165000 164000 163000

N

MARGATE
Fulsam Rock
Walpole Rocks
Long Nose Spit
Foreness Point
Palm Bay
Botany Bay
Nayland Rock
St Mildred's Bay
Westgate-on-Sea
Westbrook
Hartsdown Park
Cliftonville
Dane Park
Whiteness
Kingsgate Bay
Kingsgate
Joss Bay
NORTH FORELAND
Northdown
Twenties
Garlinge
Updown Ho
Reading Street
Stone Ho
East Cliff
BROADSTAIRS
ISLE OF THANET
Quex Park
Waterloo
Cheeseman's Fm
Earthwork
Cleve Court
Telegraph Hill
Minster Marshes
Dumpton Gap
South Cliff
RAMSGATE
Thorne Fm
Sevenscore
Dumlock
Ch Cross
Viking Ship
Cliffsend
Pegwell Bay
Marina
LB & RB Sta
West Cliff
St Augustine's Well
Cottington Hill
Thanet Coastal Path
Pegwell Bay
Mud & Sand
Ebbsfleet
(Traditional site of the Landing
of the Saxons 449 & St Augustine 597)
Sewage Works
Pegwell Bay

Key

- 250m model grid
- 250m model grid (used for interpolated values)
- North - South Line

Volume From (m^3)

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100
- 100 - 150
- 150 - 300

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

Client

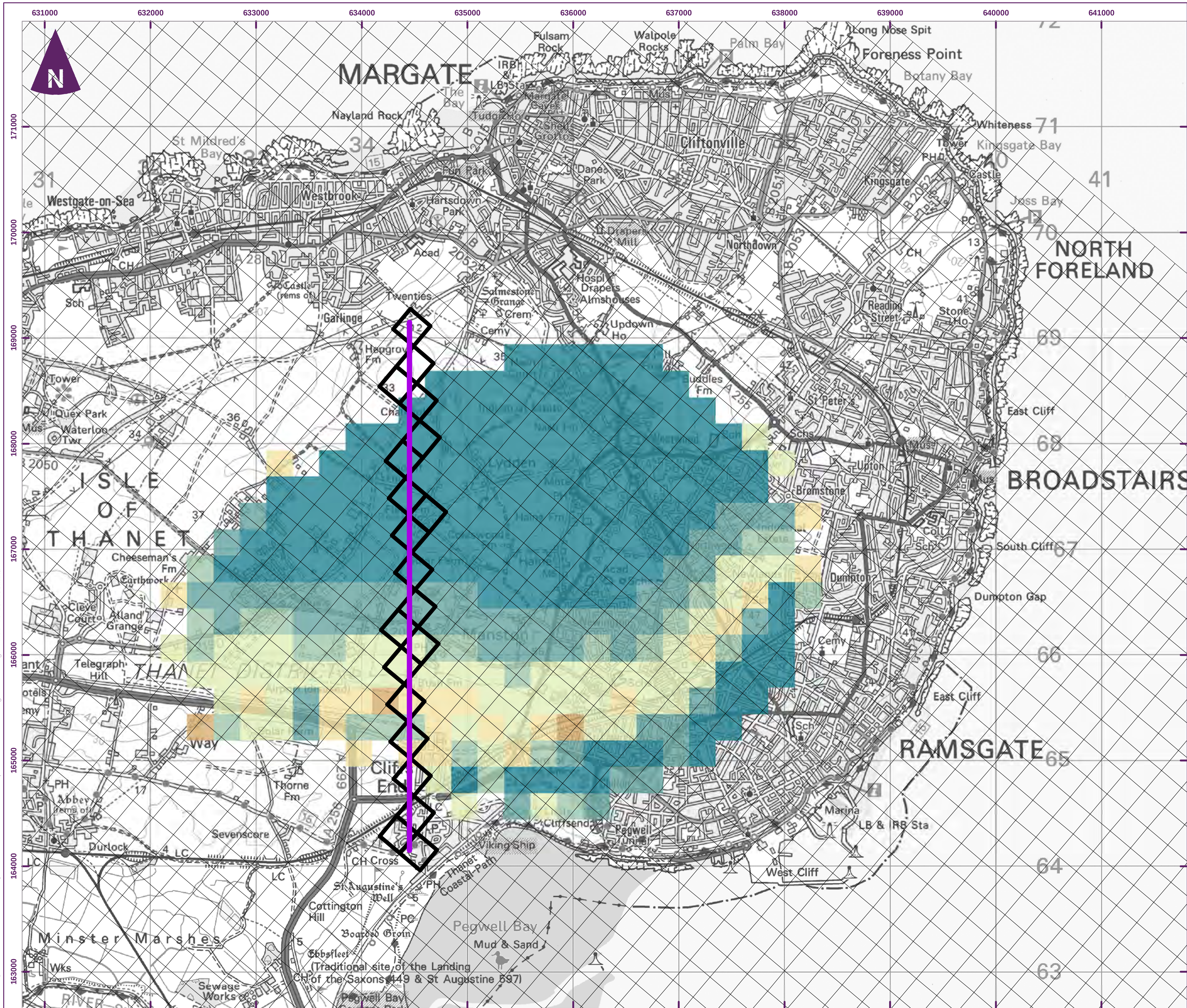
RSP

Manston Airport DCO EIA

amec foster wheeler

D3 Manston Flowsource
Lord of Manor- Volume From Layer 2
Time 547 (PDO)

October 2017 38199-Lon152.mxd eastr



Key

- 250m model grid
- 250m model grid (used for interpolated values)
- North - South Line

MOD Path Time

- 0 - 50 days
- 50 days - 400 days
- 400 days - 6 years
- 6 years - 10 years
- 10 years - 20 years
- 20 years - 30 years

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

Client

RSP

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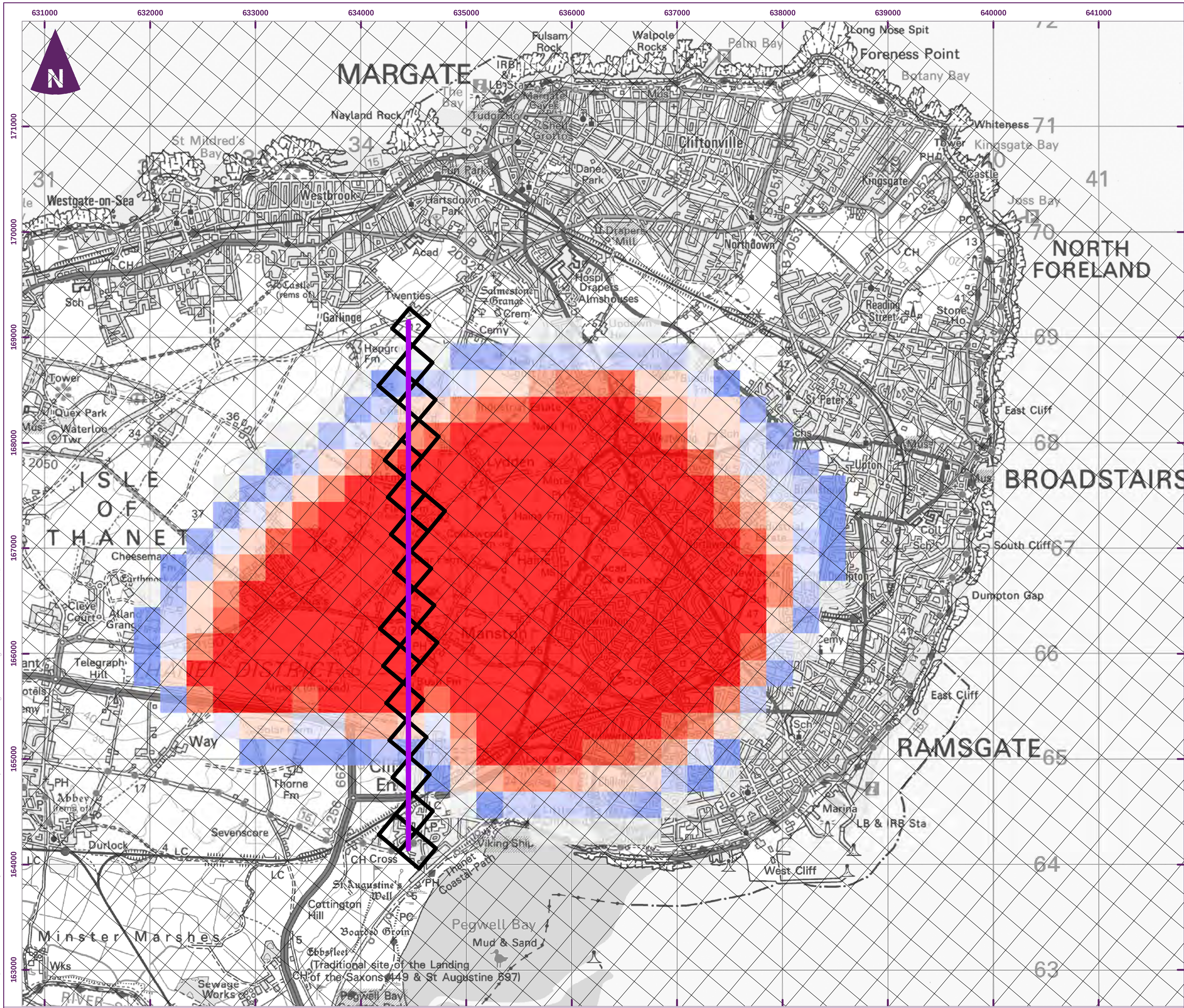
D4 Manston Flowsource
Lord of Manor- MOD Path Time LTA
Layer 2 (PDO)

October 2017 38199-Lon150.mxd eastr

file: \\sal-fs12.global.amec.com\shared\Projects\38199 LON Manston Airport DCO EIA\Drawings\ArcGIS\Figures\38199-Lon150.mxd



Key

250m model grid

250m model grid (used for interpolated values)

North - South Line

Frac Through

0 - 0.01
0.01 - 0.02
0.02 - 0.05
0.05 - 0.1
0.1 - 0.15
0.15 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

Client

RSP

Manston Airport DCO EIA

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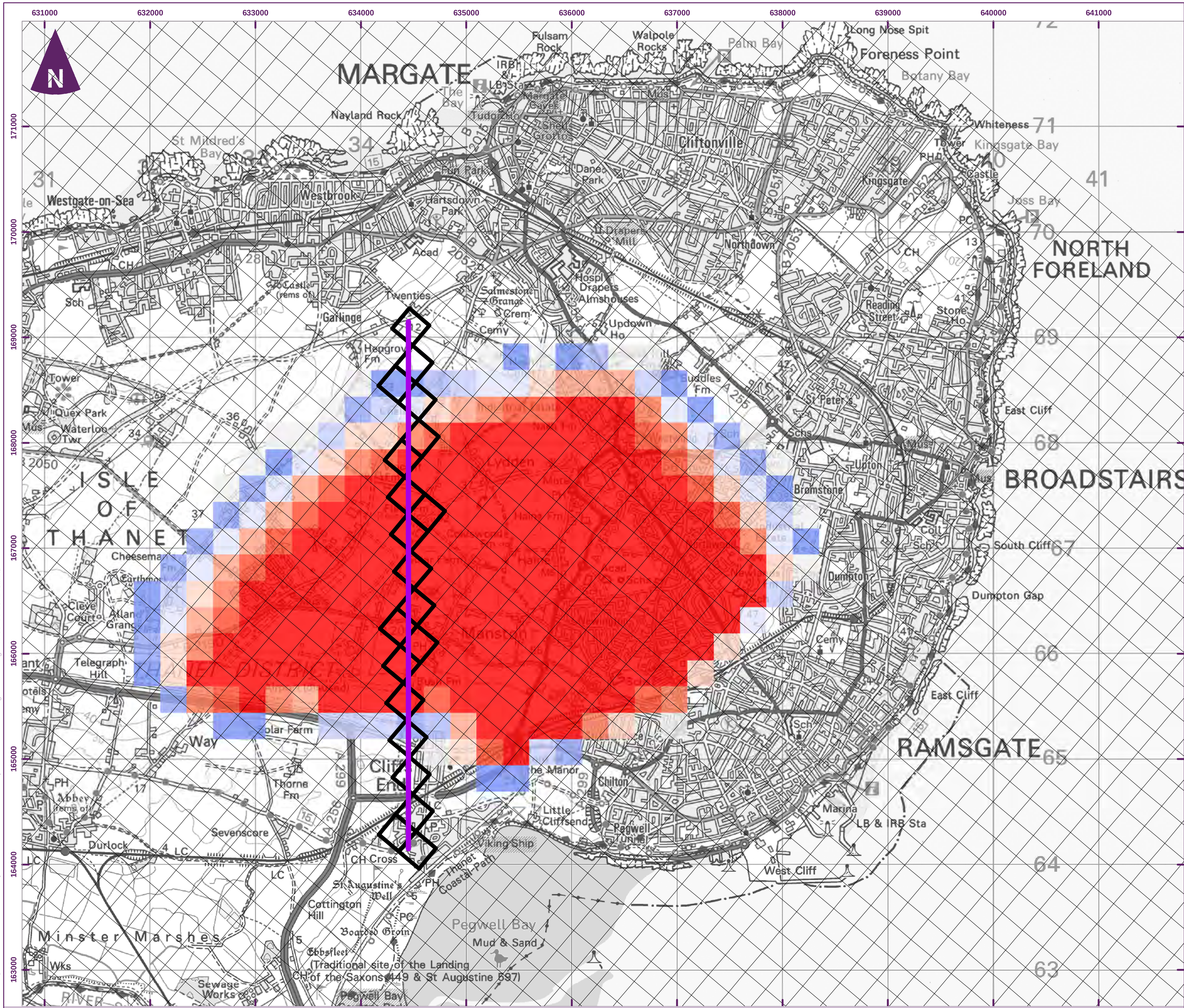
D5 Manston Flowsource
Lord of Manor- Frac Through LTA
Layer 2 (PDO)

October 2017 38199-Lon154.mxd eastr

file: \\sal-fs12.global.amec.com\shared\Projects\38199 LON Manston Airport DCO EIA\Drawings\ArcGIS\Figures\38199-Lon154.mxd



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file: \\sal-fs12.global.amec.com\shared\Projects\38199 LON Manston Airport DCO EIA\Drawings\ArcGIS\Figures\38199-Lon148.mxd

Key

- 250m model grid
- 250m model grid (used for interpolated values)
- North - South Line

Frac Through

- 0 - 0.01
- 0.01 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.15
- 0.15 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

Client

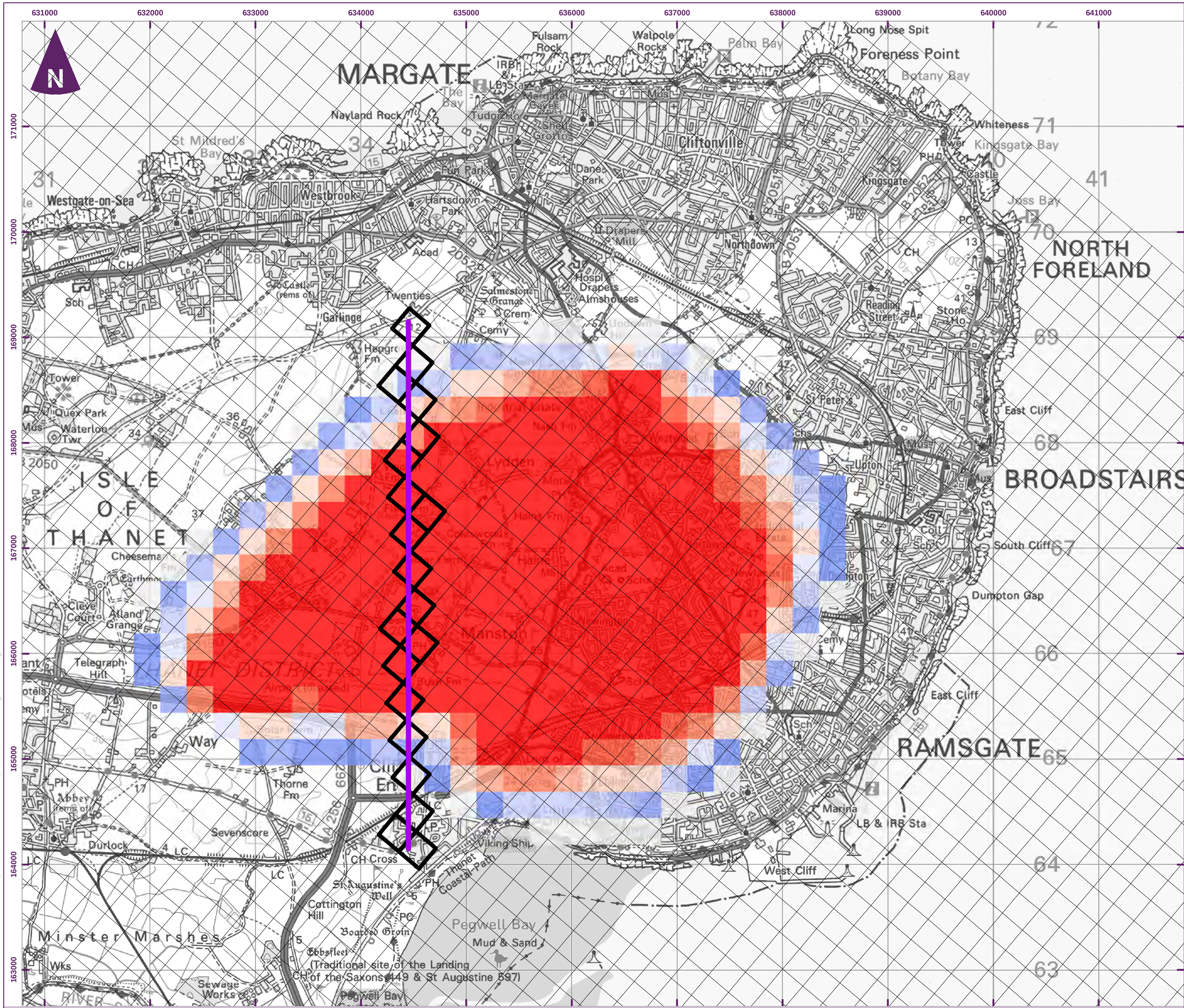
RSP

Manston Airport DCO EIA

amec foster wheeler

D6 Manston Flowsource
Lord of Manor- Frac Through Layer 2
Time 123 (PDO)

October 2017 38199-Lon148.mxd eastr



Key

250m model grid

250m model grid (used for interpolated values)

North - South Line

Frac Through

0 - 0.01

0.01 - 0.02

0.02 - 0.05

0.05 - 0.1

0.1 - 0.15

0.15 - 0.2

0.2 - 0.3

0.3 - 0.4

0.4 - 0.5

0.5 - 0.6

0.6 - 0.7

0.7 - 0.8

0.8 - 0.9

0.9 - 1

0 0.25 0.5 0.75 1 1.25 km

Scale at A3: 1:35,000

Client

RSP

Manston Airport DCO EIA

amec foster wheeler

D7 Manston Flowsource
Lord of Manor- Frac Through Layer 2
Time 547 (PDO)

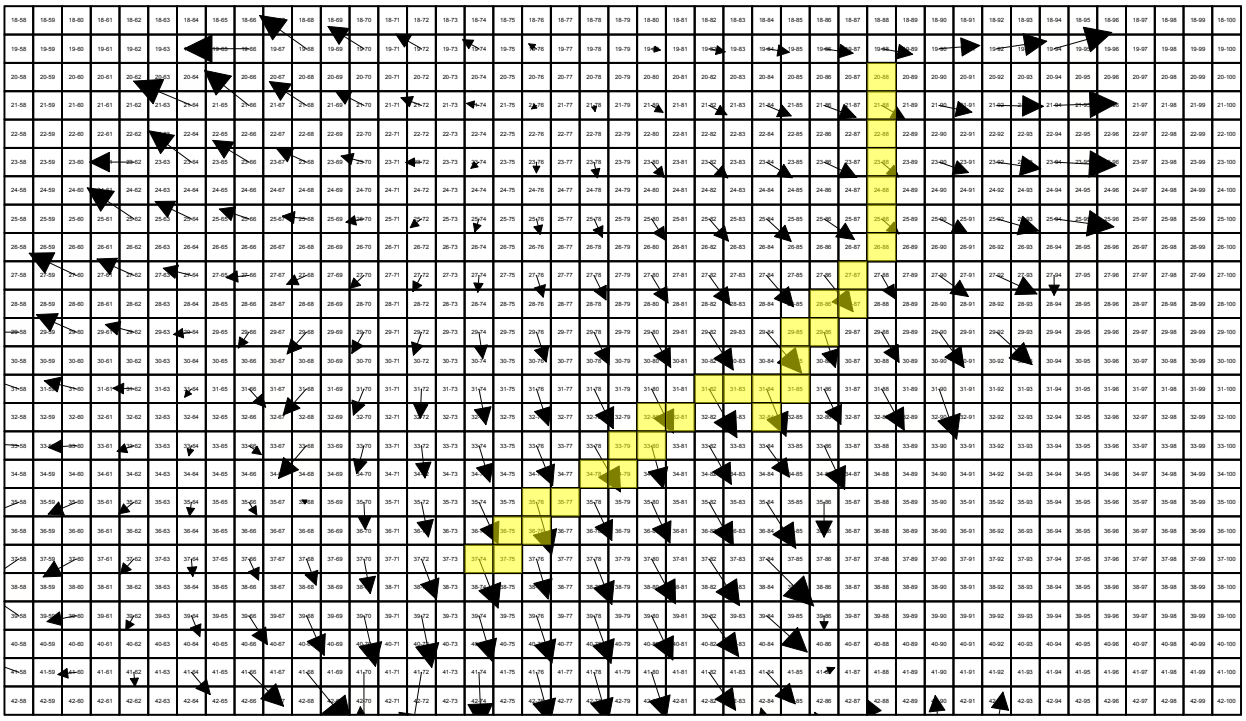
Appendix E
Flow Vector Plots

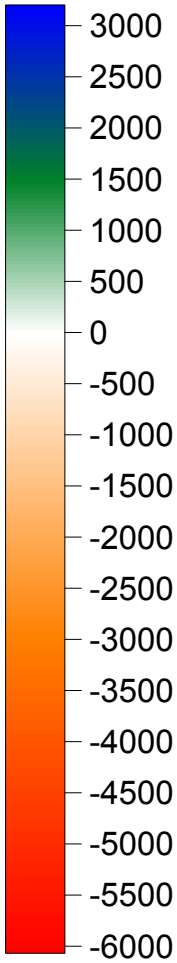
Note:

These figures are not rotated to allow for the rotation of the East Kent model grid. Grid north is therefore orientated 40° anti-clockwise from “vertical” on the page. The cells shaded yellow are those hosting the abstraction wells in the model that represent the LoTM source, and it is evident that even though the western adit is oriented almost due east-west, the cells as shown on the page are on a diagonal line.

East Kent Groundwater Model
Lord of the Manor

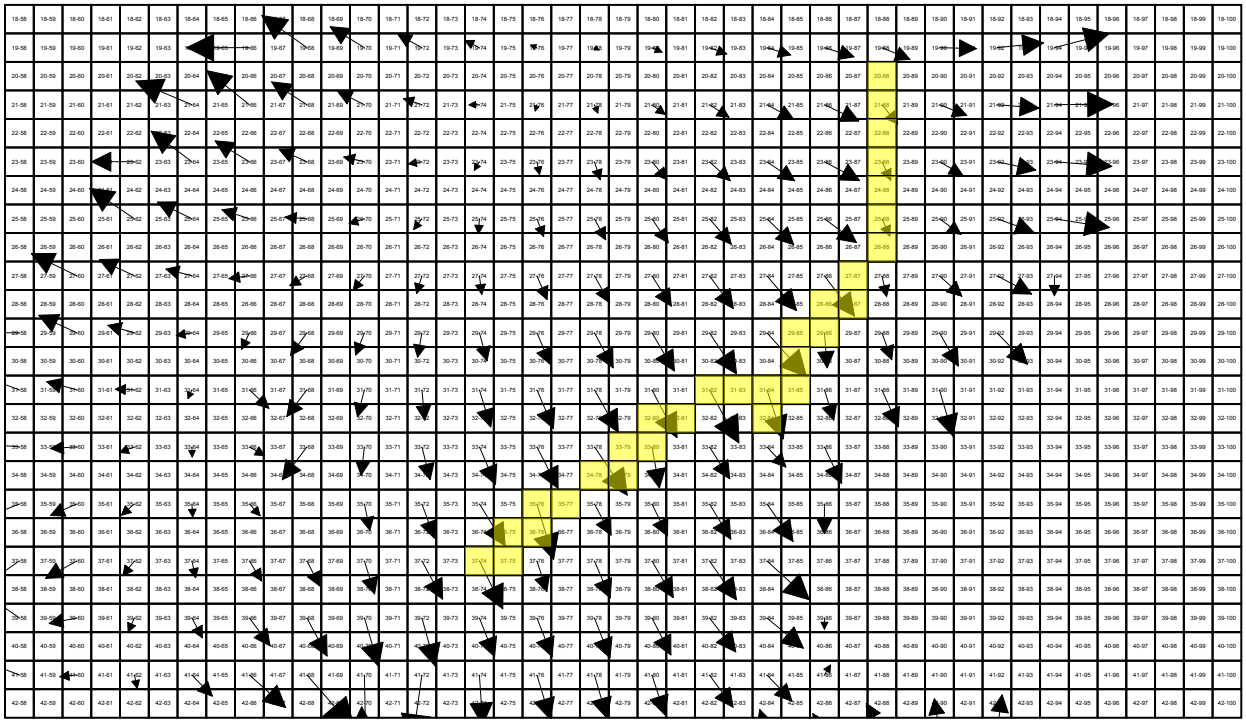
Recent Actual SP123 L2





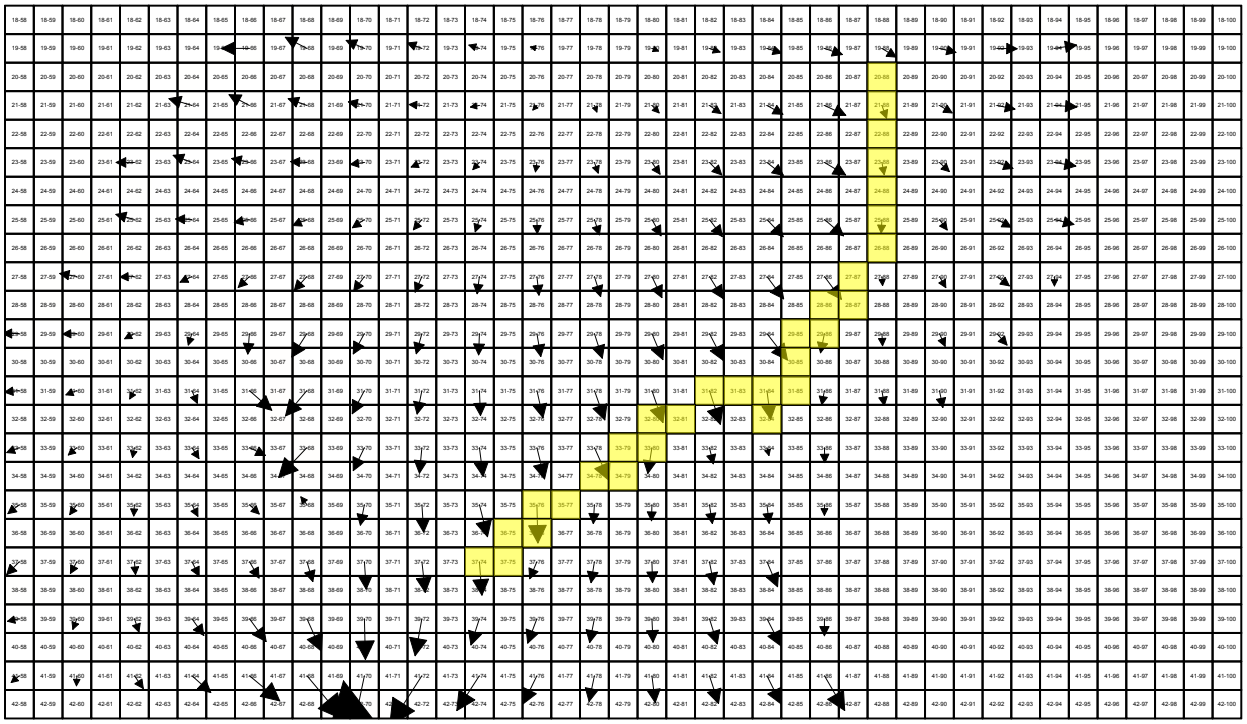
Lord of the Manor Model Cells

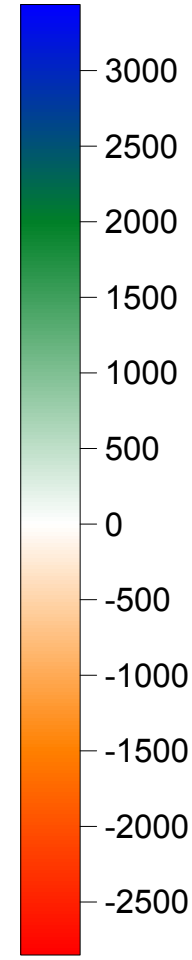
PDO SP123 L2



East Kent Groundwater Model
Lord of the Manor

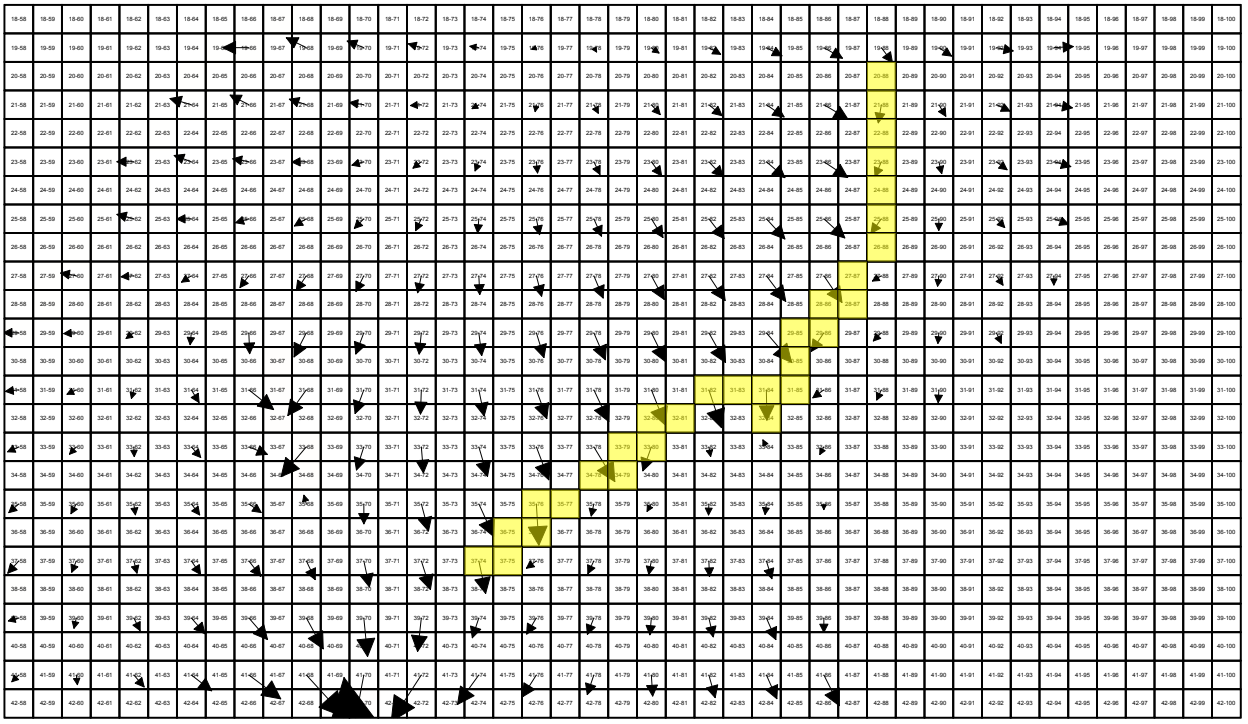
Recent Actual SP547 L2



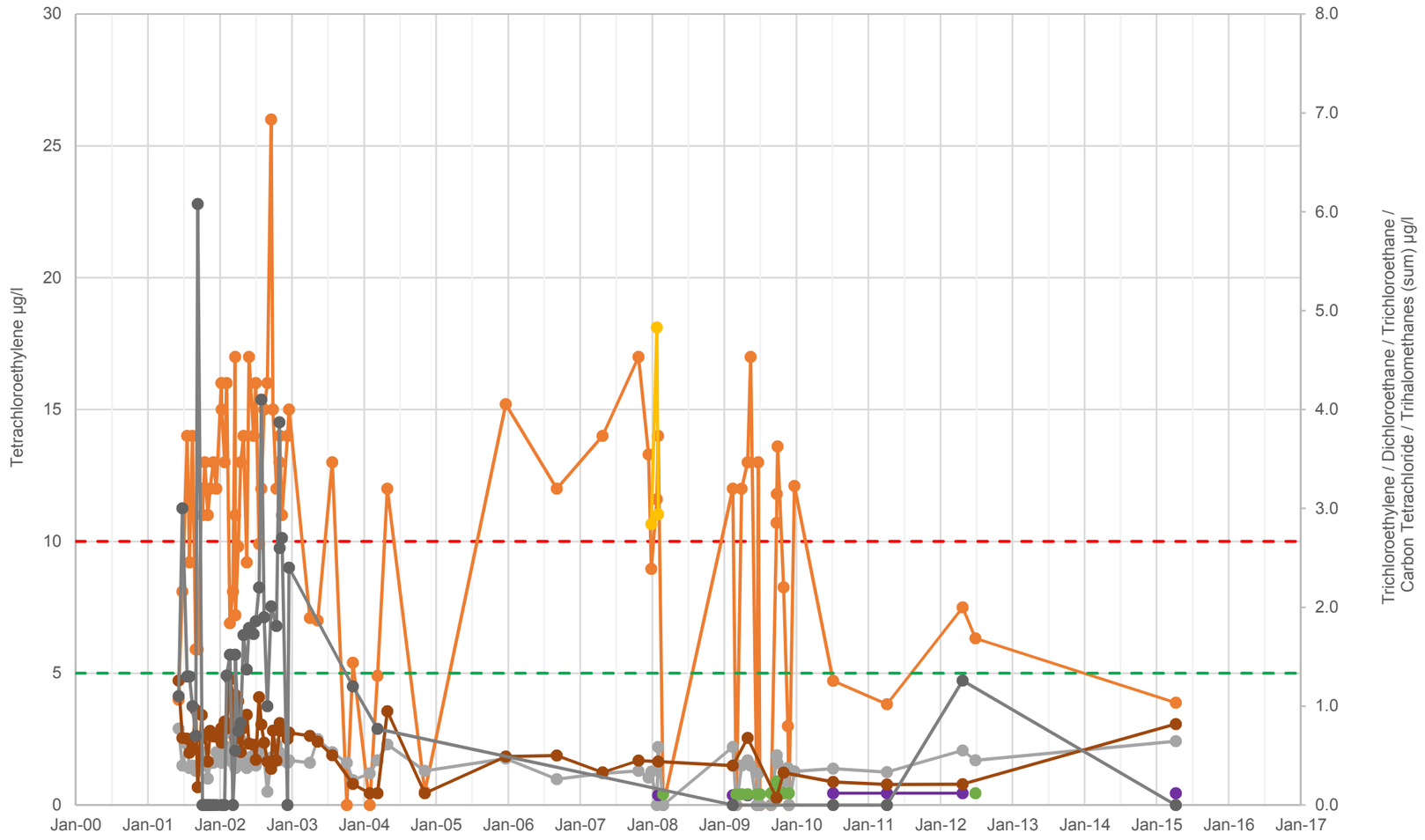


Lord of the Manor Model Cells

PDO SP547 L2



Appendix C
Figures



Key

- DWS Sum of Trichloroethane and Tetrachloroethane
- Tetrachloroethene
- Trichloroethene
- DWS Vinyl Chloride
- Dichloroethane (1,2)
- Trichloroethane (1,1,1)
- Vinyl Chloride
- Carbon Tetrachloride
- Trihalomethanes (Sum of Identified THMS)

Client

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Hydrogeological Risk Assessment

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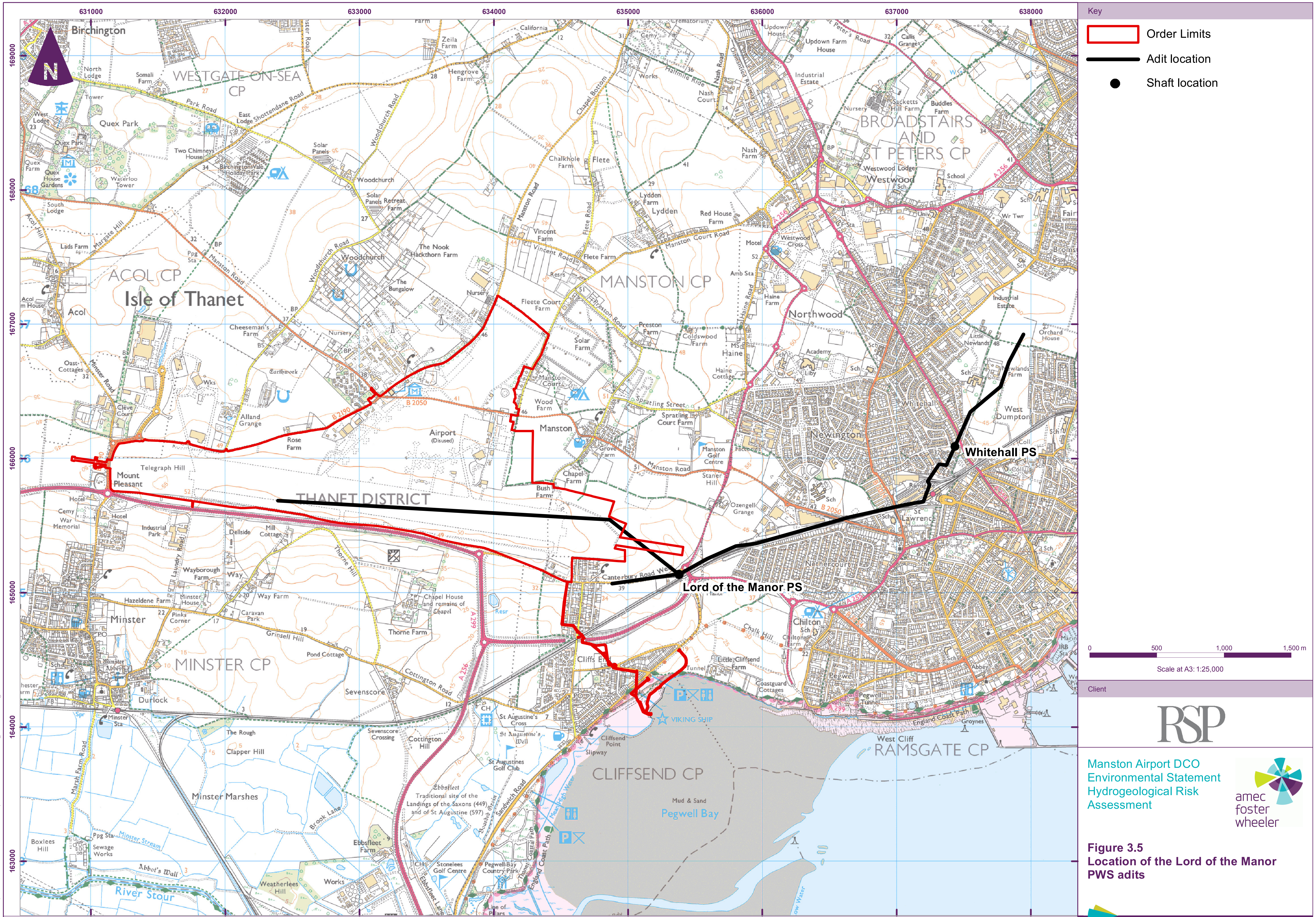
Figure 3.6
Solvent concentrations at Lord of the Manor



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Hydrogeological Risk
Assessment

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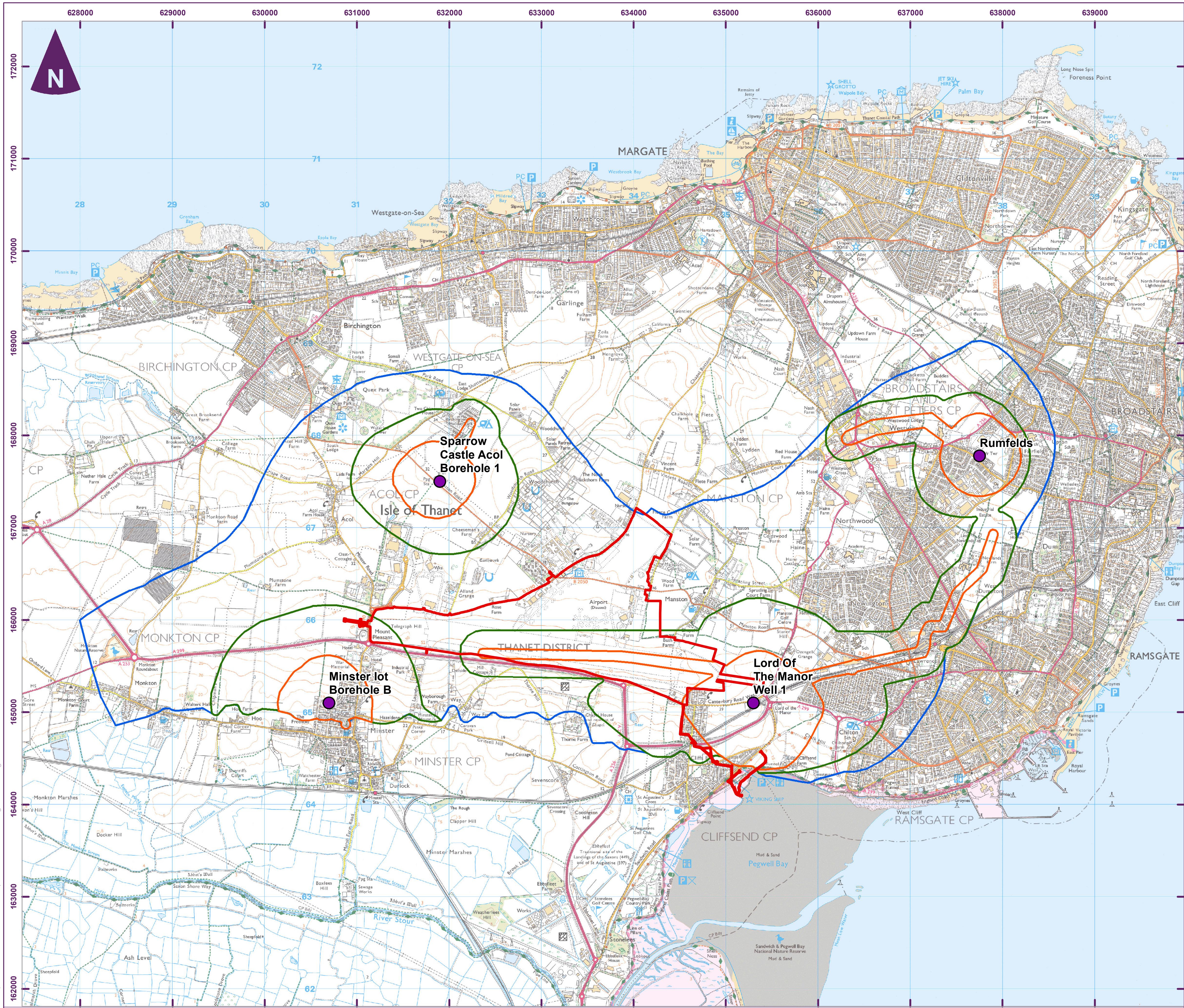
Figure 3.5
Location of the Lord of the Manor PWS adits

March 2018 38199-Lon541.mxd parkj

file: H:\Projects\38199 LON Manston Airport DCO EIA\Drawings\ArcGIS\Figures\38199-Lon541.mxd



Key

Order Limits

Southern Water groundwater abstraction

Source Protection Zones

Zone I - Inner Protection Zone

Zone II - Outer Protection Zone

Zone III - Total Catchment

0 500 1,000 1,500 2,000 m

Scale at A3: 1:40,000

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Figure 3.4
Location of Southern Water Sources and associated SPZs

March 2018 38199-Lon540.mxd parkj

file: H:\Projects\38199 LON Manston Airport DCO EIA\Drawings\ArcGIS\Figures\38199-Lon540.mxd

Key

Order Limits

0 1,000 2,000 3,000 m

Scale at A3: 1:50,000

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Figure 1.1
Site location plan

March 2018 38199-Lon535.mxd parkj

file: H:\Projects\38199-LON Manston Airport DCO EIA\Drawings\ArcGIS\Figures\38199-Lon535.mxd

Key

- Order Limits
- Total capture zone
- Inner zone (50 days to borehole)
- Outer zone (70% of abstraction)

0 0.5 1 1.5 km

Scale at A3: 1:30,000

Client

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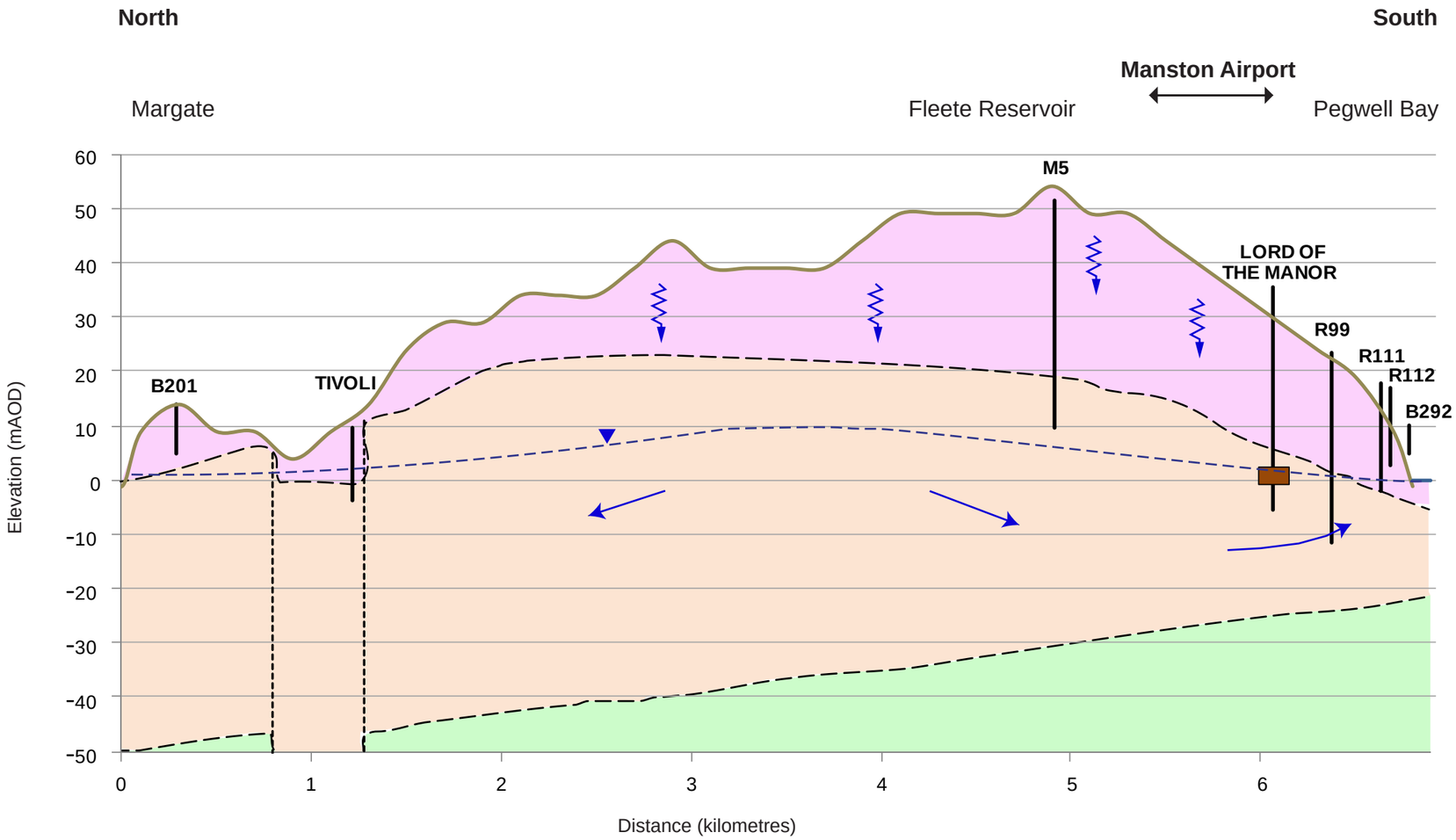
Figure 3.1
Flowsource catchment to the Lord of the Manor PWS

March 2018 38199-Lon536.mxd parkj

file: H:\Projects\38199 LON Manston Airport DCO EIA\Drawings\ArcGIS\Figures\38199-Lon536.mxd



Key

- Ground surface
- Newhaven Chalk Formation
- Seaford Chalk Formation
- Thanet Formation
- Faults
- Sea
- Borehole
- Adit levels (-0.7 - 2.8mAOD)
- Water table
- Groundwater flow direction
- Recharge

Note: Borehole Ref Nos from Atkins (2014)

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Hydrogeological Risk Assessment

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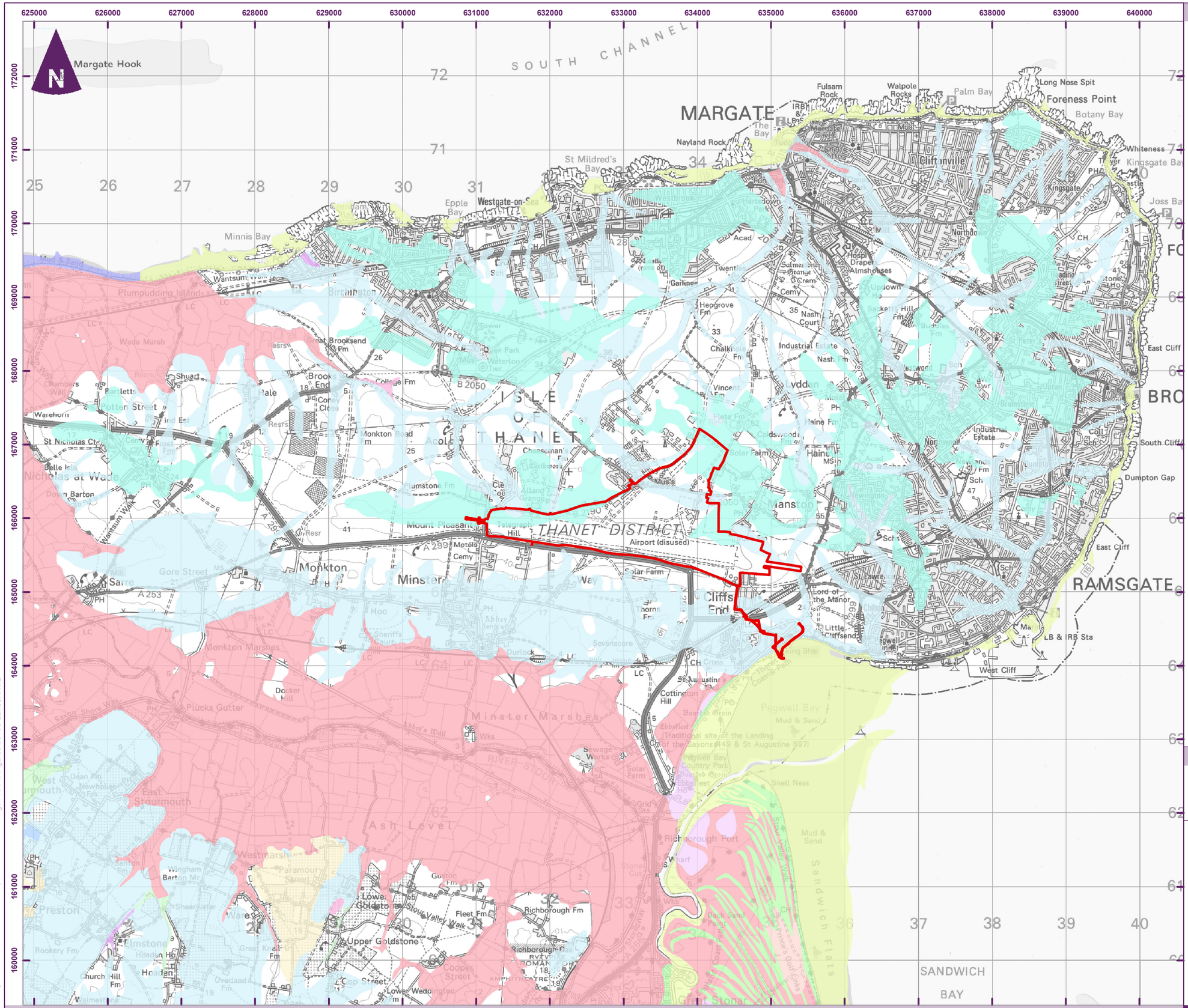
Figure 4.1
Conceptual cross section (from Atkins 2014)



file: H:\Projects\38199 LON Manston Airport DCO EIA\Drawings\ArcGIS\Figures\38199-Lon537.mxd

Key

- Order Limits
- Fault: inferred Downthrow unspecified
- Fault: observed downthrow unspecified
- Fold anticline
- Fold Syncline

Bedrock Geology

- Harwich Formation - sand and gravel
- Lambeth Group - sand
- Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated) - chalk
- London Clay Formation - clay and silt
- Margate Chalk member - chalk
- Seaford Chalk Formation - chalk
- Thanet Formation - sand, silt and clay

0 0.5 1 1.5 2 2.5 km

Scale at A3: 1:50,000

Client

RSP

Manston Airport DCO
Environmental Statement
Hydrogeological Risk Assessment

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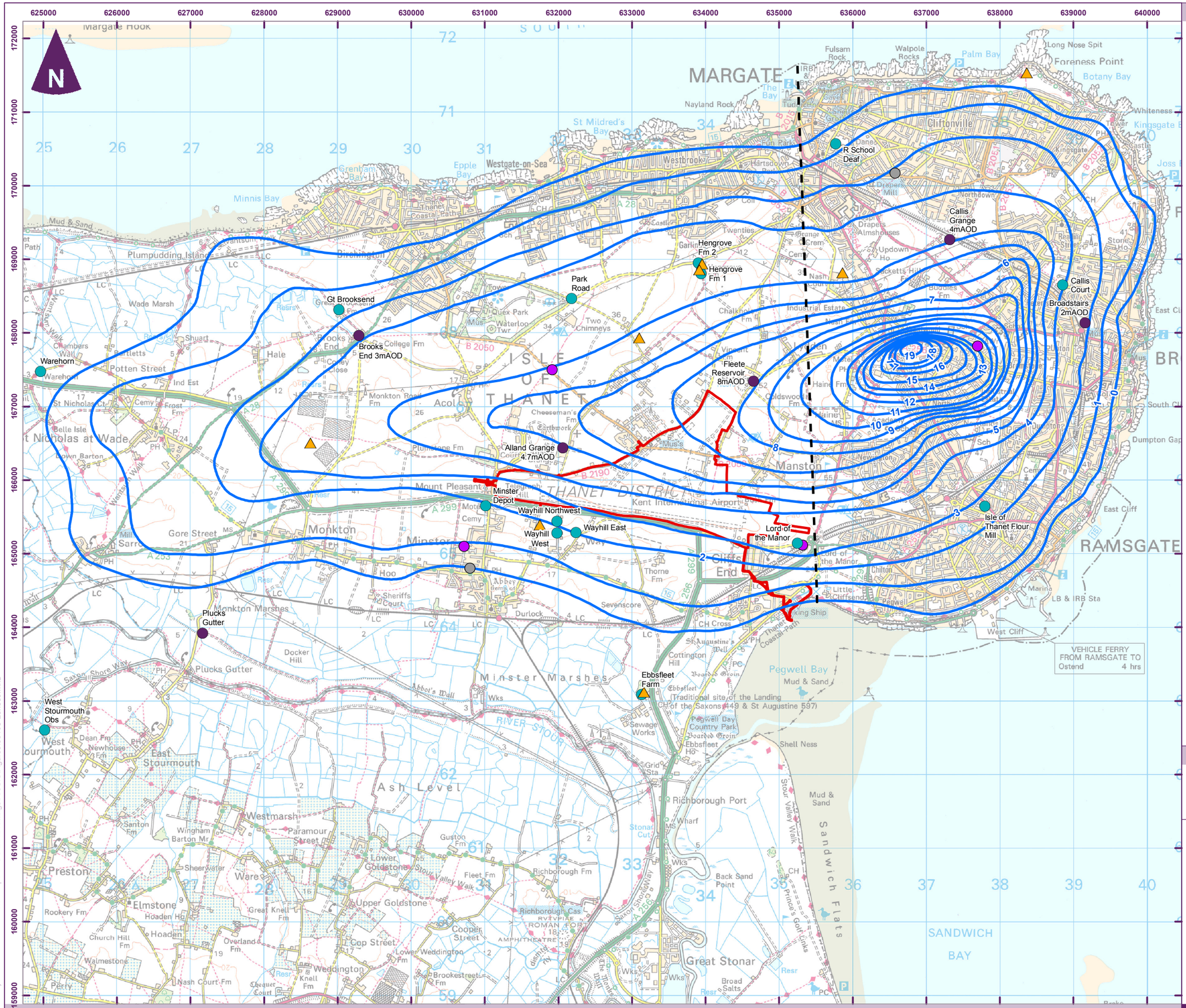
Figure 3.2b
Geological map of North Kent - bedrock



Key

- Order Limits
- Groundwater contours (mAOD)
- Licensed groundwater abstraction

Water level monitoring

- Current
- Disused

SWS Abstractions

- Current
- Disused
- Line of section used in Figure 4.1

0 0.5 1 1.5 2 2.5 km

Scale at A3: 1:50,000

Client

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Figure 3.3
Groundwater contours November 2007 (after Atkins 2014)

Key

Order Limits

0 10 20 30 40 50 m

Scale at A3: 1:1,000

Client

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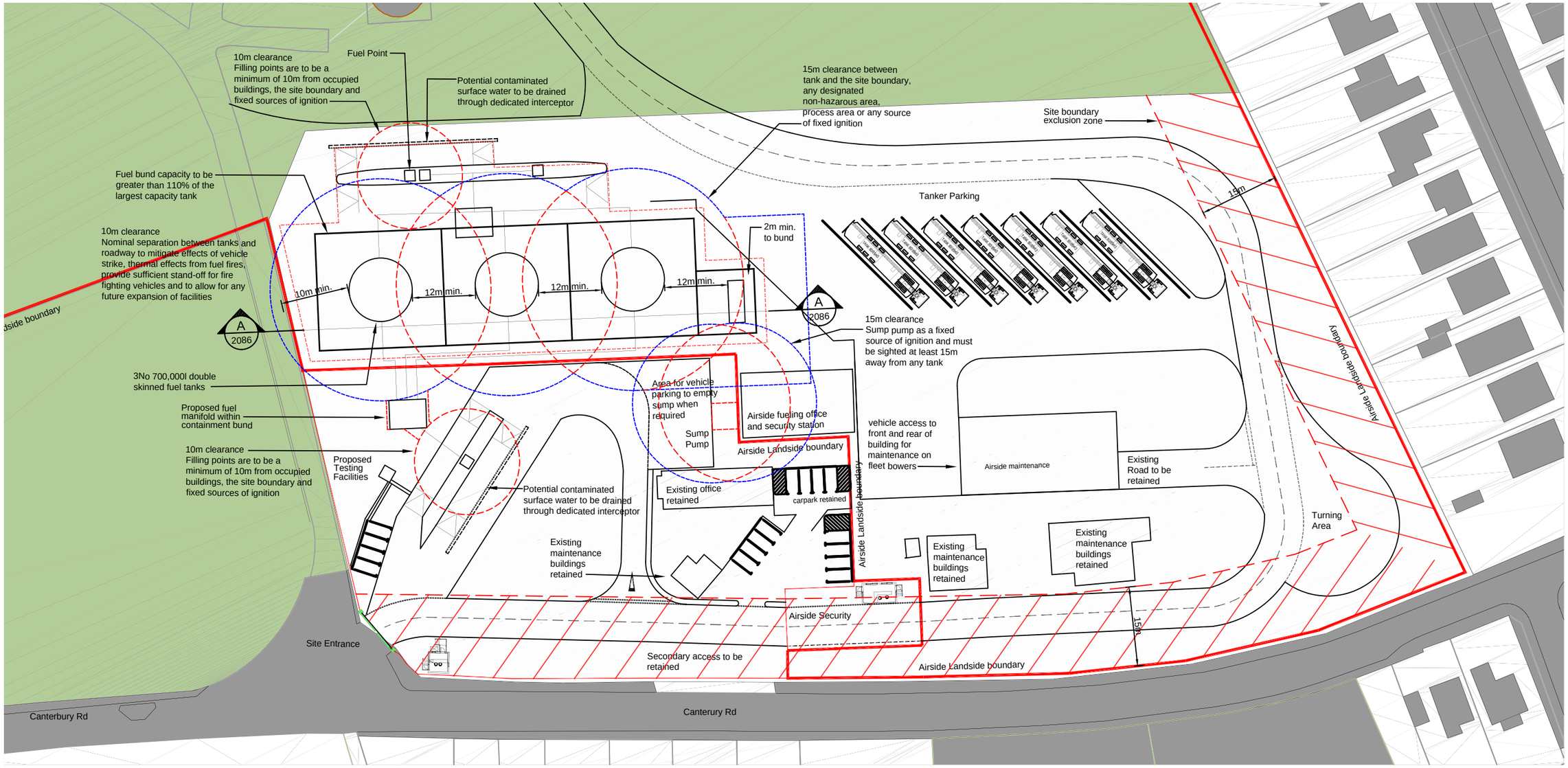
Figure 4.2
Jentex fuel storage facility

March 2018 38199-Lon544.mxd parkj

file: H:\Projects\38199 LON Manston Airport DCO EIA\Drawings\ArcGIS\Figures\38199-Lon544.mxd



Key

- Airside / Landside Boundary
- Enveloped Exclusion Zone
- Individual Exclusion Zone

Notes

1. OS Data obtained from emapsite$_{TM}$ May 2017:
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2. To reduce the risk of a discharge of fuel into public waterways, the fuel tank bunds have been provided with a sealed drainage system. All liquids in these areas will be contained within a sealed network. The captured discharge will be tested and either released into the drainage network or disposed off site by suitable means.

Client

RSP

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Environmental Statement
Hydrogeological Risk Asssement

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Figure 4.3
Manston Fuel Farm layout

March 2018

38199-Lon545.ai parkj

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