YORK POTASH LTD

APPLICATION TO CARRY OUT MINERAL WORKING AND ASSOCIATED DEVELOPMENT

September 2014

Appendices to Alternative Sites Assessment

Nathaniel Lichfield & Partners

YORKPOTASH
A Sirius Minerals Project

York Potash Project

Minehead Alternative Site Assessment

Appendices

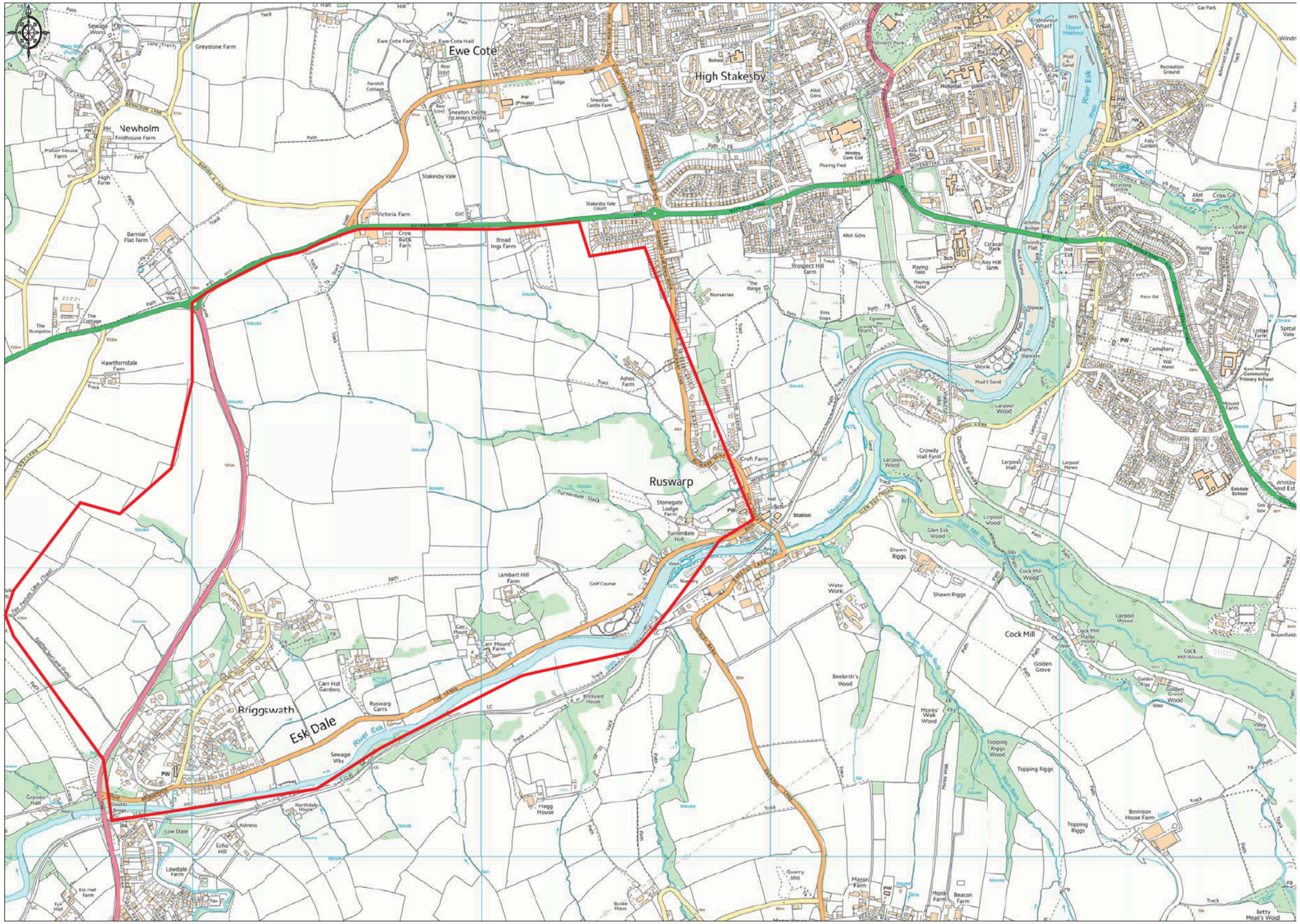
Appendix

Appendix 1

Plans of Alternative Locations Assessed in Previous ASA

KEY

Site Boundary



Nathaniel Lichfield & Partners
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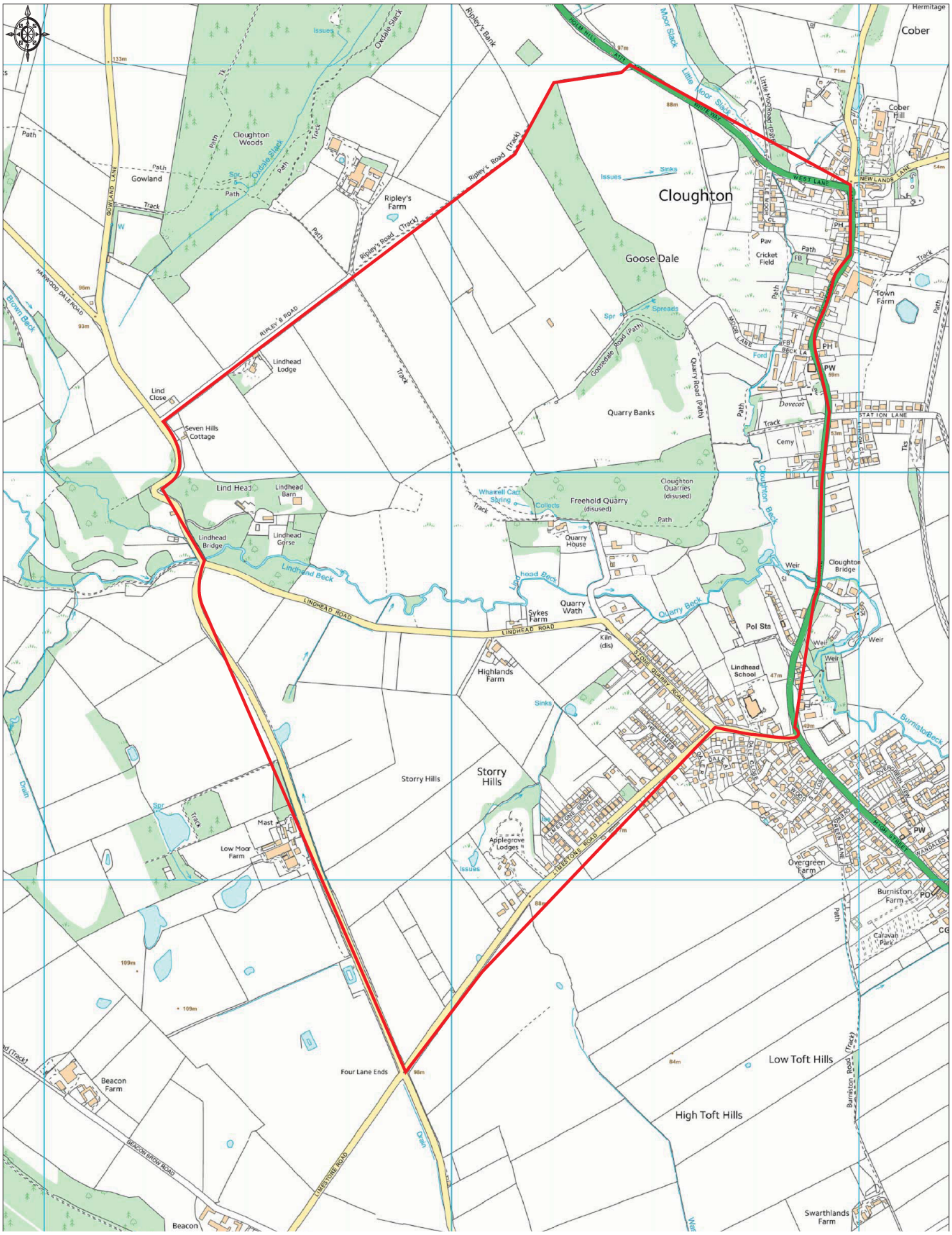
Project	York Potash
Title	**Whitby Enclave Site Location Plan**
Client	York Potash Limited
Date	April 2014
Scale	NTS
Drawn by	VM
Drg. No	IL50303/04-001

N

LE50303/04



KEY

Site Boundary

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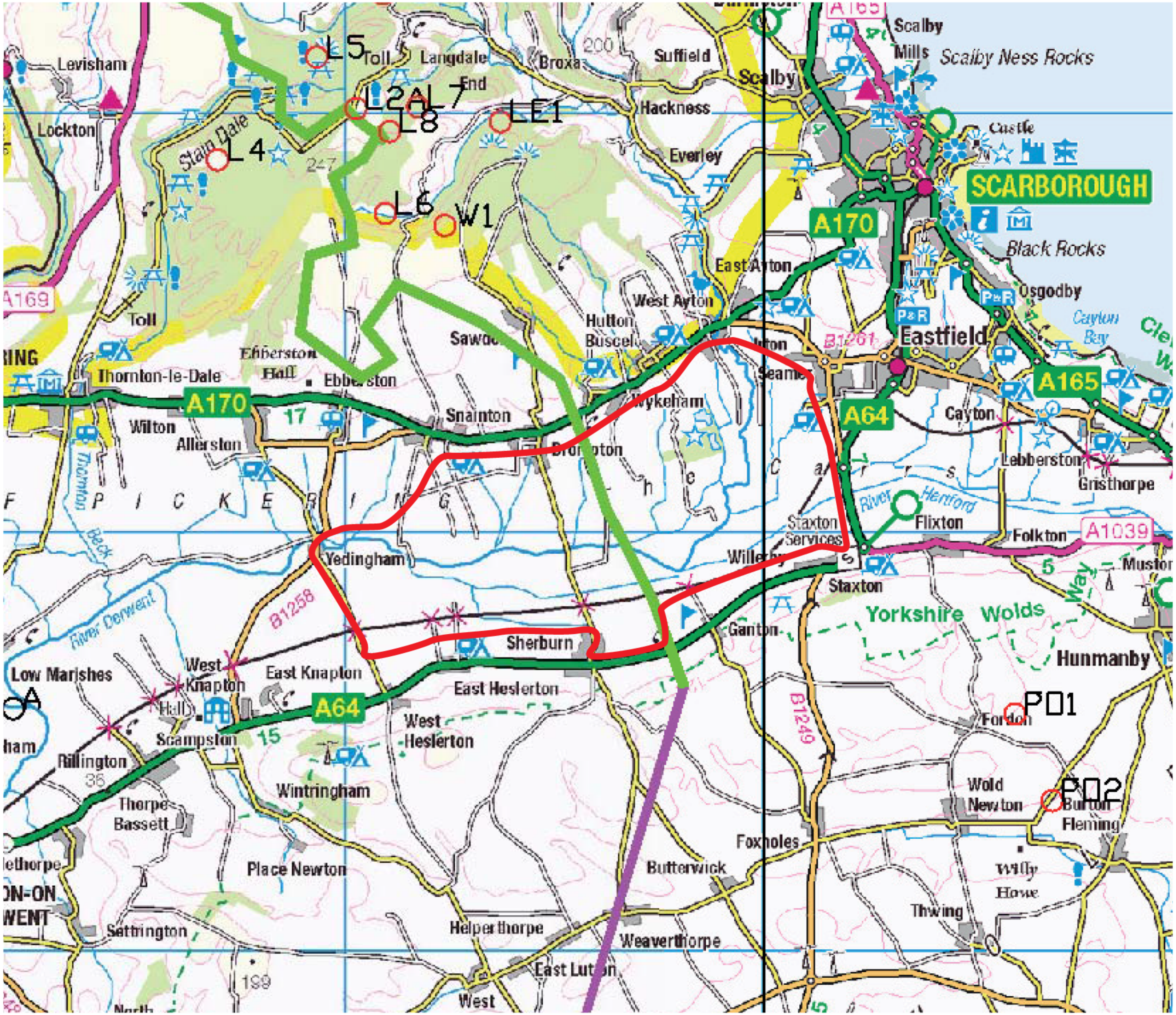
Project	York Potash
Title	**Cloughton Surrounds Site Location Plan**
Client	York Potash Limited
Date	April 2014
Scale	NTS
Drawn by	VM
Drg. No	IL50303/04-002

N

LE50303/04



KEY

Site Boundary

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Project	York Potash
Title	**Vale of Pickering Site Location Plan**
Client	York Potash Limited
Date	April 2014
Scale	NTS
Drawn by	VM
Drg. No	IL50303/04-003

N

LE50303/04

Appendix 2

AMEC Preliminary Review of Draft Alternative Sites Assessment and Subsequent Memorandum

York Potash Minehead EIA: Preliminary Review of Draft Alternative Sites Assessment

1. Purpose of this Report

This document has been produced by AMEC to provide preliminary feedback on the draft Alternative Sites Assessment (ASA) prepared by Nathanial Lichfield & Partners (NLP) (Ref 50303/04/HS/IY) dated May 2014. This will be carried out in Section 2 of this report, with reference to the headings used in the ASA.

The draft ASA was issued prior to Leeds workshop held on 20 May 2014 and contains a total of 19 Appendices. These include two particularly notable reports; SRK's *'Independent Report on the Potential for Polyhalite Exploration in North Yorkshire'* dated April 2014 (Appendix 2) and Royal Haskoning DHV's (RHDHV) *'Environmental Appraisal of ASA Shortlisted Sites'*, dated 28 April 2014 (Appendix 16), together with several other reports and plans etc, which will be referred to as appropriate during the review. Unfortunately, due to time constraints, the draft ASA was not presented at the Leeds workshop, but instead its principle author (Hugh Scanlon of NLP) gave the presentation at a specifically arranged meeting held in Helmsley on 12 June 2014.

This report will not specifically make reference to draft Chapter 2 of the ES (*'Consideration of the Alternatives*') that has also produced by RHDHV, and which will be commented upon separately in AMEC's review of the first five chapters of the ES (AMEC Ref: 35190CShr18Ri3).

The approach adopted for this report accords with the other preliminary reviews that have been produced, and therefore this report is not intended to represent AMEC's definitive position with regard to the ASA, but instead has the objective of providing YP and its consultants with preliminary advice with respect to gaps that may exist within the information submitted, so that these can be addressed prior to the submission of the final version with the planning application.

2. Draft Alternative Sites Assessment

2.1 Introduction

Setting aside the references included in the Executive Summary, paragraph 1.12 makes the first of the very many references to SRK's *'independence'* which are regularly distributed throughout the report. Indeed the title of the SRK report also describes itself as *'Independent'* and although the NPA and AMEC understand the point that is being made, we suggest that it is only necessary to introduce SRK in this way at the beginning of the NLP report.

2.2 Previous Alternative Sites Assessment

1. With respect to paragraph 2.9, AMEC has previously requested details of the Boulby Potash licence are to be shown on a plan. This request remains outstanding and it would be appreciated if this information could be provided with the ASA. This is particularly important given the statement in the third paragraph of Section 2.3 of the SRK report, which says that *"The northern limit of the AOI was set at* ***or about*** [AMEC emphasis] *the southern limit of CPL's mineral licences"*.

2.3 Stage 1: Defining the Polyhalite

It is noted that this section of the report provides a summary of the previously submitted information, e.g. the FWS reports (Appendices 7 & 9), together with the new report (SRK April 2014). Since we have previously commented on the FWS report, we have focused on the contents of the SRK report.

2. Paragraph 4.28 provides some further context as to why YPL decided not to continue with its drilling programme between borehole SM9 and the legacy Lockton boreholes. However, paragraph 4.29 does not specifically mention the point, which was previously made by AMEC, that the most easterly and northeasterly boreholes of the Lockton boreholes (L3 and LE1) had not shown such a trend and instead indicated the presence of considerable thicknesses of shelf seam polyhalite.

3. Section 2.4 of the SRK report provides more detail regarding the process of defining the mineral resource and specifically the exploration drilling and how it was re-appraised as the results from the early boreholes were received and interpreted. It is also clear from this text that, after the completion of SM4, YPL made a commercial judgement to concentrate its financial resources on the northern part of the AOI (near Dove's Nest), where it had already identified mineable thicknesses of polyhalite. Although the rationale behind such a decision is understood, AMEC and the NPA believe that the ASA and SRK reports would benefit from being clearer on the fundamental reasons for not drilling boreholes to the south of SM4. We also believe that these reports should address the question as to whether YPL had considered *'the cost of, and scope for'* locating a minehead site outside the limits of a National Park, prior to making its decision to focus its exploration efforts in the vicinity of Dove's Nest Farm.

4. With reference to point 2 above, it is clearly not correct to say, as SRK does in the second paragraph on page 12, that *"All the data now available (including the historical data from the Eskdale and Lockton regions) was suggesting that the Shelf seam was becoming progressively thinner southwards from Eskdale to SM4 and splitting up in the vicinity of Lockton"*. This sentence should therefore be amended to reflect the actual position.

5. In paragraph 4.41, the YPL Mineral Resource is defined as being 2.66 billion tonnes of polyhalite with a mean grade [of polyhalite ore] of 85.7%, with the shelf seam contributing 62% of the total. These numbers are given more context, with respect to the overall AOI, by referencing Section 2.6 of the SRK report and specifically Table 2.2 and Figures 3.4, 3.5 and 3.6. It would be useful for this table, together with one or more of these figures to be used in the ASA.

6. The data summarised in Table 2.2 confirms that the JORC reported resources are substantial within a relatively small geographical area (compared to the overall AOI) located in the

vicinity of Dove's Nest Farm. Indeed it is stated that the *'indicated'* resource amounts to 820 million tonnes (Mt) of polyhalite ore at a mean grade of 87.3% (i.e. equivalent to 710 Mt of pure polyhalite). With such a large *'indicated'* resource and a further 1.84 billion tonnes of *'inferred'* resource nearby, it would be beneficial for YPL to explain why it continues to promote an AOI of such large geographical extent, and a planning application boundary for the mine that is broadly consistent with it.

7. It would be helpful if the Mineral Resource Estimation outlined in Section 2.6 provided more information on the parameters used, and the assumptions made, within the JORC assessment to calculate the *'indicated'* and *'inferred'* resource estimations that are summarised in Table 2.2. In particular it would be useful to understand how the mean thicknesses have been derived from the available borehole data and for details of the size (expressed in hectares or square kilometres) of the resource areas to be included in the table.

8. In addition to point 6 above, it is noted that Table 4.9 of the August 2012 YP report entitled *'Requirement or the York Potash Project to be within North York Moors National Park'* provided details of the mean grade for the overall polyhalite seam thickness, together with the high grade portion. It would therefore be useful that when responding to point 6, SRK or NLP explain how the apparent variable quality of the polyhalite seam has been factored into the resource estimations.

9. It is also noted from Figure 3.5, that the *'inferred'* resource estimations, comprising both the shelf and basin seams, appear to be based on borehole evidence from two YP boreholes (SM6 and SM9) and three historical boreholes (E5, E11, and E13). However, there are no details regarding the latter in Table 2.1. Reference to the August 2012 report (mentioned above) confirms that the dates of these boreholes are given in Table 4.2 and the polyhalite thicknesses are given in Table 4.4, although no quality information is presented. Given the age and original purpose of these boreholes (i.e. drilled for oil & gas exploration), it would be useful to know the parameters used in the resource calculations, together with any assumptions made.

10. It was understood from an answer provided by Mike Armitage of SRK, during the Leeds Workshop of 20 May 2014, that the 820 Mt *'indicated'* resource is estimated to translate to a mineable output of ~250 million tonnes. It would be useful for the NPA to know the assumptions that underpin this conversion rate, including details of the assumed maximum mineable thickness of the polyhalite horizon.

11. With regard to the potential polyhalite resources at Whitby Enclave, Table 3.1 includes limited details of the historical boreholes that are located between the two Donovan faults, including polyhalite thicknesses and qualities. However, it is noted that the thickness data presented does not tally with the details included in Table 4.4 of the August 2012 report and clarification regarding the differences would be appreciated.

12. Further to point 10 above, it is also assumed that the quality information given in Table 3.1 has resulted from some re-analysis of the historical records. If so, is it possible that there are potentially richer sub-horizons of polyhalite within the overall seam thickness at E3? It is also noted that borehole E5 (located to the south of the main Donovan Fault), has similar thickness characteristics to E3, but it is unclear from the information presented whether it is showing similar quality trends to E3.

13. With further reference to the Leeds workshop, it is understood that Mike Armitage had suggested that the polyhalite resource to the north of the main Donovan Fault could be of

the order of 600 Mt. Although it is appreciated that this is an estimate based on limited geological data (i.e. three legacy boreholes), and that it would not be JORC compliant, for completeness it would be useful for Section 3.3.2 of the SRK report to include a reasoned estimate based on the available data, together with the relevant caveats as appropriate.

2.4 Stage 2: High Level Assessment of Constraints on Minehead Construction and Operation

1. It is understood from the ASA presentation held at Helmsley on 12 June 2014 that Stage 2 Mining Constraints plan information (Appendix 12) will be made available as GIS layer files to enable the data to be reviewed by AMEC in more detail at a suitable scale.
2. AMEC notes the key mining constraints that have been applied and agrees that these are appropriate to the sieving process.

2.5 Stage 3: High Level Assessment of Environmental and Sustainability Criteria

1. Similar to point 1 in Section 2.4 above, it is understood from the contents of Hugh Scanlon's ASA presentation that Stage 2 Environmental Constraints plan information (Appendix 13) will be made available as GIS layer files to enable the data to be reviewed in more detail at a suitable scale.
2. With reference to paragraph 6.5, it was noted from Hugh Scanlon's ASA presentation that the reference to National Parks was elevated from fifth to first in the bullet point list. This change is appropriate given the importance of this designation in the context of this application and we trust that paragraph 6.5 will be amended in the final version.
3. It is noted that paragraph 6.31 refers to *"...the implications of locating a minehead within or in close proximity to a city, town or village"*. However, whilst proximity to residential properties clearly increases the risks of environmental effects, it is not appropriate to use this as a definitive constraint and therefore AMEC agrees with the conclusion outlined in the last sentence of paragraph 6.3.5.
4. Paragraph 6.32 refers to four other considerations, including the limitations of acquiring agreement from landowners and this point is also picked up in paragraph 7.276. In this respect we note that letters from landowners (or their agents) have been included in Appendix 19. However, in themselves they provide little context regarding the discussions that may have taken place between the parties, and further information on this will be required if they are to carry more weight within the ASA.
5. Further to point 4 above, paragraph 6.41 acknowledges that compulsory powers exist, but counter this by stating that they represent *"...an impediment"*. Further explanation as to the extent that they are an impediment would be useful.
6. It is understood that NPL has decided to include alternative development sites within the National Park (paragraphs 6.56-6.59) for completeness, although it is worth noting that this is not necessary from the NPA's perspective.

2.6 Stage 4: Detailed Assessment of Shortlisted Sites

2.6.1 Overview

As YPL and NLP will be aware from the discussions that took place at the 12 June ASA meeting, it is evident that the potential alternative minehead locations at Cloughton are emerging as less viable options than the alternatives at Whitby Enclave. AMEC has therefore focussed most comment on the Whitby Enclave alternatives, and specifically the larger site near Ruswarp. Unfortunately this site has been referred to as *'Site 1'* in the main ASA report; as *'Area 3'* on the RHDHV drawings in its *'Environmental Assessment of Shortlisted Minehead Sites'* report; as and as *'Site 4'* in the SRK report; and as Site 3 on the Estell Warren ZTV drawings in Appendix 17. Consistent referencing between all of the reports would be appreciated.

Despite the focus on Ruswarp, it also remains appropriate for the YPL team to consider the Cloughton options, and notably the site at Lindhead Gorse in this report, not least because it enables the company to deal with the issues raised as part of the review of the previous application. The referencing problem referred to above also relates to this site.

2.6.2 Whitby Enclave (Ruswarp Site)

Area Prospects Assessment

1. It is stated in paragraph 7.6 that *"SRK has advised that a programme of investigative drilling would require 6 to 7 boreholes to be drilled...to provide a sufficient amount of information to prepare a Mineral Resource estimate, as defined by the JORC code"*. From Section 5.3.7 of the SRK report, we understand that six boreholes equates to three *'parent'* and three *'daughter'* holes. From Tables 5.3 and 5.4 respectively of the SRK report, it is understood that this would require a drilling and results interpretation phase lasting 20 months and costing an estimated £16.1 million. We also understand from the ASA presentation that these costs do not include the YPL overhead costs, which have been estimated to be nearly £800,000/month.

2. Whilst the NPA appreciates that the cost and delay to the project would now be substantial and cannot be readily borne by YPL at this stage of the project's development, this response in itself does not really appropriately address the *'cost of'* requirement of the MDT. Furthermore, as raised with respect to point 2 of Section 2.3 above, the interested parties have to consider whether it is appropriate to justify not investigating the feasibility of the minehead alternatives (in terms of the availability of the polyhalite resource), just because such an investigation would take time and considerable financial resources to complete. This is not a straightforward consideration, especially when it could be argued that such an investigation could have been undertaken previously; thereby minimising the problems now cited in respect to delay and the associated costs associated with that delay.

3. Having made the above points, the NPA does acknowledge that the clock cannot be turned back regarding this issue. However, for its part, YPL should acknowledge that its handling of this issue reduces the weight that should be attributed to this point and this should be reflected in the presentation of the subject in the ASA and supporting documentation.

4. To fully address the *'cost of'* requirement of the MDT, the NPA requires YPL and its consultants to undertake a high level cost comparison of developing a Dove's Nest style mine design at both Ruswarp and Dove's Nest Farm itself. It is appropriate for such a study to include the direct costs associated with additional investigative programme at Ruswarp

within any cost comparison table, although the NPA and AMEC is of the opinion that assessment should only make secondary reference to the additional YPL overhead costs resulting from not carrying out the investigative work earlier.

5. With reference to the first bullet point on page 33 of the SRK report, paragraph 7.8 states that *“there would be insufficient material here to support a viable mining operation on its own and any such operation located here would need to develop through the Donovan Fault to access the Mineral Resource already delineated to the south by YPL”*. As mentioned in point 12 of Section 2.3 above, this general statement should be supported by an estimated quantity of the total reserve, based on the evidence currently available, together with details of what this is likely to mean in terms of the size of a mineable polyhalite reserve.

6. Paragraph 7.13 suggests that the polyhalite resource located between the two Donovan faults *“would be the subject of disturbance and may have undergone significant salt flow and folding, complicating the geometry of the seams and making it difficult to define the Mineral Resource and mine the area”*. From the second paragraph of Section 3.3.2 on page 32 of the SRK report, it is suggested that evidence for this statement is provided by the seismic surveys of this area. However, paragraph 7.13 cites borehole E3 as the evidence of this although, as mentioned in point 11 of Section 2.3 above, borehole E5 (located within SRK’s *‘inferred’* resource area) appears to have similar thickness characteristics, albeit no quality information has been presented in either report. In summary, whilst it is accepted that there is a risk that the polyhalite resource at Whitby Enclave may be degraded in some way, the case for this seems to be based on limited historical information and therefore appears to be inconclusive. Further substantiation of the available evidence should therefore be provided to give more weight to this point.

Scope to Accommodate Mining Operations and the Associated Costs

7. It is stated in bullet 5 of paragraph 7.49 that *“The pre-production period could take as long as 8 years if workable mineral resources are not discovered in the immediate vicinity of the sinking of the shaft.”* However, this would only be the case if the shafts at Whitby Enclave were being sunk purely to access polyhalite resources south of the Donovan Fault, rather than to mine reserves immediately beyond the shaft pillars further north. If so the need to spend time investigating those resources in detail would be negated.

8. Further to point 7 above, Table 5.2 of the SRK report states that the roadways required to connect the Ruswarp minehead site to the mineral resource to the south of the Donovan Faults would be 1900 m long, and that the anticipated timescales for this work, assuming acceptable tunnelling conditions, would be 9 months? Given this, clarification over the calculation of the 8-year timescale, referred to in paragraph 7.49, should be provided.

9. It is stated in bullet 6 of paragraph 7.49 that *“...an additional ventilation shaft would be required and this would likely have to be located within the NYNMP.”* SRK’s Table 5.2 refers to this being *“...required for future mine workings located in the NYNMP”*, but is not specific as to whether these workings would be located within the identified *‘indicated’* or *‘inferred’* resource areas, or beyond. To support this point, details of the maximum distance that the workings can extend away from the main shafts should be provided.

10. In paragraph 7.54 it is stated that YPL had already spent £60 million in defining the current Mineral Reserve. To put this in the context of the alternative sites, it would be useful if Table 7.1 (SRK’s Table 5.4) includes a third column with the comparable costs for Dove’s Nest Farm.

11. In addition to the points raised above, SRK's Section 5 entitled *'Assessment of Shortlisted Minehead Sites'* contains some useful commentary and accompanying plans, which show the alternative sites relative to key geological features, together with shaft infrastructure layouts, including the proposed shaft pillars. However, similar layout information is not currently provided for Dove's Nest Farm and this would be a useful addition to the report, especially if it is proposed to radiate away from the shafts in several directions during the early development of the mine.

12. With reference to Tables 5.1 and 5.2 of the SRK report, it is stated that the amount of waste rock that would need to be excavated at Ruswarp would be 487,800 m^3 (Best case) compared to 213,700 m^3 at Dove's Nest. We understand that this is mainly due to the 1900 m development tunnels that need to be driven through the Donovan Faults, which would contribute 284,000 m^3. Whilst this potentially represents an important consideration in terms of both the additional cost and the associated landscape and visual effects for the minehead design, it is noted that these figures do not take account of the reduced length of the first section of the MTS, i.e. Ruswarp is located ~1.5 km closer to Lady Cross Plantation than Dove's Nest Farm. It is also unclear why main shafts at Ruswarp result in a greater quantity of waste rock despite being 20 m shorter in depth, and whether these numbers account for a potentially reduced depth of MTS shaft at this location.

13. Further to point 12 above, it could be argued that similar drivages would also be required if a mine at Dove's Nest subsequently expanded northwards to exploit reserves of polyhalite to the north of the Donovan Faults. This issue should therefore be considered as part of any comparison regarding waste production between the two minehead options.

Potential Environmental Effects of Development

14. With regard to transport and access, paragraph 7.64 states that *"Any traffic impacts upon Whitby and Scarborough further to the east and south respectively would therefore be limited."* We believe this sentence underplays the potential difference that the Whitby Enclave option would potentially make (compared to the Dove's Nest site) in terms of traffic and transportation, especially in the context of the effects from HGVs during the construction period. The potential comparable benefits should therefore be acknowledged and outlined more clearly, especially once the transport assessment for the minehead ES has been completed.

15. The contents of paragraph 7.66 is considered to be overly negative in the context of the potential adverse effects on residential properties from noise and air quality, with the emphasis being placed on a 500 m buffer zone from the site boundary. The residential locations to the south and east within the zone are located at much lower elevations than most of the prospective site and, with an access most likely to be located in the northwest of the Ruswarp site, there should be opportunity to provide potentially effective mitigation during the construction phase.

16. Figure 5.6 of the RHDHV report provides an illustration of the potential noise effects from a minehead at Ruswarp during both the construction and operational phases. Although it is unclear what assumptions these plans have been based on, they do not suggest that a noise problem is anticipated during either phase of the development. Further explanation of the basis of the noise calculations and contour plots would be useful to help understand the concerns expressed by NLP.

17. Paragraph 7.67 refers to the potential NO_2 problem, as recorded at the monitoring station near to the A174 (located ~250-300 m north of the Mayfield Road junction) in Whitby. AMEC is unsure why this has been mentioned in the context of the Ruswarp site, since the monitoring station is located ~1.4 km to the east of its northeast corner and construction HGV traffic for this site travelling east along the A171 from Teesside would not pass through Whitby. Clarification is therefore sought as to whether YPL considers the potential air quality issues associated with central Whitby to be typical of the Ruswarp site as well.

18. There appears to be some inconsistency between the various plans (e.g. RHDHV Figure 5.6; SRK Figure 5.9, and Estell Warren Site 3 ZTVs), as where the focus of the environmental effects will be. Clarity with respect to the location of the shafts, and consistency between the various documents, would be appreciated.

19. Although AMEC has not reviewed the *'Landscape and Visual Impacts Assessment of the ASA Shortlisted Sites'* (Appendix 17) in detail at this stage, it is noted that Estell Warren has concluded that, based on the criteria used, that Dove's Nest Farm (Site 5) has been adjudged to be preferable to Ruswarp (Site 3), albeit it is noted that the latter is considered to be the second preference. This is also despite the fact that the former is located within the National Park, and the latter not, with the reasoning for the conclusion seemingly mainly based on the conclusion that the mitigation measures for the operational mine *"could take considerably longer to become effective and would entail a significant change from existing open valley side landscape character to one of a wooded nature"*. For such a conclusion to be accepted and indeed to be used as an important differentiator in the context of this ASA, it is likely that NPA will require additional evidence to be provided. It may also be appropriate for YPL's consultants to consider whether its outline proposals for operational mitigation (i.e. provision of woodland) are the most appropriate given its stated landscape character and visibility characteristics.

20. Paragraph 7.84 refers to the *"...approximate 45 m downward slope across the site from the western to the eastern boundary"*, and the fact that *"The land would therefore have to be re-graded and re-profiled, at least in part, to accommodate the above ground mining buildings and associated infrastructure"*. This is judged unfavourably in comparison to the Dove's Nest Farm site, but such an approach seems oversimplistic, and it would be more useful to compare existing gradients and the suitability of the topography to accommodate a the required infrastructure for a similar minehead, together with the associated spoil mounding, taking into account the relative spoils handling requirements of the two sites (see point 12 of this section above). With this in mind, it should be noted that SRK considers the site topography at Ruswarp (see Table 5.2) to be favourable for the construction of the sunken headframes.

21. With reference to paragraph, it is difficult to reconcile the evidence presented in the ASA with the conclusion that *"...it is clear that development could not proceed without harmful environmental effects, the combination of which would significantly detract from its suitability"*. Whilst some harmful effects may inevitably result from development of Ruswarp, the question to be considered here is how it compares with Dove's Nest Farm, which is also likely to cause harmful environmental effects.

22. Turning to paragraph 7.214, NLP concludes *"this comparative assessment demonstrates that when environmental issues are assessed in isolation, the comparative impacts of bringing forward development at the alternative locations do not present opportunities to accommodate the minehead with a lesser environmental cost. In contrast, environmental*

impacts associated with these alternatives, taken as a whole, are likely to be of a higher significance, and would result in significant harm to the character and landscape setting of the NYMNP." It is assumed that this conclusion is a least partially based on RHDHV's Table 6.1, which itself is based on a traffic light system. However, we have a number of concerns relating to this table given the evidence presented, subject to the outcome of the EIA for the Dove's Nest minehead development, including the following:

- Transport & access: Area 5 being attributed as amber;
- Noise: Area 3 (&4) being attributed as red;
- Air: Area 3 being attributed amber, with *"Access routes have air quality concern"*, being listed as one of the reasons (see point 17 above for further comment);
- Flood Risk: Area 3 being attributed as amber compared to green for Dove's Nest because *"Onsite drains present technical constraint"*;
- Landscape: Area 3 (&4) being attributed as red, compared to amber for Dove's Nest (see point 19 above).
- Heritage and PRoW: Given as negative reasons in the summary, despite having comparable ratings to Dove's Nest within Table 6.1.

Other Considerations: Onward Transport Option

23. It is noted that paragraph 7.215 refers to the MTS between Dove's Nest and Wilton as being 37.5 km long, which is the length that we had previously been aware of. However, in the penultimate row of SRK's Table 5.2, this distance is quoted as 36.5 km and confirmation of this distance would be useful.

24. This subject is discussed in paragraphs 7.215 to 7.226, but there is no commentary here that reflects the fact that the Whitby Enclave sites are located closer to Teesside, even though this is acknowledged in paragraph 7.274, with the caveat that a direct route would entail locating *"...an intermediate site within European-protected designated land"*. The distance issue is discussed in paragraphs 7.272 and 7.274, but no consideration is given to connecting with the first selected intermediate site at Lady Cross Plantation, which would appear to reduce the comparable distance for the first section of MTS by 1.5 km. Indeed Table 5.1 of the SRK report, which compares the *'Physicals'* (i.e. distances, quantities etc) between Dove's Nest and Ruswarp (SRK Site 4) is still referring to a comparable pipeline lengths, although Table 5.2 refers to the MTS without specifying the likely reduction in tunnel length? Clarity regarding the comparable MTS distances should therefore be provided.

25. Paragraphs 7.221-7.223 focus on the use of tunnels from remote locations to access the mineral resources at depth. Various constraints (e.g. mine ventilation, worker health and safety, travel to work times etc) are cited in general terms only, but the commentary is not supported in the NLP report by any factual evidence of what this means in terms of quantification or feasibility, cost, risk etc. Table 5.2 of the SRK report provides some details in terms of relative tunnel distances to the indicated resource area from Whitby and Cloughton, together with waste excavations, timescales etc, but this is not translated into estimated additional travel times and extra costs.

26. Further to point 25 above, the commentary should also take account of the fact that a minehead located at Dove's Nest will also at some point in time face similar development

constraints to develop beyond the currently defined *'inferred'* resource area, but stress that the likely timescales involved.

27. Paragraph 7.221 implies that there could be a problem with unstable and unpredictable geology, but there is no apparent distinction between Whitby and Cloughton, or directly relevant discussion of this point. A plan showing the comparable potential route of an MTS from Ruswarp and Dove's Nest, perhaps with reference to the key geological features (i.e. major faults, Cleveland Dyke etc, would be a potentially helpful addition to the ASA.

2.6.3 Cloughton Surrounds (Lindhead Gorse Site)

Introduction

As outlined in Section 2.6.1 above it has become clear that from a number of perspectives that the two site options at Cloughton are more constrained than the Whitby alternatives. We have therefore sought not to review this location in the same level of detail, although would recommend that the points earlier in the report may be equally relevant and applicable to Cloughton, and should be taken into account when the report is updated.

Having said this, potentially one of the most significant impediments to locating a minehead development near Cloughton is the constraint imposed by onward transportation to a suitable endpoint destination and therefore we have highlighted some areas where the provision of additional information would benefit the report.

Other Considerations: Onward Transport Options

1. The discussion of the onward transport options in paragraphs 7.215 to 7.220 focus on the merits of the tunnel over the pipeline, but aside of providing some introduction to later discussion regarding pipeline options south from Cloughton, it is unclear what purpose this text provides, especially since routing a pipeline across the National Park has been ruled out by YPL for environmental reasons.

2. With reference to points 25 and 26 in Section 2.6.2 above, Cloughton is clearly a lot further from the current *'indicated'* and *'inferred'* resource areas than Whitby and it is suggested that this is highlighted more clearly within the text and illustrated on plans, potentially by combining and expanding Figures 5.3 and 5.4 of the SRK report and thereby show the key geological features.

3. Similarly to point 27 in Section 2.6.2 above, a plan showing the comparable potential route of an MTS from Lindhead Gorse and Dove's Nest, perhaps with reference to the key geological features (i.e. major faults, Cleveland Dyke etc, together with the main ecological designations within the National Park would be a potentially helpful addition to the ASA.

4. Further to point 3 above, it would also be helpful to accompany the suggested Cloughton MTS options plan with a cross-section to illustrate the depth and potential geological constraints associated with this option.

5. With reference to paragraph 7.229 and Table 7.2, it would help provide context if the relative locations of the Teesside and Hull Port options and Whitby, Cloughton and Dove's Nest minehead locations were shown on a plan.

6. Discussion of the port option at Hull starts from paragraph 7.231 and includes some commentary regarding the geology (MTS option) in paragraph 7.232 and topography (pipeline) in paragraph 7.237. To highlight the points made, the text would once again benefit from the accompaniment of a simplified plan.

7. Further to the point made in point 6 above, there would be also be merit in highlighting all of the transport options constraints associated with the use of the Cloughton: Lindhead Gorse alternative minehead site on one or more plans, as appropriate to their production at a readable scale. This would help the reader quickly identify the locations of the main constraints that have been described in the text.
8. At the outset of the discussion regarding rail access, i.e. from paragraph 7.245 onwards, it would be useful to provide an accompanying plan that shows the existing rail network within this part of North Yorkshire, together with the routes of former lines. The illustration of the Boulby rail route arrangements on this plan would also be helpful to provide context and this plan should come before the more detailed constraints plan referred to in point 7 above. The plan could also be used to support the capacity issues text set out in paragraphs 7.263-7.266.
9. With respect to the rail options, it is noted from paragraph 7.254 and the plans in Appendix 18 that consideration has been given to the creation of a new southern rail line to connect the two Cloughton sites to the main line at Seamer. This summary highlights the difficulties of creating a completely new route, although the existing plans are not sized to be at a defined measureable scale at a given print size and such an amendment would be helpful.
10. Paragraph 7.272 states that *"Arup, on behalf of YPL, has established MTS routes from Whitby and Cloughton to Teesside to enable Royal Haskoning DHV to undertake a high level comparative environmental assessment..."* As mentioned above (point 27 of Section 2.6.2 and point 3 of Section 2.6.3) plans showing these routes are not currently included in the RHDHV report, but it would be helpful if they could be in any updated version. Such plans should be reproduced at an appropriately readable scale.

3. ASA Conclusions

Given that AMEC has set out a comprehensive list of issues that would benefit from additional consideration, description and illustration, which may lead to amendments to at least some of the conclusions that have been drawn, it would be inappropriate to comment in details on the overall ASA conclusions at this stage. However, we would caution against the conclusions introducing new issues or ones that we believe have been addressed by the work that has been undertaken by the YPL team in the preparation of this ASA and the supporting appendices.

For example, paragraph 8.9 opens with the statement that *"At Whitby, ignoring the proximity of the faulting to the short-listed sites that itself prejudices the ability to sink a shaft and establish a pillar of support to protect the integrity of the mine..."* However, whilst this represented part of the ASA submitted with the 2013 application, the further work undertaken by SRK for the new ASA has confirmed that the Donovan Faults do not pass through the site and that there is no impediment to sinking a shaft at this location because of the presence of faults.

Finally, it will be important to ensure that the conclusions set out in the final ASA are entirely consistent with the findings of the updated report. It is also advised that these focus on the key points and that if more minor points are to be made to support the case that the minehead for the project could not reasonably be constructed outside the National Park, then these should be given the appropriate level of context and their importance not overstated.

Author: Trevor Parkin

[redacted]..........

Reviewer: Neil Marlborough

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Memorandum

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To	Justin Gartland Chairman Nathaniel Lichfield & Partners		
From	Trevor Parkin		
Date	13 August 2014	Our Reference	S35190ShrM028i2/TJP/dcf
Copy	Chris France, NYMPNA Mark Hill, NYMNPA Jane Davies, NYMNPA Neil Marlborough, AMEC		
Subject	**YORK POTASH: ALTERNATIVE SITES ASSESSMENT - WHITBY ENCLAVE**		

1. INTRODUCTION

This memorandum has been prepared to formally respond to your request (email of 6 August 2014) for feedback regarding and extract from what we assume is an updated version of the SRK Report from April 2014 entitled *'An Independent Report on the Potential for Polyhalite Exploration in North Yorkshire, England with particular reference to the York Potash project'* We understand that this extract has been prepared to provide further information regarding the potential mineable polyhalite resource north of the Donovan Fault, which is the resource that would potentially be directly accessible from any shafts sunk at the Whitby Enclave alternative minehead location.

In order to provide a comprehensive response, we have referred back to AMEC's *'Preliminary Review of Draft Alternative Sites Assessment'* dated 17 June 2014 (AMEC Ref: 35190n019i3) to determine how well the points raised then, with respect to Whitby Enclave, have been addressed by the new information, and whether the SRK submission would be enhanced by the provision of additional information and/or explanation.

For ease of reference we have used the sub-headings used in the extract and numbered each of the points that we have made.

2. FEEDBACK ON SRK EXTRACT

2.1 AVAILABLE DATA

Under this heading on page 1, Table 3-1 from the earlier report is presented again. Table 3-1 was the subject of comment by AMEC in paragraphs 11 and 12 of Section 2.3 the June 2014 review. Specifically we noted that that the thickness data presented did not tally with the details included in Table 4.4 of the August 2012 report and sought clarification regarding the differences.

We also enquired whether the quality information referred to in Table 3-1 had resulted from "some re-analysis of the historical records". Although SRK make some statements regarding the quality of resource, notably with reference to borehole E3 with the suggestion that "...the only potentially economic grades extend over a thickness of only 4ft", the points raised by AMEC have not been specifically addressed. Furthermore it is stated later in the extract (second paragraph on page 4) that *"...it should be noted that not only is there very little data but also that this data is of poor quality. The three drillholes were not sampled on a continuous basis but rather just chip sampled in sections that appeared of interest and the logging is relatively simple. As a result of this the determination of the length of polyhalite intersections and their grades is subjective."* Given this and the age of this borehole, i.e. Table 4.4 of the August 2012 report states it was drilled in 1948, it would be helpful for SRK to elaborate on its conclusions regarding the polyhalite thickness and grade.

2.2 MINERAL RESOURCE/ORE RESERVE POTENTIAL

This section provides a useful commentary as to how SRK has estimated the quantity of *'potentially mineable material'* to the north of the Donovan Fault. For ease of reference our understanding of the key points is summarised as follows:

- The total polyhalite mineralisation is 700 million tonnes (Mt), but this has been graded at only 63% purity because of borehole E3;
- At economic grades, this equates to 200-400 Mt, which has been converted to a *'potentially mineable tonnage'* of 40-80 Mt, based on the same approach that SRK *"...used to derive the Probable Ore Reserve of 250Mt reported for the area to the south of the Donovan Fault from the Shelf Seam Indicated Mineral Resource of 820Mt";*
- Five factors have been used to calculate the *'potentially mineable tonnage'*, including;
  - losses due to shaft pillar (20 Mt);
  - losses under villages (8-21 Mt);
  - losses immediately north of the Donovan Fault due to geological disturbance (70% of unspecified tonnage);
  - loss in tonnage due to reduction in polyhalite purity (40%);
  - loss due to mine stability pillars (47.3%).

In order to provide better clarity to the calculations, it would be useful if the above information is presented in a summary table to show how they have been derived. The table should also show how the tonnages for Whitby Enclave compare to the proposed development at Dove's Nest Farm. It would also be very helpful if some of the geological information from Figure 3.5 is overlaid over the 1:25,000 OS background (shown in readable greyscale) to give the comparison of the two alternatives better context. At this scale, the entire area of Whitby Enclave, together with the Dove's Nest Inferred Mineral Resource would fit on an A2 size plan and the information to be shown should include the following:

- Key faults (Donovan 1&2; Whitby, Pasture Beck, South) and the Cleveland Dyke, including disturbance zones where significant levels of resource losses are expected;
- Locations of YPL and relevant legacy boreholes;
- Extents of Whitby Enclave target areas and Dove's Nest Indicated and Inferred Mineral resource areas;
- Shaft pillars, including an indicative location at Whitby Enclave;
- Urban areas subject to resource sterilisation.

In addition to the above, we had previously requested, via paragraphs 7 and 9 of the June 2014 review, details of the parameters used, and assumptions made, within the JORC assessment. Perhaps this is contained elsewhere within the updated SRK report, and if so please accept my apologies for repeating the request, but otherwise it would be useful to receive this information in order to consider it in the context of this document exchange.

2.3 SRK COMMENTS

It is noted in the first of the updated bullet points that the number of drillholes required to determine the polyhalite resource at Whitby Enclave has reduced from 6-7 in the April version of the report to 5-6 in the latest extract, the cost of the drilling has increased from £15 million to £17 million. Why is this the case?

It is noted in the third bullet point that a reserve of 80 million tonnes is considered to be *"...insufficient to pay back the construction costs of establishing a mining operation on its own and any such operation located here would need to develop through the Donovan Fault to access the Mineral Resource already delineated to the south of this by YPL."* To put this statement into context for the NPA members, it would be useful to know the tonnage that SRK believe the reserve would need to be in order to provide payback for the construction costs.

With reference to the third bullet point, SRK state that *"...before a decision could be made to establish a mine in this location* [Whitby Enclave]*, a significant amount of work would need to be undertaken to determine the best approach to develop through this and also to then determine if the material to the south could be included in the mining plan i.e. while the material to the south of the fault may be reportable as a Mineral Resource for a shaft also sunk to the south, this may not be possible if the shaft was located to the north."* The key wording in this text is highlighted since, again for context, it would be useful to know what additional work SRK envisages would be required to include the polyhalite material (to the south of the Donovan Fault) in any mine plan for a minehead located at Whitby Enclave and why it might not be possible for this material to be reportable as a mineral resource.

3. CLOSING REMARKS

Given the importance of the Alternative Sites Assessment to the consideration of the Major Development Test, it is considered that it is vital that it is as comprehensive as possible in order for the NPA officers and members to have all of relevant information in front of them for the determination process. We have therefore attempted to identify where gaps remain in the Alternative Sites Assessment and trust that our requests outlined above will be relatively straightforward to fulfil.

Regards

[redacted]

TREVOR PARKIN
Technical Director

Appendix 3

Response to AMEC Review

AMEC: Preliminary Review of Draft Alternative Sites Assessment 17/06/2014

AMEC Ref	AMEC Comment	Action Taken
2.1	Remove repeated references to SRK's *"independence"*.	SRK assessment has been undertaken independently, but the ASA has removed references as requested.
2.2	Provide a plan of Boulby Potash licence area.	Southern boundary of Boulby Potash 1998 Planning Application Boundary area is now shown within the SRK report Figures 2.1 and 3.5. This is considered to represent an appropriate boundary to delineate the Boulby Mine, for the purposes of this ASA. Note that YPL does not have an up-to-date plan of the detailed extent of CPL's mineral rights, which typically are confidential.
2.3.2	ASA paragraph 4.28 - 4.29, should make appropriate reference to the Lockton boreholes (LE1 and L3) that indicate thick polyhalite.	The ASA has been updated to reflect how the intersections found in the Lockton boreholes supported the decision not to further explore areas to the south of SM4. Cross reference is made to the SRK report in this regard, that explains the inferior nature of the polyhalite found in this area generally.
2.3.3	Demonstrate a clear reasoning for not drilling boreholes to the south of SM4 and address the question as to whether YPL had considered 'the cost of, and scope for' locating a minehead site outside the limits of a National Park, prior to making its decisions to focus its exploration efforts in the vicinity of Dove's Nest farm.	The ASA provides an accurate account of the exploration process that resulted in the selection of Dove's Nest Farm as the appropriate minehead site for the project. The NP status of the site was known to YPL at this time and the policy implications associated with this was understood.
2.3.4	Amend sentence on SRK report page 12 to reflect thick polyhalite at Lockton boreholes.	Page 11 of the SRK report now includes a description of the polyhalite encountered at Lockton Boreholes.

AMEC Ref	AMEC Comment	Action Taken
2.3.5	To provide a context to the defined YPL mineral resource, following ASA paragraph 4.41 include table 2.2 and figure 3.4/3.5/3.6 from SRK report.	Section 4 of the ASA now incorporates the figures as requested.
2.3.6	Justify the pursuance of such a large mining area.	As described in the Planning Statement that accompanies the application submission, the boundary of the proposed application is consistent with onshore mineral rights agreements.
2.3.7-9	Provide more information on the parameters used, and the assumptions made within the JORC assessment (in particular the mean thickness, variable quality and interpretation of historic boreholes).	Section 2.6.3 and 2.6.4 of the SRK report now includes a methodology on the techniques and parameters used to derive the indicated and inferred mineral resource estimate.
2.3.10	Provide more information on the assumptions on mineable output conversion rate.	Section 2.6.5 of the SRK report now provides a description of the application of factors to derive the ore reserve estimate.
2.3.11	Clarify inconsistencies in SRK table 3.1 with August 2012 report table 4.4.	As now stated in section 3.3.2 of the SRK report, the thickness and grade of polyhalite found in table 3.1 represents SRK's interpretation of the information available and reflects its independent view of the potentially economic intersections of polyhalite in these historic holes. The August 2012 report reflected FWS's interpretation and was produced prior to SRK's resource estimate and did not benefit from the work done to derive this. It should also be noted that the limited information available relating to the historical drilling means that different geologists will derive different interpretations.
2.3.12-13	SRK section 3.3.2 to include an estimate of resource to north of Donovan Fault and consider whether it is possible that there are potentially richer sub-horizons of polyhalite within the overall seam thickness at E3.	Section 3.3.2 of the SRK Report now provides its estimate of the mineable tonnage that could be present to the north of the Donovan Fault. Two scenarios are provided – one which assumed that a higher grade polyhalite is present in E3, despite evidence to the contrary. Also see 7.18-7.33 of the ASA that summarises these findings.

AMEC Ref	AMEC Comment	Action Taken
2.4.1, 2.5.1	NLP to provide the combined mining and environmental constraints map and associated shadow map as GIS files.	This has been included within Appendix 27 of the ASA as requested.
2.5.2	Move National Parks to the top of list in ASA paragraph 6.5.	The ASA text has been adjusted as requested.
2.5.3	Do not use proximity to residential properties as a definitive constraint in ASA paragraph 6.31.	As described in paragraph 6.30 and 6.35, proximity to residential development is not considered as a definitive constraint within stage 3 of the ASA and accompanying RHDHV report. However, the proximity of residential receptors is an environmental constraint as in the detailed shortlisted site assessment undertaken in Section 7.0 of the ASA.
2.5.4	To add weight provide context for discussions with landowners in ASA.	As appropriate, landowners and their agents where contacted via telephone to enquire whether they would be interested in selling or leasing land to York Potash. The responses appended to the ASA are direct responses to this request.
2.5.5	Provide explanation of the 'impediment' arising from potential use of compulsory purchase orders in ASA.	Paragraph 6.41 of the ASA now includes a brief description of the available compulsory purchase order process and the implications arising from having to rely on such a process.
2.5.6	It is not necessary to consider development alternatives within the National Park in paragraphs 6.56-6.69.	Noted. However this section provides context for the EIA.
2.6.1	Provide consistent site referencing between all of the reports.	Noted. Site referencing within the ASA and SRK report have been adjusted.
2.6.2.2-3	When discussing the cost and delay of investigative drilling it should be acknowledged that an investigation could have been undertaken previously and therefore reduces the weight that should be	As appropriate, the costings provided at Table 5-4 of the SRK Report, present real costs to a company, wishing to take forward a project at either Cloughton or Whitby Enclave and hence remain relevant for the purposes of assessment in accordance with Paragraph 116 of the NPPF.

AMEC Ref	AMEC Comment	Action Taken
	attributed to this point.	
2.6.2.1-4	To address MDT 'cost of' requirements, undertake a high level cost comparison of a Dove's Nest style mine design at Ruswarp and Dove's Nest farm (including costs of investigative drilling and only making secondary reference to additional YPL overhead costs).	Table 5-4 of the SRK report now includes estimated pre-construction costs for Dove's Nest Farm.
2.6.2.5	Support statement in first bullet point on page 33 of SRK report with an estimated quantity of total reserve.	Page 36 (Table 3-2) of the SRK report now includes an estimated quantity of total mineable tonnage that could be present though of course this is not a reserve.
2.6.2.6	ASA to confirm the reference in paragraph 7.13 is based upon the E3 borehole rather than seismic surveys (as suggested in 3.3.2 of SRK report).	The ASA (Paragraph 7.22) now provides further information on the predicted nature of polyhalite between the Donovan Faults, drawing upon SRK's Report.
2.6.2.6	Further evidence required to give weight to the assumption of a degraded resource at Whitby Enclave as suggested in SRK section 3.3.2.	Section 3.3.2 of the SRK report now provides further reasoning to the assumption that the area between the Donovan Fault 1 and Donovan Fault 2 is structurally disturbed.
2.6.2.7	The pre-production period referenced in ASA paragraph 7.49 (now paragraph 7.56) bullet 5 is only correct if being sunk to access resource south of the Donovan Fault.	As demonstrated by SRK report (Table 5-2); two pre-production scenarios have been established. The best case scenario of 8 years assumes that mineable mineral resources are discovered at the Whitby shaft location. If this is not the case then an additional 67 months would be required to access the Mineral Resource south of the Donovan Faults leading to a total period to access mineralisation of up to 14 years.
2.6.2.8	Clarify whether this timescale (quoted at paragraph 7.49 (now paragraph 7.56)) incorporates the required roadways (as stated	As described above, the 8 year timescale represents the best case scenario and therefore does not incorporate the potential requirement of roadways to the indicated mineral resource.

AMEC Ref	AMEC Comment	Action Taken
	in table 5.2 of SRK report).	
2.6.2.9	Detail the maximum working distances from shaft without requiring an additional ventilation shaft.	Table 5-2 of the SRK report now clarifies the estimated working distances for additional ventilation shafts.
2.6.2.10	SRK to include Dove's Nest Farm in estimated pre-construction costs table 5.4.	Table 5.4 of the SRK report now includes pre-construction costs for Dove's Nest Farm.
2.6.2.11	Within section 5, provide plans and commentary for the potential layout of Dove's Nest Farm.	Below ground layout plans for Dove's Nest Farm have been provided as part of the planning submission.
2.6.2.12-13	Include calculations in tables 5.1 and 5.2 for the reduction of waste rock due to a shorter and shallower MTS at Whitby and a potential for increase in waste at Dove's Nest Farm due to a northern expansion.	Section 5.3.6 of the SRK report now details the assumptions made in calculating waste rock generation.
2.6.2.14	In ASA paragraph 7.64 should specifically acknowledge the transport benefits of locating a minehead at Whitby	As requested, text within the ASA and RHDHV reports have been adjusted to reflect potential transport benefits at Whitby Enclave. The summary matrix has all of the Whitby Enclave sites showing green for transport.
2.6.2.15	The RHDHV Report has overplayed noise impacts and does not consider the lower elevation of sensitive receptors. It should also consider opportunities for mitigation measures.	The number of residential receptors within the 500m buffer has been used to give an indication on the potential noise impacts. Topography has been included in the creation of the noise contour maps (note Figure 5.6). In response to suggestions that the noise impact has been overplayed, the noise contour maps have been recolored so that 70dB now appears yellow and text within the ASA has been reworded to directly reflect the RHDHV report. As described in Section 5.3.2 of the RHDHV report, mitigation measures have the potential to remove noise impacts during operations; however during construction, impacts would be inevitable. The ASA has been updated to clarify this point. In terms of construction vibration mitigation measures, whilst it is not possible to specify an exact list of appropriate

AMEC Ref	AMEC Comment	Action Taken
		measures, RHDHV have included a list of likely best management practice to be implemented within Section 5.3.2.
2.6.2.16	Detail the assumptions taken in creating the noise contour figures.	The methods of producing the contour maps are explained in Section 4.2 of the RHDHV report. As described in the response to point 2.6.2.15, the number of residential receptors within the 500m buffer has been used to give an indication on the potential noise impacts. As now stated in the ASA, Figure 5.6 shows that construction noise would be likely to extend to all receptors within the 500m buffer (190 residential properties) and beyond.
2.6.2.17	Clarify whether construction traffic would pass the air quality monitoring station mentioned in paragraph 7.67.	Paragraph 7.67 (now 7.132) refers to possible HGV routes associated with a Ruswarp site. It indicates that if the A171 east of the site and the A174 in Whitby were to be affected, then there are locations along such access roads with proximate residential receptors and in some areas elevated levels of NO2. It is accepted that HGV traffic for this site travelling east along the A171 from Teesside would not need to pass through Whitby. However, without a full transport assessment of construction traffic origins and destinations, the review of the Ruswarp site would not have been complete without consideration of the possible traffic effects to the east of the site. The ASA clearly does not state that air quality issues associated with central Whitby are typical of the Ruswarp site.
2.6.2.18	Provide a consistent location of shaft sites when considering environmental effects throughout plans.	It is acknowledged that there is discrepancy in the location used as the basis for different assessments conducted within the earlier draft of ASA and its accompanying documents. For the noise assessments these points were chosen to represent the midpoint of the redline boundary (i.e. the average location for the peak noise output). Similarly, for the ZTVs Estell Warren adopted a single, centrally located point as established in Section 2 Methodology. As described in Section 4.2 of the SRK report the minehead locations were determined by the impact of the infrastructure on the surface environment and the proximity to the Mineral Resource.
2.6.2.19	Underplayed role of National Park in	The Park's position is acknowledged with regards to impacts on the National Park.

AMEC Ref	AMEC Comment	Action Taken
	assessment. Additional evidence, other that the length of time for mitigation measures to take effect, is required to demonstrate that Dove's Nest Farm is preferable to Ruswarp. Consider whether outline proposals for mitigation are the most appropriate given the landscape character and visibility characteristics.	However, it is reiterated that the impact on the National Park is not the only concern when assessing the visual impacts of a scheme. In response to the request for additional evidence, a more detailed landscape assessment has been undertaken for Site 3 (Whitby Enclave) option. This assessment provides a more detailed comparison and assessment of mitigation options with the optimum alternative from a landscape assessment. The outcomes of this updated assessment are included in the updated ASA, RHDHV report and the Appended Landscape and Visual Effects Assessment.
2.6.2.20	Adjust ASA paragraph 7.84 to compare existing gradients and the suitability to accommodate a minehead and spoil mounding whilst taking account of SRK's view that Ruswarp is suitable for a sunken headframe (table 5.2).	Paragraph 7.84 of the ASA (now 7.155) accurately identifies a need for some re-profiling of the site, but this point is not overplayed in the assessment. Note that the worked up scheme for Ruswarp, which is assessing the in landscape and visual work provided at Appendix B of Appendix 19 of the ASA, incorporates a sunken headframe design.
2.6.2.21	Reconsider ASA with regard to Whitby Enclave alternative sites. Consider how each site compares with Dove's Nest Farm.	Ignoring the context of the mining prospects section of the ASA that dismisses both Whitby sites as future mining projects; NLP remain of the opinion that minehead development at either alternative sites at Ruswarp or Briggswath could only proceed whilst delivering harmful environmental effects which would detract from the overall sustainability of the project. As requested, the ASA now includes a section which summarises the comparative environmental impacts of alternative sites to that of Dove's Nest Farm. This can be found in paragraphs 7.219-7.222.
2.6.2.22	Address concerns on table 6.1 including:- i. Transport & access: Area 5 (Dove's Nest Farm) being attributed as amber; ii. Noise: Area 3 (Ruswarp) and 4 (Briggswath) being attributed as red; iii. Air: Area 3 (Ruswarp) being attributed	i. Amber is correct and is in keeping with the findings of the planning application Environmental Statement. Text regarding the Dove's Nest farm site (Paragraph 5.5.1 of RHDHV report) has been amended to make this point clearer by stating that HGV demand will route via Whitby, but this is in the context of the higher background traffic follows (i.e. >400 HGVs per day). ii. The concern regarding classifying Sites 3 (Ruswarp) and 4 (Briggswath)

AMEC Ref	AMEC Comment	Action Taken
	amber (see point 2.20 above) iv. Flood Risk: Area 3 (Ruswarp) being attributed as amber compared to green for Dove's Nest Farm; v. Landscape: Area 3 (Ruswarp) and 4 (Briggswath) being attributed as red, compared to amber for Dove's Nest Farm; and vi. Heritage and PRoW: comparable ratings to Dove's Nest Farm in table 6.1.	are acknowledged. Therefore these have been reclassified as amber, requiring further investigation. iii. This point is addressed in response to 2.6.2.17. Colour-coding is retained. iv. Drainage channels are mentioned for Area 3 (Ruswarp) as they represent a potential flood risk onsite, which would need to be managed during construction process. Amber represents a potential environmental risk which requires further investigation. Therefore colour-coding has been retained. v. As a result of the more detailed assessment of the Whitby Enclave alternative at site 3 (Ruswarp), landscape impacts have been reclassified as amber at this site as a result of the improved mitigation options available. Site impacts for site 4 (Briggswath) retained due to potentially high impacts on landscape features and poor mitigation options. vi. Potential heritage setting impacts are the same for all sites and this is represented in the summary row of Table 6.1. Recreation and amenity impacts are marked as amber for all sites – this is due to the potential need for PRoW diversion for Areas 1-4 and for impact upon a Sustrans route for Area 5. The reason for the potential impact on the Sustrans route is not covered in the summary is because it is related to the area's traffic impacts, which are already mentioned in the summary row. The summary text for Area 5 has been amended to make this clearer.
2.6.2.23	Within SRK table 5.2: amend Dove's Nest Farm MTS length as 37.5km.	The SRK report has been updated (36.5 km is the correct length of the tunnel).
2.6.2.24	When discussing onward transport options in ASA, reflect that Whitby is closer than Dove's Nest Farm and clarify the distances.	Direct distances are clearly acknowledged in ASA table 7.2. Commentary has been added at 7.295.
2.6.2.24	Remove pipeline length and replace with MTS	The SRK report has been updated to reflect the MTS transport option.

AMEC Ref	AMEC Comment	Action Taken
	length in table 5.1.	
2.6.2.25	Quantify the assumptions in discounting the use of tunnels to access the resource from remote locations, referenced in ASA paragraphs 7.221-3.	As stated in the ASA, a tunnel structure used as a primary access to win and work the resource could not be considered a sensible alternative to the traditional shaft access to the mine (see paragraphs 7.238-7.241). Further detailed works relating to potential cost and risk has therefore not been undertaken.
2.6.2.26	Consider the need for future additional ventilation structures at Dove's Nest Farm.	As now explained in SRK table 5.2, an additional ventilation shaft is not required by the current mine plan to access the defined Ore Reserve.
2.6.2.27	In relation to ASA paragraph 7.221 Provide a plan(s) showing the potential MTS routes from Ruswarp, Lindhead Gorse and Dove's Nest Farm, referencing key geological features.	As stated above in response to AMEC comment 2.6.2.25, the use of a tunnel structure to access, win and work the resource could not be considered a sensible alternative and therefore further works have not been undertaken.
2.6.3.1	Consider removing the comparison of the pipeline to the MTS in ASA (paragraphs 7.215 to 7.220).	Noted. However this section provides context for the remainder of the report, highlighting why pipeline alternatives for any of the sites should not be considered in detail.
2.6.3.2	Highlight Cloughton's distance from resource areas. Could be achieved by combining and expanding figures 5.3 and 5.4 of SRK report.	Given the above comments, as it is in excess of 14km from the Indicated Resource, it is clear that any development at either Cloughton short listed site has no means of accessing this area. It is considered that the existing plans provide sufficient clarity in this regard; however, the introduction of Appendix 18 may prove helpful.
2.6.3.3	Provide a plan(s) showing the potential MTS routes from Lindhead Gorse (Cloughton) and Dove's Nest farm, referencing key geological features.	A plan of the MTS route is included within the planning application submission. For reasons provided in the text (paragraphs 7.250-7.254 and 7.296) an MTS from Cloughton is not seen as a viable option to either Teesside or Hull, therefore is it not considered that mapping a potential route adds value to the ASA. However, a plan has now been provided (Appendix 20) which located the alternative sites, Dove's Nest farm and both Hull and Teesside destination options.

AMEC Ref	AMEC Comment	Action Taken
2.6.3.4	Further to 2.6.3.3provide a cross section that illustrates the depth and geological constraints associated with a Cloughton MTS option.	See response to AMEC ref 2.6.2.27, 2.6.3.2 and 2.6.3.3.
2.6.3.5	Supplement ASA table 7.2 with a plan of Teesside and Hull port options with the Whitby, Cloughton and Dove's Nest farm sites illustrated.	This has been provided at Appendix 20.
2.6.3.6	Provide a cross section of topography and geology for Cloughton to Hull route.	The ASA now provides a geological map (Figure 7.1) of the area and topographical profiles of direct routes between Cloughton and Immingham Dock are provided in Appendix 21.
2.6.3.7	Highlight all Cloughton transport option constraints on one plan.	NLP believe the plans included in the ASA are suitable to identify the constraints described in the text.
2.6.3.8	Provide a plan of the existing and former rail network to support ASA paragraphs 7.263-7.266.	The ASA appends a plan as requested (Appendix 22).
2.6.3.9	Supply higher quality rail alignment plans with recognisable scales.	The plans have been appended at higher quality and now include a scale bar (Appendix 23).
2.6.3.10	Provide MTS from Whitby and Cloughton to Teesside.	The potential MTS route from Whitby to Teesside is discussed within ASA paragraphs 8.34-8.36. The MTS route from Cloughton to Teesside was established by Arup on a straight line bases. For reasons described in ASA paragraph 7.296, this option is not considered viable, therefore more detailed assessment has not been undertaken and the inclusion of such a plan would not add value.
3	Remove reference to the immediate presence of faulting at Whitby in paragraph 8.9 as SRK have confirmed a shaft could be sunk in this	The ASA text is correct in stating that faulting is in the proximity of the shortlisted sites. The fault zones do in fact encroach within the boundary of site 2 (Land at Burniston).

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AMEC Ref	AMEC Comment	Action Taken
	location.	
3	Review conclusion to ensure no new issues are introduced.	Stated conclusions are consistent with main body of report.
3	Ensure the conclusion focuses on key point and if minor points are being made then provide appropriate levels of context.	Conclusions focus on the inability to create a minehead development at any alternative location, providing a comprehensive review of justification.

AMEC: Alternative Sites Assessment – Whitby Enclave Memorandum 13/08/2014

AMEC Ref	AMEC Comment	Action Taken
2.1	With regards to borehole E3, SRK to elaborate on its conclusions regarding the polyhalite thickness and grade.	This has been updated. Please see Section 3.3.2 of the SRK report.
2.2	Present the information regarding the estimates quantity of potentially mineable material north of the Donovan Fault alongside a comparison of Dove's Nest Farm.	A full account of the estimates of mineable polyhalite that could be present within the Whitby Enclave is now provided (see SRK Table 3-2).
2.2	Highlight specified geological information on OS background.	This has been provided at Appendix 18 of the ASA.
2.2	Provide details of the parameters used, and the assumptions made within the JORC assessment.	Section 2.6.3 and 2.6.4 of the SRK report now includes a methodology on the techniques and parameters used to establish the indicated and inferred mineral resource estimation.
2.3	Why has the number of drillholes required to determine the polyhalite resource at Whitby Enclave been reduced?	SRK is unsure of the number of drillholes that will be required as this will depend upon the results obtained and in particular the extent to which continuity of polyhalite thickness and grade is established. SRK has now edited its report to convey better this uncertainty.

AMEC Ref	AMEC Comment	Action Taken
2.3	What tonnage would be needed to provide payback for mine construction costs?	Note SRK's consideration of this within section 3.3.2.
2.3	What additional work would be required to include polyhalite south of the Donovan Fault in a mine plan for a minehead located at Whitby Enclave?	See ASA text paragraphs 7.29-7.32 that clearly explains why such an eventuality is not a sensible, achievable or deliverable mine plan for a Whitby Enclave minehead.
2.3	Why might it not be possible for polyhalite south of the Donovan Fault to be reported as a Mineral Resource?	SRK has included extra text in its report to explain this. Specifically though this is because while it may be practically and economically viable to extract this material from a shaft located on the same (south) side of the fault (and so in this case it could be reported as a Mineral Resource) it may not be so if the access development is required to develop through this(in which case it could not). The key point is that for something to be reported as resource there must be reasonable potential for it to be economically mined.

Appendix 4

SRK Independent Report on the Potential for Polyhalite Exploration in North Yorkshire

AN INDEPENDENT REPORT ON THE POTENTIAL FOR POLYHALITE EXPLORATION IN NORTH YORKSHIRE, ENGLAND WITH PARTICULAR REFERENCE TO THE YORK POTASH PROJECT

Prepared For

York Potash Limited

Report Prepared by

srk consulting

SRK Consulting (UK) Limited
UK05678

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EXECUTIVE SUMMARY
AN INDEPENDENT REPORT ON THE POTENTIAL FOR POLYHALITE EXPLORATION IN NORTH YORKSHIRE, ENGLAND WITH PARTICULAR REFERENCE TO THE YORK POTASH PROJECT

1 INTRODUCTION

York Potash Ltd (YPL or the Company) is currently preparing an application to the North York Moors National Park Authority (NYMNPA) in relation to its York Potash Project (YPP or the Project). Specifically this application seeks planning permission to develop a Mine Head at Doves Nest to access the polyhalite YPL has identified in the immediate vicinity of this site following a three year period of exploration and assessment.

Following the submission of an earlier application, and comments received on this from NYMNPA, YPL has requested SRK Consulting (UK) Ltd (SRK) to provide it with an independent opinion on the polyhalite resource identified in the region to date and the process followed to discover and delineate this, the likelihood of discovery of additional resources of this mineral following further exploration in the region, and also the potential for either the existing resource or any potential additional resource to be exploited from a Mine Head located outside of the North York Moors National Park (NYMNP). This document presents the independent conclusions of SRK's work.

2 SRK QUALIFICATIONS

SRK is an associate company of the international group holding company SRK Consulting (Global) Limited. The SRK Group comprises over 1,600 staff, offering expertise in a wide range of resource engineering disciplines with 50 offices located on six continents. The SRK Group's independence is ensured by the fact that it holds no equity in any project. This permits the SRK Group to provide its clients with conflict-free and objective recommendations on crucial judgement issues. The SRK Group has a demonstrated track record in undertaking independent assessments of exploration projects, resources and reserves, project evaluations and audits, Mineral Experts' Reports, Competent Persons' Reports, Mineral Resource and Ore Reserve Compliance Audits, Independent Valuation Reports and independent feasibility evaluations to bankable standards on behalf of exploration and mining companies and financial institutions worldwide.

3 SCOPE OF WORK

In producing this report, SRK has:

1. Reviewed the exploration and evaluation programme followed by YPL over the last three years that resulted in the preparation of the most up to date polyhalite Mineral Resource estimate by SRK in May, 2013. This resource lies within the NYMNP and YPL is proposing to access and mine this from two vertical shafts with a Mine Head located at the Doves Nest site which is within the NYMNP.
2. Developed a regional three dimensional (3D) model of the sub-surface geology of the North Yorkshire area focused on the orebody that hosts the polyhalite mineralisation and based on the results of YPL's exploration work, geological interpretive work completed by FWS Consultants Ltd (FWSC) and historical information available in the public domain.
3. Used the above 3D model to comment upon the potential for the discovery of additional polyhalite resources in the region as a whole and on the geological features in the area that have the potential to hinder the development of the above resources.
4. Commented upon the potential for the development of a polyhalite mine to exploit the already identified Mineral Resource and any potential nearby resource from various other site locations outside of the NYMNP.
5. Estimated the cost of project development for each of two preferred alternative sites (one at Whitby and one at Cloughton) and also the time required for this and compared this to the project development cost of the currently proposed site and allowing for the possibility that additional mineable polyhalite mineralisation may be identified nearer these sites.
6. Made conclusions regarding the likelihood that an exploration or mining company acting reasonably would commit to the exploration and assessment required to investigate the feasibility of extracting polyhalite mineralisation from these sites.

4 MINERAL RESOURCE TERMINOLOGY

Throughout this report references are made to "Mineral Resources" and for the potential to discover "Mineral Resources". Specifically, references are made in this report to the JORC Code which is one of the established internationally accepted codes used to report estimates of the amount of a given material in the ground that has potential to be exploited by a mining operation.

Getting to a position when a Mineral Resource, as this is defined by the JORC Code, can be reported is a key step in the development of a mineral exploration project and prerequisite of obtaining debt or equity funding to develop a mine. The Code sets out criteria that are required to be assessed when reporting estimates of tonnes and grade, inclusive of criteria regarding the quality and quantity of data, the geological understanding and the work done to demonstrate that the mineralisation has potential to be mined economically, and also minimum levels of disclosure to ensure transparency in reporting and also minimum qualifications and experience required of those responsible for producing the estimates. Most notably the aim of the JORC Code is to prevent disclosure of estimates of tonnes and grade based on too little or poor quality data or produced by individuals without the experience to understand all of the issues that could impact on the resulting estimates.

Given the above, it should be understood that the reporting of a Mineral Resource estimate requires the completion of a significant amount of exploration work typically inclusive of multiple intersections of the target orebody by drillholes or underground development, and certainly not single drillholes, which in turn requires significant expenditure.

The JORC Code defines a Mineral Resource as "*a concentration or occurrence of material of intrinsic economic interest in or on the Earth's crust in such form, quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge."*

This definition of a Mineral Resource is reasonably well agreed by the majority of the internationally accepted codes used in the exploration and mining industry to report material being explored as a potential mining target and is therefore in common usage throughout the industry.

A key part of this definition is the requirement that mineralisation has not only been identified as being present but that it has been sufficiently explored to enable estimates of tonnage and quality to be established to a reasonable degree of confidence. Fundamental to reporting a Mineral Resource therefore is establishing the continuity of mineralisation between observation points which therefore requires multiple drillhole intersections rather than single drillhole intersections.

Mineral Resources are reported in three categories dependent upon the confidence the expert who produced the estimate has in the estimates of tonnage and quality derived. The highest confidence category is "Measured", the second highest "Indicated" and the third "Inferred".

The key distinction however is between the Indicated and Inferred categories as once a tonnage of mineralisation is reported as Indicated, this means that the material has been delineated to level of confidence needed to be used as the basis of a Pre-Feasibility Study (PFS) or Feasibility Study (FS) which in turn are the documents typically produced by mining companies to support a decision on the development of a mine.

In the case of YPL, as commented upon below, SRK has already reported an Indicated Mineral Resource as defined by the JORC Code which has been demonstrated by a PFS to be sufficient to support a viable mining operation. The establishment of this Mineral Resource is a pre-requisite of a mining operation and in SRK's opinion it would not be possible to obtain the funding required to develop a mine to exploit the polyhalite in North Yorkshire without this.

5 EXPLORATION WORK COMPLETED BY YPL

The Area of Interest (AOI) outlined by YPL encompassed the areas in the region with the best potential for the delineation of a Mineral Resource and the establishment of a mining operation given the data available to YPL at the time. While all of this area had been identified by YPL as having potential to contain polyhalite mineralisation, the more promising historical data (in terms of consistent results, with the additional benefit of good sylvite potential) was in the north of the AOI, and in SRK's opinion this would have appeared to be the most attractive from an exploration perspective and indeed, as demonstrated by results, remains the most attractive from both an exploration and a mining perspective. The prioritisation of polyhalite over sylvite was the result of a conscious decision to focus on the horizons where it was most likely that a Mineral Resource could be delineated by drilling from surface.

The exploration programme followed by YPL was planned and carried out in a professional manner. It began by stepping out from an area where there was a good expectation of initial success and was modified in response to results obtained. New and plausible geological models were continually developed and refined to explain these new results, the historical drillhole data, and the new seismic interpretations and exploration was focussed in the north of the AOI and on the Shelf Seam where there was best potential to delineate sufficient material to a sufficient level of confidence to justify the establishment of a mining operation.

The results of this exploration programme, which as commented in this report have contributed to YPL's total expenditure to date on the project of some GBP60 million, now form the basis of a Mineral Resource, and subsequently an Ore Reserve which a PFS has demonstrated to be economic to exploit from a mine head at Dove's Nest. This is a major step forwards in terms of the Project as a whole and justifies the exploration strategy developed by YPL and the decisions made during the exploration programme itself.

6 SRK ASSESSMENT OF REGIONAL POLYHALITE POTENTIAL

In order to properly assess the potential for the development of a Mine Head at locations outside of the NYMNP, SRK has reviewed all of the relevant geological data it understands is available in the region to determine whether there is potential for the delineation of a Mineral Resource in areas other than that outlined by YPL to date. This has enabled SRK's assessment of these alternative Mine Head sites, to be informed not just by their relative location to the Mineral Resource already delineated but also to areas where there is potential for a Mineral Resource to be outlined following further exploration.

SRK has restricted its assessment to the area to the south of the southerly limit of the Boulby Mine licence area and specifically to three areas where in SRK's opinion there appears to be some potential for exploitation from outside of the NYMNP. These have been termed the Whitby Area, the Lockton-Cloughton Area and the Fordon Area respectively.

SRK's conclusions from this work were that:-

- There are several areas in the vicinity of the AOI and further south that have potential to contain polyhalite mineralisation. In all cases, however, the indications are that the mineralisation is either deeper, geologically more complex or constrained by geological features. Further, in the Whitby Area, where there is some reliable quality data, while two of the three drillholes in the area intersected polyhalite seams of reasonable thickness and potentially economic grades, one intersected a very wide zone of very low grade polyhalite that would clearly not be economic to exploit.
- None of these areas have been sufficiently explored to date to enable the quantity or quality of the in situ polyhalite to be assessed.
- All these areas would therefore require a significant amount of exploration work to be undertaken, and thus expenditure, before a Mineral Resource could be delineated of the size and to the level of confidence required to support a decision on establishing a mine. Notably this would require multiple polyhalite intersections, one drillhole would be insufficient, and multiple parent and daughter drillholes would be required.
- Given the issues mentioned above, even if a significant amount of expenditure is incurred, the likelihood of being able to report a Mineral Resource estimate of sufficient size and quality to justify the establishment of a mine on completion of this is unlikely. Certainly none of these areas are in SRK's opinion as prospective as the area drilled to date by YPL.
- Finally, some of these areas would need to be both explored, and if exploration was successful, also potentially be developed from within the NYMNP.

Given the above, in SRK's opinion it would be unreasonable to expect a company such as YPL that has already delineated a significant Mineral Resource elsewhere to explore in any of the areas identified and highly unlikely that any other exploration company would risk the expenditure required to commit to this in the foreseeable future or indeed that it would be able to raise the money required to fund this if required.

7 ASSESSMENT OF SHORTLISTED MINEHEAD SITES

The four alternative mine head sites to Doves Nest assessed by SRK are the results of a comprehensive study for such undertaken by NLP on behalf of YPL. Two of these are in the Cloughton area, one west of the village of Burniston and one west of the village of Cloughton; and two in the so-called Whitby Enclave, one to the north, and the other to the northeast of the village of Briggswath. For the purpose of its more detailed technical and economic comparison with the Doves Nest site SRK has selected the most promising site at each of these two areas.

In order to make this comparison, SRK has planned the surface infrastructure required at each site and also the shaft and underground development required in each case which clearly varies between the sites. In doing this, SRK has planned the development in such a way so that if there is polyhalite mineralisation present between the shaft and the YPL Mineral Resource area, the development is placed within this such that the amount of waste material mined is minimised.

Further, while SRK has assumed that the primary intent of any mine development at these locations would be to access the Mineral Resource already delineated by YPL, as this is the only Mineral Resource delineated to date, SRK has also assumed that prior to any construction commencing, a programme of exploration and evaluation would be required such as has already been conducted at Doves Nest. This reflects SRK's opinion that it would be inconceivable, given that these sites are further from the Mineral Resource than the proposed site at Doves Nest and therefore clearly less attractive from a safety and technical perspective, that any mining company acting reasonably would not first explore the potential of the immediate area to contain polyhalite mineralisation that could be mined using the same infrastructure.

SRK conclusions from its assessment were that:

- The Cloughton site would effectively be a completely new project, requiring geological exploration and a full feasibility study before a decision could be made on implementation. This process, which SRK estimates might take at least five years and cost some GBP 100 million, carries a substantial risk that the outcomes may prove to be unfeasible.
- The Whitby Enclave site would also require significant geological exploration, geotechnical investigations and feasibility studies to develop sufficient confidence in the achievability of a life of mine plan, which includes access through the Donovan Fault. SRK estimates this process might take some four years and cost in excess of GBP 70 million.

In addition to the above, the overall project risk profile of the two sites is significantly higher when compared with the Doves Nest Site. Notably, at the Whitby Enclave there is added risk of tunnelling through the Donovan Fault. Unless this can be effectively mitigated with investigations from surface and project planning, effectively all the project capital investment, including the large scale investment for sinking a shaft, is at risk and the project may prove to be technically and economically unfeasible.

Similarly, at the Cloughton site there is risk that any exploration programme undertaken to develop a Mineral Resource to support mining of polyhalite accessed from outside the NYMNP is completely unsuccessful. Further, should a Mineral Resource be defined, there remains risk that the project site cannot be developed for other reasons that arise from the feasibility studies that would have to be completed, although this risk cannot be quantified at this stage.

8 CONCLUSIONS

SRK's overall conclusions are as follows:-

1. The exploration programme followed by YPL was planned and carried out in a professional manner, was initially and properly focussed in an area where there was a good expectation of success, was then adapted as results became available to demonstrate both continuity between intersections and prove up a sufficient tonnage to justify the establishment of a mining operation and now forms the basis of a mining plan which has been demonstrated to be economic to exploit from a mine head at Doves Nest.

2. While there are several other areas in the vicinity of the AOI and further south that have potential to contain polyhalite mineralisation, none of these have been sufficiently explored to date to enable the quantity or quality of the available polyhalite to be assessed and all would therefore require a significant expenditure to be committed before their potential could be properly assessed. Further, all of these areas are for geological reasons less attractive targets than the Doves Nest area.

3. All of these areas would need to be explored, and if exploration was successful, some also potentially be developed from within the NYMNP. Other areas could be explored, and if the exploration was successful, potentially be developed from outside the NYMNP.

   In SRK's opinion, however, none of these areas represent attractive exploration targets; it would be unreasonable to expect a company that had already delineated a significant Mineral Resource elsewhere such as YPL to explore these and it would be unrealistic to expect that any exploration company new to this region would risk the expenditure required to commit to this in the foreseeable future or that it would be able to raise the money required to fund this if needed.

   Further, given the limited quantity and poorer quality of the polyhalite that could be present north of the Donovan Fault and therefore the reliance of any mine established in this area to be mining material south of the Donovan Fault early in the mine life with the risk of both first negotiating, and then maintaining safe operations beyond the fault, it is in SRK's opinion of SRK that further exploration of this area by YPL is not justified at this time.

4. Four alternative sites have been identified in the region where mine heads could be located to access the existing Mineral Resource and/or the other areas with potential to host polyhalite resources in the region. There are however significant technical challenges associated with all of these. Notably, these are all further from the delineated Mineral Resource than the Doves Nest site and any access development to this would need to negotiate some major structural features. Technically this is likely to be possible but a significant amount of further technical work inclusive of drilling needs to be done in all cases to investigate these features and the local stratigraphy generally which would delay the Project by four years, longer in the case of the Cloughton sites, and incur considerable additional expenditure before a decision could be made on developing the mine. In addition there is a substantial risk that this work may prove these sites not to be technically viable.

   In this regard it should be noted that the development of and production ramp up of a mine is funded by capital investment into the project. More extensive development requirements have longer development periods and incur greater cost before revenue is earned and returns are made to investors and financiers. This can in turn reduce the number of potential investors that are willing to invest and either increase the cost of finance or make financing impossible.

   Accessing the YPL Mineral Resource from the sites at Cloughton would for example almost certainly be economically unviable even if this work yielded positive results, while accessing this from the Whitby sites would both be less economic than accessing this from the currently proposed site at Doves Nest, possibly to the point that it would be uneconomic, and would require the access infrastructure to negotiate a major fault the characteristics of which are currently unknown.

In fact, in all cases, the practicality and additional safety issues incurred would likely render access from these sites inappropriate from a mining perspective. Establishing a mine head at all these sites therefore requires a Mineral Resource to be delineated in these areas which, as commented above, SRK considers would not be an attractive proposition to a mining company at this time and which SRK would not recommend YPL or any other exploration or mining company to embark upon.

5. Given all the above, SRK would not recommend that YPL undertakes any more work to investigate the viability of establishing a mine head at any of the locations commented upon in this report. It is also SRK's opinion that it would be unrealistic to expect that any other exploration or mining company would risk the expenditure required to commit to the exploration and development work required to assess the merits of establishing a mine head at any of these at the present time, or indeed in the foreseeable future, or that it would be able to raise the funds to do so if required.

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AN INDEPENDENT REPORT ON THE POTENTIAL FOR POLYHALITE EXPLORATION IN NORTH YORKSHIRE, ENGLAND WITH PARTICULAR REFERENCE TO THE YORK POTASH PROJECT

1 INTRODUCTION

1.1 Background

York Potash Ltd (YPL or the Company) is currently preparing an application to the North York Moors National Park Authority (NYMNPA) in relation to its York Potash Project (YPP or the Project). Specifically this application seeks permission to develop a Mine Head at Doves Nest to access the polyhalite YPL has identified in the immediate vicinity of this site following a three year period of exploration and assessment.

Following the submission of an earlier application, and comments received on this from NYMNPA, YPL has requested SRK Consulting (UK) Ltd (SRK) to provide it with an independent opinion on the polyhalite resource identified in the region to date and the process followed to discover and delineate this, the likelihood of discovery of additional resources of this mineral following further exploration in the region, and also the potential for either the existing resource or the potential additional resource to be exploited from a Mine Head located outside of the North York Moors National Park (NYMNP). This document presents the independent conclusions of SRK's work.

1.2 Summary of Work Completed and Findings

In producing this report, SRK has:

1. Reviewed the exploration and evaluation programme followed by YPL over the last three years that resulted in the preparation of the most up to date polyhalite Mineral Resource estimate by SRK in May, 2013. This resource lies within the NYMNP and YPL is proposing to access and mine this from a vertical shaft with a Mine Head located at the Doves Nest site which is within the NYMNP.
2. Developed a regional three dimensional (3D) model of the sub-surface geology of the North Yorkshire area focused on the orebody that hosts the polyhalite mineralisation and based on the results of YPL's exploration work, geological interpretive work completed by FWS Consultants Ltd (FWSC) and historical information available in the public domain.
3. Used the above 3D model to comment upon the potential for the discovery of additional polyhalite resources in the region as a whole and on the geological features in the area that have the potential to hinder the development of the above resources.

4. Concluded from this that while there is likely additional polyhalite material yet to be discovered in the region, this is unlikely to be sufficiently attractive as an exploration project to enable a company acting reasonably to justify a surface based exploration programme at the present time.

5. Based on all the above, commented upon the potential for the development of a polyhalite mine to exploit the already identified Mineral Resource from various other site locations outside of the NYMNP. Specifically SRK has assessed the relative technical merits of four alternative site locations identified as a result of a study of potential alternative minehead sites undertaken by Nathaniel Lichfield & Partners (NLP), two near the town of Whitby and two near the village of Cloughton.

6. Determined which site from each of the two areas has the best potential to provide an alternative access point to the currently defined Mineral Resource.

7. Estimated the cost of project development (specifically the costs of the technical work still required to be completed to enable a decision on mine construction to be made) for each of the two preferred alternative sites (one at Whitby and one at Cloughton) and also the time required for this and to access the Mineral Resource and compared this to the project development cost of the currently proposed site and allowing for the possibility that additional mineable polyhalite mineralisation may be identified nearer these sites.

8. Concluded that the only realistic option for establishing a mine to exploit polyhalite in the region in the foreseeable future is via a shaft location at Doves Nest Farm as currently planned.

1.3 Qualifications of Consultants

SRK is an associate company of the international group holding company SRK Consulting (Global) Limited. The SRK Group comprises over 1,600 staff, offering expertise in a wide range of resource engineering disciplines with 50 offices located on six continents. The SRK Group's independence is ensured by the fact that it holds no equity in any project. This permits the SRK Group to provide its clients with conflict-free and objective recommendations on crucial judgement issues. The SRK Group has a demonstrated track record in undertaking independent assessments of exploration projects, resources and reserves, project evaluations and audits, Mineral Experts' Reports, Competent Persons' Reports, Mineral Resource and Ore Reserve Compliance Audits, Independent Valuation Reports and independent feasibility evaluations to bankable standards on behalf of exploration and mining companies and financial institutions worldwide. The SRK Group has also worked with a large number of major international mining companies and their projects, implementing and managing exploration programmes and providing mining industry consultancy service inputs.

This work has been prepared based on input of a team of consultants specialised in the fields of sylvite and polyhalite geology and resource and reserve estimation all of whom have extensive experience in the mining industry and are members in good standing of appropriate professional institutions.

SRK is not an insider, associate or affiliate of YPL. The results of the work undertaken by SRK are not dependent on any prior agreements concerning the conclusions to be reached, nor are there any undisclosed understandings concerning any future business dealings.

1.4 Mineral Resource Terminology

Throughout this report references are made to “Mineral Resources” and for the potential to discover “Mineral Resources”. Specifically, references are made in this report to the JORC Code which is one of the established internationally accepted codes used to report estimates of the amount of a given material in the ground that has potential to be exploited by a mining operation.

Getting to a position when a Mineral Resource, as this is defined by the JORC Code, can be reported is a key step in the development of a mineral exploration project and prerequisite of obtaining debt or equity funding to develop a mine. The Code sets out criteria that are required to be assessed when reporting estimates of tonnes and grade, inclusive of criteria regarding the quality and quantity of data, the geological understanding and the work done to demonstrate that the mineralisation has potential to be mined economically, and also minimum levels of disclosure to ensure transparency in reporting and also minimum qualifications and experience required of those responsible for producing the estimates. Most notably the aim of the JORC Code is to prevent disclosure of estimates of tonnes and grade based on too little or poor quality data or produced by individuals without the experience to understand all of the issues that could impact on the resulting estimates.

Given the above, it should be understood that the reporting of a Mineral Resource estimate requires the completion of a significant amount of exploration work typically inclusive of multiple intersections of the target orebody by drillholes or underground development, and certainly not single drillholes, which in turn requires significant expenditure. Notably the reporting of a Mineral Resource for the YPP as given in Section 2.6 of this report marks the culmination of three years of exploration and the expenditure of some GBP60 million.

The JORC Code defines a Mineral Resource as “*a concentration or occurrence of material of intrinsic economic interest in or on the Earth's crust in such form, quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge.”*

This definition of a Mineral Resource is reasonably well agreed by the majority of the internationally accepted codes used in the exploration and mining industry to report material being explored as a potential mining target and is therefore in common usage throughout the industry.

A key part of this definition is the requirement that mineralisation has not only been identified as being present but that it has been sufficiently explored to enable estimates of tonnage and quality to be established to a reasonable degree of confidence. Fundamental to reporting a Mineral Resource therefore is establishing the continuity of mineralisation between observation points which therefore requires multiple drillhole intersections rather than single drillhole intersections.

Mineral Resources are reported in three categories dependent upon the confidence the expert who produced the estimate has in the estimates of tonnage and quality derived. The highest confidence category is “Measured”, the second highest “Indicated” and the third “Inferred”.

The key distinction however is between the Indicated and Inferred categories as once a tonnage of mineralisation is reported as Indicated, this means that the material has been delineated to level of confidence needed to be used as the basis of a Pre-Feasibility Study (PFS) or Feasibility Study (FS) which in turn are the documents typically produced by mining companies to support a decision on the development of a mine.

In the case of YPL, as commented upon below, SRK has already reported an Indicated Mineral Resource as defined by the JORC Code which has been demonstrated by a PFS to be sufficient to support a viable mining operation. The establishment of this Mineral Resource is a pre-requisite of a mining operation and in SRK's opinion it would not be possible to obtain the funding required to develop a mine to exploit the polyhalite in North Yorkshire without this.

2 EXPLORATION WORK COMPLETED BY YPL

2.1 Background

The geology of North Yorkshire is dominated by a succession of sedimentary, largely evaporite, rocks which were deposited from an inland body of water (termed the Zechstein Sea) between 250 and 300 million years ago. At the time of this deposition, this sea occupied what is now the North Sea plus areas of Britain, inclusive of North Yorkshire, and the north European plain through Germany and Poland.

The resulting sedimentary succession is comprised predominantly of a sequence of relatively shallow dipping beds of evaporite rocks such as halite, anhydrite and, most notably in the context of this report, polyhalite, which were deposited in five distinct cycles which have been labelled Z1 to Z5, respectively, Z1 being the first deposited and therefore now the deepest and Z5 being the youngest and therefore now the shallowest.

The shallow dipping beds containing polyhalite, occur in the Z2 cycle, are located between 1,000 and 2,500 m below surface in the North Yorkshire region and would therefore require the development of a vertical or inclined shaft to be accessed and exploited.

Polyhalite is a hydrated, potassium, calcium and magnesium sulphate with the formula $K_2Ca_2Mg(SO_4)_4.2H_2O$ and it is a typically minor constituent of many ancient evaporite sequences. Its chemical composition lends itself to use as a direct application fertilizer and also as a source of potassium for the production of blended fertilizers. It is for this reason that it is currently a much sought after commodity.

2.2 Historical Exploration in the Region

Evaporite successions such as that formed in the Zechstein Basin represent excellent exploration targets for a variety of minerals many of which occur much more commonly in economic quantities in these rocks than polyhalite. Notably this includes sylvite, which is another and more established source of potassium for fertilizer and which is already being exploited at Boulby Mine near Whitby, but they can also contain oil reservoirs and act as a cap to underlying gas fields.

The Zechstein Basin is no exception, the North Yorkshire region has consequently been subject to intermittent exploration for sylvite, oil and gas over the past 80 years and it is this exploration work that first led to the intersection of polyhalite mineralisation.

Notably, three companies explored for sylvite in and around the AOI during the 1960s. These comprised:-

- Cleveland Potash Ltd (CPL), owned initially by Imperial Chemical Industries (ICI) and Charter Consolidated Ltd (though later ICI's shares were bought by Minorco/Anglo-American Corporation);
- Whitby Potash Ltd (WPL), owned by Armour Chemical Industries (and later by Shell and then Consolidated Goldfields).

  WPL applied for planning consent for solution mining in 1962, however the application was later withdrawn. WPL also established a pilot solution mining plant on Egton High Moor in 1966, this closed down in 1970; and
- Yorkshire Potash Ltd (YSL), owned by Rio-Tinto Zinc Corporation.

All of the above companies submitted, and were granted, planning applications following public inquiries in the late 1960s but while CPL commenced construction of the Boulby Mine in 1969, both the WPL and YSL permissions lapsed. Boulby Mine initially had an expected life of 20 to 30 years but in 1997 consents were granted to extend the existing licence area including taking up some of WPL's original ground and the mine is still in operation today.

The main orebody mined at Boulby is a sylvite seam which is present in the Z3 cycle and the bulk of the historical exploration activity in the region has therefore been focussed on the Z3 and overlying cycles. A certain body of information was however also collected on the underlying Z2 cycle which confirmed the presence of seams of polyhalite within this. This information, combined with indications from both mining at Boulby, and the historical exploration drilling, indicated that the Z3 Sylvite Seam, generally referred to as the Boulby Potash Seam, was both generally very variable in thickness and grade over short distances and thinner and poorer in quality to the south of the Boulby Mine licence, and suggested to YPL that the Boulby Potash Seam would be a challenge to explore.

Given this, and the fact that the other known sylvite seam, which is in the Z4 cycle and generally referred to as the Sneaton Potash Seam, was lower grade and situated very near to the top of the evaporites (i.e. close to the overlying aquifers which would cause challenges from a mining perspective in that it would need to be ensured that the mining does not impact on the integrity of these), YPL's strategy from the outset was to target not only these sylvite seams, as had been done by previous explorers, but also the underlying polyhalite. Historical drilling had shown this to be present in the deeper Fordon Sequence, part of the Z2 Cycle, and YPL considered this would be more consistent and less prone to variation over short distances, an observation SRK understands is supported by the results of trial mining of this seam already carried out at Boulby Mine.

SRK considers the initial strategy developed by YPL based on its assessment of the available data and its identification of polyhalite as a prime exploration target to be reasonable given the nature of that data and indeed given the results of the exploration work it has since carried out.

2.3 Identification of an Area of Interest (AOI)

The broad onshore extent of the Zechstein evaporites had already been reasonably defined by historical drilling and, although the quality of the old logs was variable and often poor, approximate geographical limits could be placed on each seam. Exploration between the 1950s and 1970s for sylvite in the Z3 and Z4 seams had concentrated around Eskdale, and drillhole records from ICI, Fisons, WPL and YSL included intersections of Z3 at depths below surface which were comparable in terms of thickness and quality with those at the working Boulby Mine. Records of the Z2 polyhalite were sparser – and, with a few exceptions, tended to comprise wireline geophysical logs from which the presence, thickness and quality of polyhalite had to be inferred. Taken in conjunction with offshore hydrocarbon well records, this was, however, sufficient to enable YPL's consultants to develop a simple geological model which suggested that polyhalite had potential to be present throughout an area of some 350 x 50 km in extent wrapping around the NW corner of the Zechstein Basin. Most of this would lie offshore but it also extended across some 90 km of the Yorkshire coastline between Staithes and Humberside, and inland for up to 20 km. No complete assays of polyhalite cores were available, but published descriptions of cores from boreholes at Atwick, Eskdale and Fordon, and examination of historical wireline logs, suggested that at least some of this polyhalite could be of good quality.

The aim of the AOI outlined by YPL therefore was to encompass the entire area within which it was conceivable that potentially workable thicknesses and grades of sylvite (in Z3 and Z4) and polyhalite (in Z2) could occur at a mineable depth – the maximum depth at that time being considered to be around 1,900 m. This approach seems perfectly reasonable and in line with that typically used, the aim being to tie up as much ground as possible and to prevent any areas being taken up by competitors before the mineral potential has been fully evaluated.

The northern AOI limit was set at or about the southern limit of CPL's mineral licenses and planning permission, a few kilometres north of the River Esk and capturing the area to the west of Robin Hood's Bay which had been explored previously for sylvite by WPL, and YSL (and others, even earlier).

The fact that both WPL and YSL had applied for, and eventually won, planning permissions in the 1970s for mining the Z3 sylvite was highly encouraging (and indeed is what had drawn the attention of the original promoters to this area) – though it was quickly recognised that subsequent discoveries and mining experience at Boulby Mine meant that much less reliance could be placed nowadays on those old borehole records for resource estimation. In fact, the unusual degree of small scale variation in thickness and grade of the Z3 sylvite led YPL to conclude fairly quickly that it would be very difficult to prove up a JORC compliant Mineral Resource for this horizon by drilling from surface alone and that whilst the sylvite potential was recognised, it was understood from an early stage that polyhalite had to be the primary target on which any future mine had to be based; and that sylvite presented a secondary target to be explored in detail only after commencement of polyhalite mining. Any early reticence about polyhalite as a primary target was also dispelled by research showing that polyhalite – whilst lower in potassium content than traditionally mined potash salts – could yield a premium priced SOP fertilizer product, and valuable by-products.

Historical records from Eskdale, and Robin Hoods Bay, approaching the northern AOI boundary, showed thick, well-defined, polyhalite intersections; and some spot cores assayed in the 1940s and 1950s had proved to be comprised of 90% polyhalite which is an exceptionally high grade material in world terms.

Both the polyhalite and the sylvite seams had been shown by historical drillholes near Staithes, again in Eskdale and at Lockton, and further south in the Vale of Pickering to nip-out, or thin and disappear inland approaching the former edge of the Permian evaporite basin and there was reasonable constraint on the inland limit of exploration potential – enabling the western boundary of the AOI to be drawn with confidence.

There was also convincing evidence from historical gas exploration holes that the Z3 sylvite decreases in quality and thickness southwards from about Harwood, and it seems that the seam was not deposited in a broad east-west zone through Scarborough. The Z2 polyhalite also showed signs of deterioration at the old Lockton Gasfield, where it is clearly present but occurs in several seams that are difficult to correlate between boreholes. Beyond that it could be traced south of Scarborough, through Fordon, and down the coast as far as about Withernsea.

The southern limit of the YPL AOI was drawn along the Vale of Pickering. This valley follows a major east-west fault zone that is strongly developed in, and highly disruptive of, the evaporite sequence. This Vale of Pickering Fault Zone would not only likely form a barrier to mining, but it displaces the polyhalite much deeper to the south, and beyond what was considered to be the reasonable limit of mineability (notably, the polyhalite described from boreholes at Fordon and Atwick lies more than 2,000 m below surface). Furthermore, there is a thick halite horizon above the polyhalite along this section of coast, and this hosts numerous, high pressure, gas storage caverns of national strategic importance. It is for these reasons that the area south of the Vale of Pickering was excluded from the AOI.

Offshore mining was considered feasible, as currently practiced in the Z3 sylvite seam at Boulby Mine, and formerly for coal for up to 11 km offshore in the Durham and Northumberland Coalfield, and for this reason the AOI was also extended offshore. CPL's offshore rights extended south to Ravenscar, but YPL was able to option adjacent rights in an irregular outline between CPL to about Scarborough and extending 12 km offshore. Historical hydrocarbon wells had confirmed the presence of polyhalite, at depths of <1,700 m below the sea bed, in this area and this therefore became the eastern boundary of the AOI.

Once delineated, YPL sought to obtain exploration licences and mineral options throughout the AOI. Once a point was reached when contracts had been exchanged covering an area of some 600 km^2, a review of JORC-compliant Exploration Targets was commissioned from FWSC. That exercise, completed in January 2011, identified the potential for between 3.3 and 6 billion tonnes of polyhalite-mineralised material (ranging between 67 and 94% polyhalite); 330 to 400 million tonnes of sylvite mineralisation at 35 to 40% KCl in the Z3 seam; and 140 to 180 million tonnes of sylvite mineralisation at 10 to 20 KCl in the K4 seam, within the area then "under contract". Exploration Targets are statements, or estimates, of exploration potential only. They are not mineral resources, are purely conceptual in nature, and serve to guide and inform exploration strategy. It was understood that detailed exploration was then needed to prove the concept that polyhalite was present at workable depth, thickness, and quality to enable a Mineral Resource to be delineated with sufficient confidence to in turn attract the significant investment funding needed for such an enterprise in a previously unmined deposit.

The AOI boundary, and also the Boulby Mine licence boundary, is shown on Figure 2-1. SRK understands that the AOI boundary has recently been adjusted to avoid RAF Fylingdales but the boundary as shown in Figure 2-1, and indeed all of the figures in this report, that show this boundary reflect the position prior to this last adjustment.

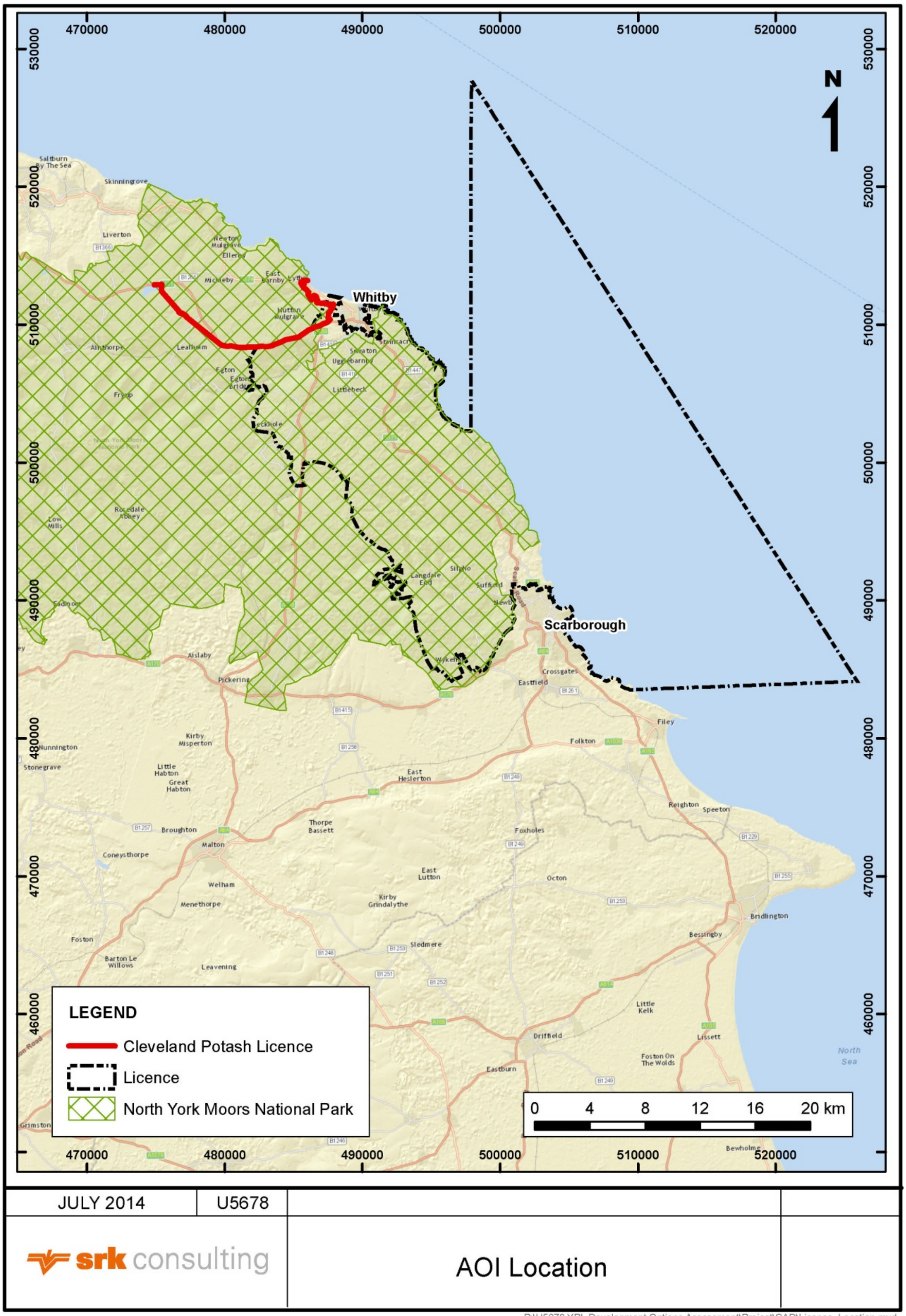

Figure 2-1: Geographic location of the AOI

In SRK's opinion the AOI outlined by YPL encompassed the areas in the region with the best potential for the delineation of a Mineral Resource and the establishment of a mining operation given the data available to YPL at the time. While all of this area had been identified by YPL as having potential to contain polyhalite mineralisation, the more promising historical data (in terms of consistent results, with the additional benefit of good sylvite potential) was in the north of the AOI, and in SRK's opinion this would have appeared to be the most attractive from an exploration perspective and indeed, as demonstrated by results, remains the most attractive from both an exploration and a mining perspective. The prioritisation of polyhalite over sylvite was the result of a conscious decision to focus on the horizons where it was most likely that a Mineral Resource as defined by the JORC Code could be delineated by drilling from surface.

2.4 Exploration Drilling

YPL initially designed its drilling programme primarily to infill the areas between the historical boreholes throughout the whole AOI, in the expectation that this would yield an improved geological model from which to identify the best place for the follow-up drilling needed to delineate a Mineral Resource. Actual borehole sites, however, also needed to take account of other factors, notably the mineral rights status and access. Specifically, YPL therefore focussed on areas where land and mineral agreements were already in place, and away from moorland. Since the majority of positive drillhole information on sylvite and polyhalite, available at the time YPL was planning its exploration, was centred on the northern part of the AOI, this was naturally the area targeted to commence exploration.

Once the first group of drillhole sites had been selected, approvals were applied for and granted, allowing drilling operations to commence. As the drilling programme advanced, and results were received, YPL was able to develop a new and more detailed conceptual model of the formation of polyhalite, and its disposition. In response to this, as will be described later, the exploration programme was continually modified as results became available. This is a standard exploration approach to take.

The initial plan was to drill each hole in two stages, using different drilling rigs; as this was believed to be the quickest and most cost-effective strategy. Each hole was to be drilled 'openhole' (i.e. without coring) to a depth of about 700 m (equivalent to the base of the second casing string) using a light-weight 'top-hole' rig; and handed over to a heavy duty, oil-field type rig to complete, with core sampling through the evaporites of interest. Five holes (SM 1 to 5) were progressed by the top-hole rig before that strategy was abandoned as being too inflexible. The top-hole drilling had been so speedy that, by SM5, it was already three holes ahead of the deep drilling and, if had it continued, it would have removed any opportunity for YPL to adjust its drillhole locations in response to the results being obtained.

The first drillhole (SM 1) was located at Pasture Beck; inside the area for which YSL had formerly been granted permission to mine sylvite, and in the general vicinity of historical hydrocarbon test holes that had recorded the presence of thick seams of polyhalite. Drilling commenced 29 July 2011, some seven months after YPL's Exploration Target report, and about 18 months after commencement of work in the region. The borehole ended at a total depth (TD) of 1,669 m and was complete by 29 October 2011.

Prior to drilling starting, YPL's economic model suggested that any polyhalite seams intersected needed to be able to provide a minimum mining thickness of polyhalite of 5 m, which YPL estimated might require a seam at least some 10 m thick given the likely variations in thickness along strike. This was a judgemental estimate, but in retrospect has been demonstrated to be a reasonable starting assumption. In general terms, the thicker the seam (within sensible limits) the better - since less development is required to excavate the same tonnage and mining costs are therefore reduced.

A complete core was recovered through the evaporites in SM1, and results exceeded expectations in terms of polyhalite grade and thickness. The drillhole had to be abandoned prematurely, for operational reasons, while still in polyhalite; but nevertheless the entire cored section of seam (from top to bottom) was 49 m thick with an overall mean grade of 66% polyhalite. It consisted of sections of high grade polyhalite, separated by lower grade bands of polyhalite mixed with halite. Three particularly high grade sections could be identified and gave a combined (or aggregate) thickness of 23.3 m and a mean grade of 95% polyhalite. The Z3 sylvite seam was of poor quality; but the Z4 seam was 2.1 m thick with a mean grade of 37% KCl.

The second drillhole (SM2 at Howlet Hall) was located on arable land close to some historical drillholes that had intersected sylvite and polyhalite, and therefore again represented a good location. Operational problems affected the drilling progress and it took nearly five months to complete, from start of top-hole, to its final depth 1,598 m below surface. No usable quality data were recovered for the two sylvite seams (both were present, but neither was cored), but the results from the Z2 polyhalite were again excellent. Two high grade seams were intersected separated by about 60 m of much lower grade, mixed halite and polyhalite, an upper seam, some 32.6 m thick and comprising 83.1% polyhalite and a lower seam some 34.3 m thick with a mean grade of 78.3% polyhalite.

SM3 (at Raikes Lane) had good access and though adjacent to moorland was again on agricultural land. This intersected a single polyhalite seam that was 25 m thick overall, with a mean grade of 87.5% polyhalite. Continuity over a short distance was confirmed by a deflection (SM3A) that showed comparable seam depth, thickness and grade. The Z3 and Z4 sylvite seams were cored through but in neither case were the grades of economic interest.

SM4 (at Gough, or Jugger Howe) followed and was ultimately the most southerly hole drilled by YPL. This intersected a much thinner seam (5.1 m with a mean grade of 89.4% polyhalite) while the deflection from this similarly intersected a seam with a thickness of 5.7 m with a mean grade of 86.2% polyhalite. The Z3 and Z4 sylvites again showed grades that were sub-economic. A new sylvite seam – that became known as the Gough Seam – was also intersected at the top of the Fordon Formation where it was 9 m thick with a mean grade of 21.6% KCl.

By this time a new and more robust conceptual geological model of the genesis and disposition of polyhalite in the Z2 Fordon Formation had been developed by YPL and FWSC. Notably it had become apparent that two distinct sub-parallel seams of polyhalite, rather than one, were being intersected and while not always both present (in fact the overlap zone is quite small) they were interpreted to be tabular, gently dipping, sub-parallel seams separated by approximately 80 m of sulphatic halite. The uppermost of these seams was termed the Shelf Seam and the lowermost the Basin Seam. The two seams have different characteristics with respect to roof and floor conditions, and to the degree of halite inter-banding. Reprocessing of historical seismic data had been concurrent with drilling, and provided a clearer picture of the disposition (and overall thickness) of the Fordon Formation as a whole and provided useful support of the model – in particular by helping to predict the likely boundaries of the Shelf and Basin seams (as well as determining locations of faults in the polyhalite). The Shelf Seam was chosen as the more attractive exploration target, since it was at shallower depth, lies entirely onshore, has stronger roof and floor conditions (for mining), and contains less halite impurity.

Given this, and the fact that the polyhalite intersections in the first four holes were much better than expected in terms of both grade and width, the exploration strategy was reappraised. All the data now available (including the historical data from the Eskdale and Lockton regions) was suggesting that the Shelf seam was becoming progressively thinner southwards from Eskdale to SM4 and splitting up in the vicinity of Lockton and given this, SM5 (which was located even further south than SM4) was abandoned and the northern part of the AOI became the prime focus. It should be noted that while polyhalite had been intersected in several holes the vicinity of Lockton, the widest single intersection logged as polyhalite was 14m in thickness and in all cases the polyhalite seams were split and intercalated with halite or anhydrite (as shown in Table 3-2 later in this report). Further there is no information available with regards the quality of polyhalite in this area. Given this, even if potentially mineable polyhalite does occur in this area, which is unknown, the work required to confirm the continuity of the individual horizons and enable the production of a resource estimate for these would be significant.

SM6 (at Newton House Plantation) was drilled to test the south-western limit of potentially minable polyhalite and indeed intersected a thin, and split, seam of polyhalite (one with a thickness of 0.5 m and a grade of 64% and one with a thickness of 2.2 m and a grade of 85.6%, separated by 5 m of very low grade mineralisation). Not only were these seams very thin but they were accompanied by the appearance of kalistrontite. This is an unusual mineral, of no known commercial value, that appeared to have developed at the expense of (or replacing) polyhalite. Since the historical boreholes at Lockton, due south of SM6, also showed split seam conditions it seemed likely this would continue through the unexplored ground separating the two locations. Even the sylvite grades in SM6 were disappointing, both seams showing grades of less than 20% KCL.

Exploration effort returned, therefore, to focus on the north where good polyhalite results had been found. SM7 (at Mortar Hill) was drilled to define the eastern extent of the Shelf Seam and further understand the relationship between the Shelf and Basin seams. Although complicated by the proximity of an unexpected fault, it intersected the thickest seam of polyhalite drilled to date. The Shelf Seam intersected in SM7, and its first deflection, SM7A, was 42.5 m thick with a mean grade of 85.2%, and 53 m with a mean grade of 93% polyhalite respectively. A second deviation (SM7B) was also drilled, but was not core-sampled. This exercise extended the known extent of the Shelf Seam eastwards and confirmed the continuity and quality of the deposit in the north of the AOI.

Additional 2D seismic survey lines were run across the area between Eskdale and Harwood, to improve the definition of faults affecting the Fordon sequence, and identify fault-free areas that might be suitable for mining and SM9, plus deflections 9A and 9B (at Maybeck), were then drilled, to prove continuity between SM6 and SM3 and add further confidence to the geological model being built up. This drillhole however intersected four thin and highly variable seams, and – like SM6 – with kalistrontite substituting for polyhalite. The best seam intersected was 5.5 m thick and had a mean grade of 76% polyhalite but this was not repeated in the deflections, where the best intersection was only 2.1 m containing 71% polyhalite.

Thus at this point in time, the three southernmost drillholes completed by YPL had intersected thin, or thin and split, polyhalite; and at two of the locations had yielded the unwelcome appearance of kalistrontite at the expense of polyhalite. Drilling was therefore again focussed to the north and SM11, and deflections 11A and 11B, drilled at Dove's Nest and the last hole completed by YPL, intersected a thick Shelf Seam variously between 51 and 59 m thick with excellent grades.

In summary therefore to date YPL has now drilled at nine sites for a total of 16,009 m that have provided 16 intersections of the polyhalite seam(s) and it is information from these drillholes that has been used directly to derive the polyhalite Mineral Resource estimate presented below. The orebody model is based on a cut-off grade of 80% polyhalite and most of the intersections in the south in particular (notably SM9A and SM9B) did not meet these requirements and were therefore not used. The 80% polyhalite cut-off grade was selected so as to constrain the resource (and resulting mined product) to material of sufficient quality to be attractive to a purchaser and reflects discussions and off-take agreements between YPL and potential purchasers of the product. The cost of completing the drillhole programme alone was approximately GBP25 million and the programme took over three years to complete.

Sylvite has been cored in two or three seams, but, as expected, is variable in thickness and grade and the drilling has been insufficient to confirm the continuity of a potentially economic zone or therefore to enable a Mineral Resource to be reported. This therefore confirms YPL's supposition that even if there is a mineable zone of this present (which is possible but unknown), it would be very difficult to confirm this by drilling from surface.

Figure 2-2 shows the collar positions of the drillholes completed by YPL and Figure 2-3 is an East-West geological section through the AOI showing the geometry of the orebody intersected.

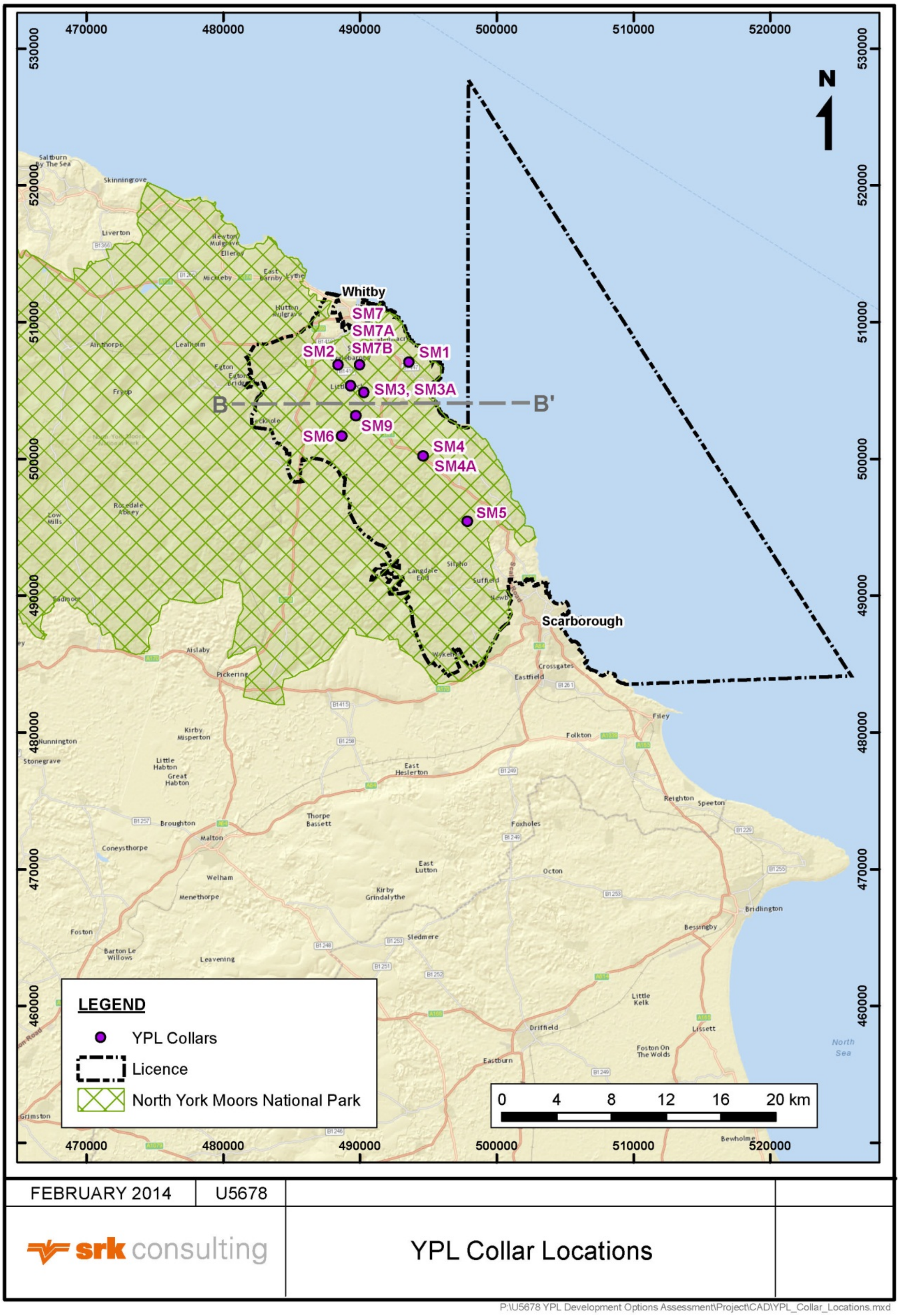

Figure 2-2: Drillhole collar positions completed by YPL

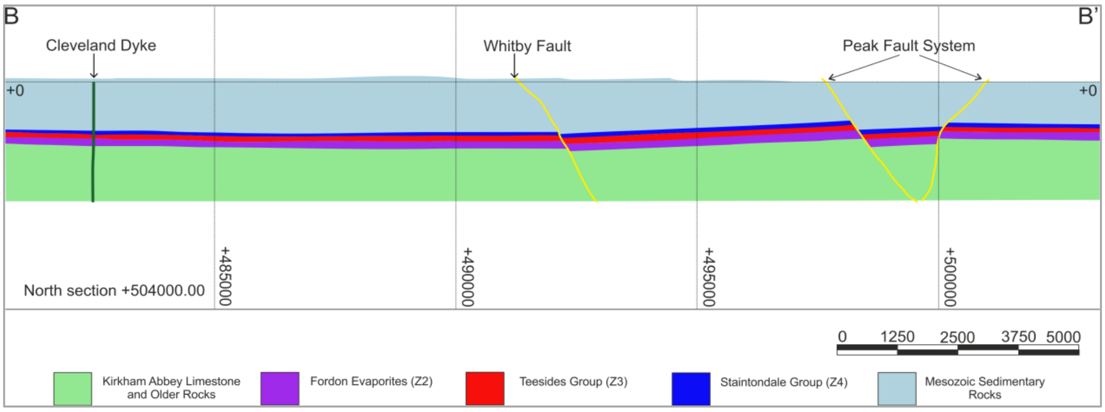

Figure 2-3: West-East 2D geological cross-section through the AOI

In SRK's opinion the exploration programme followed by YPL was planned and carried out in a professional manner. It began by stepping out from an area where there was a good expectation of initial success and was modified in response to results obtained. New and plausible geological models were continually developed and refined to explain these new results, the historical drillhole data, and the new seismic interpretations and exploration was focussed in the north of the AOI and on the Shelf Seam where there was best potential to delineate sufficient material to a sufficient level of confidence to justify the establishment of a mining operation. The results of this exploration programme, which as commented earlier in this report have contributed to YPL's total expenditure to date on the project of some GBP60 million, now form the basis of a Mineral Resource which a PFS has demonstrated to be economic to exploit from a mine head at Dove's Nest.

2.5 Exploration Seismics

In addition to drilling data, there is also a significant amount of data from seismic surveys available to assist in understanding the geology of the region. Seismic surveys involve propagating controlled seismic waves into the earth. When these seismic waves intersect physical contrasts such as a change in rock type, some of the waves are reflected back up to the surface. The time taken for these waves to return to the surface is related to the depth of the geological feature, allowing the geologist to develop an understanding of the subsurface geology.

Data from a total of 71 seismic lines (a 2D seismic survey) have been reviewed by SRK in preparing this report. These are a combination of historic seismic lines and more recent seismic lines collected by YPL. All but three of these seismic lines were collected onshore and due to planning and logistical constraints all of these onshore lines were recorded in 'crooked line' mode i.e. they follow roads rather than going in straight lines. The historic seismic lines can be broadly subdivided into two groups based on their age:

1) Seismic lines collected during the 1960s and early 1970s which were used for hydrocarbon and sylvite exploration and which were predominantly shot using dynamite such that the original images are generally of a low quality at the target depths for polyhalite; and

2) Seismic lines collected during the late 1970's and 1980's as part of several hydrocarbon exploration programmes most of which were shot using a truck-mounted seismic source, as opposed to dynamite, and are of a fair quality at the target depths for polyhalite.

Spectrum Geo Ltd (Spectrum) was contracted by YPL to process these historic seismic lines. Most lines were initially processed from the raw stacks, which is the data produced at the time of collection after an initial processing stage, although a few were processed from the original field tapes. Processing from the original field tapes produced a significant improvement in quality and this was subsequently applied to a number of key historic seismic lines. Even with reprocessing, there were still significant limitations in the resolution and coverage of the historic seismic lines. Therefore, in 2012 YPL collected an additional five seismic lines that covered a large portion of the northern half of the AOI, where YPL's drilling programme was focussed. These lines were shot by CGG-Veritas using a truck mounted seismic source and subsequently processed by Spectrum. These new seismic lines have excellent resolution and the quality is probably as good as can be economically and reasonably achieved with currently available technologies. Figure 2-4 below shows the extent of seismic line data available for the region.

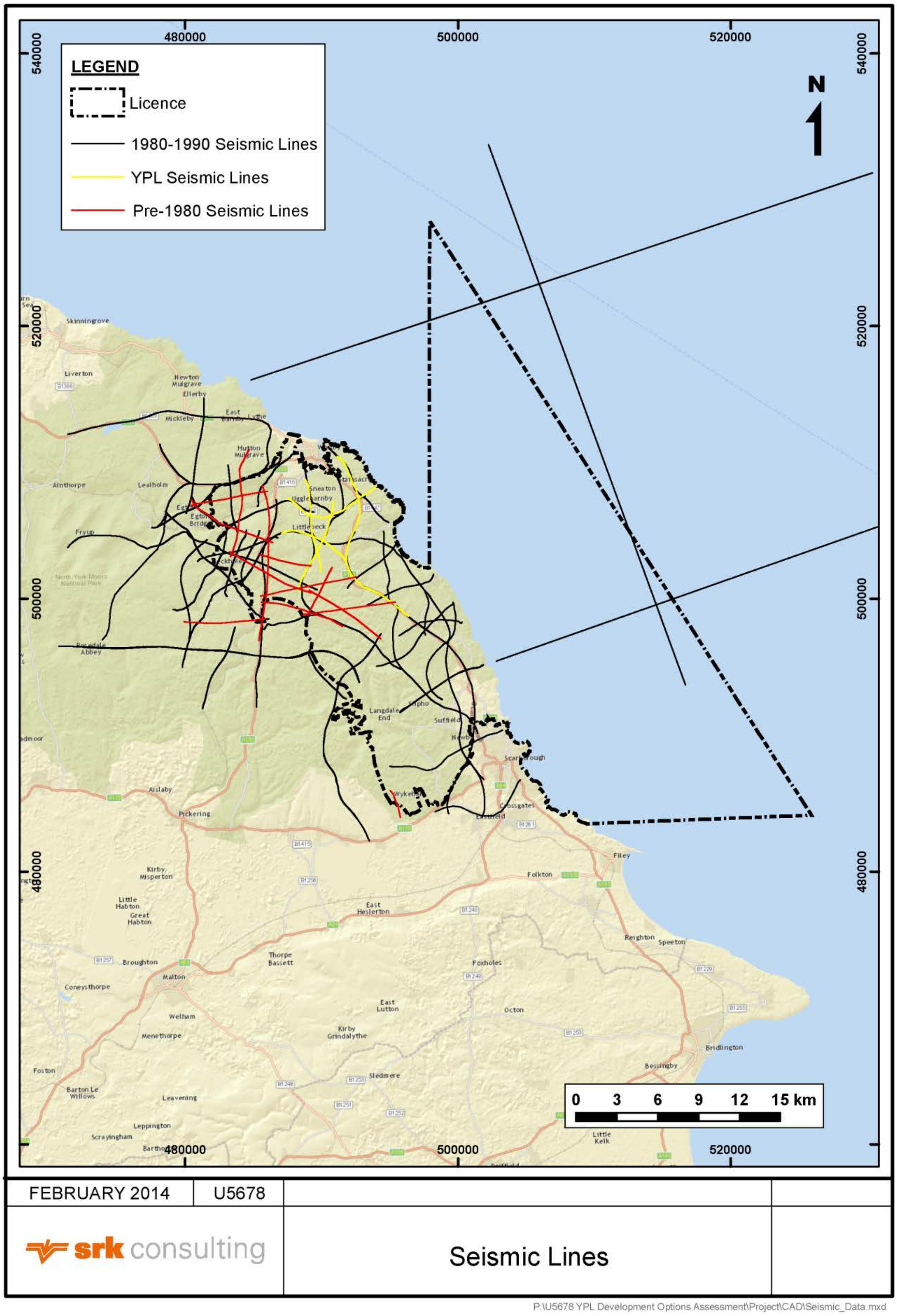

Figure 2-4: Seismic Line Data

Despite the large number of seismic lines, it is important to understand that the dataset still has several key limitations. In order to image geological contacts, seismic reflection surveys rely on physical contrasts between adjacent rock units. When two rocks with similar physical properties are juxtaposed, the contact is difficult to image. As such contacts such as the top and bottom of the polyhalite cannot currently be directly imaged. Steeply-dipping to sub-vertical structures are also often difficult to image. When combined with the resolution limits for vertical offset (which is approximately 15 m), this can make identification of low displacement faults difficult. Finally, 2D seismic still requires the geologist involved to interpret how structural features link up between seismic lines. This is a partially subjective process, particularly for smaller faults, so the interpretations are necessarily non-unique.

In summary, therefore, a reasonable amount of seismic data is available and this has proved very useful to SRK in interpreting the stratigraphy and structure of the region and thereby its assessment of the regional potential for polyhalite mineralisation. While 3D seismic data could be collected, and while this might improve SRK's understanding further, time and cost constraints make 3D seismic unfeasible at this point in time and even 3D seismic data would not resolve the structure definitively and an uncertainty would remain until the faults were intersected during mining.

2.6 Mineral Resource/Ore Reserve Estimation

2.6.1 Introduction

The most up to date Mineral Resource estimate for the Project was prepared by SRK in May 2013 and is based on a combination of exploration work done by YPL as commented upon above and SRK and YPL's review of exploration work completed historically. The data this estimate is based on, the methodology used by SRK to derive this and the estimate itself is summarised here but presented in full in SRK's report *"Mineral Resource Estimate on the York Potash Project, Yorkshire, United Kingdom"* dated May 2013.

Given that certain large scale fault features had been identified from an interpretation of available seismic data and that these were considered likely to both displace the polyhalite seams significantly and disturb the rock quality (and therefore could represent barriers to mining), these were used to limit the extent of the resource where present. Notably the Donovan Fault acts as the limit of the resource to the north and was used as a bounding feature as the significant offset associated with the fault has been interpreted to have resulted in displacement of the polyhalite down to the north.

SRK's resulting Mineral Resource estimate includes both the Shelf and Basin polyhalite seams, for a total of 2.66 Billion tonnes (Bt) of polyhalite with a mean grade of 85.7%. The Shelf Seam comprises 62% of the current Mineral Resource, and, given the shallower depth and more extensive development of this seam in this area, has been the main focus of the 2011 – 2013 drilling programme conducted by YPL. The estimate was derived by SRK and reported using the JORC Code, which, as already commented, is an internationally accepted code for the reporting of Mineral Resources.

In addition to producing a Mineral Resource estimate, SRK has also produced an Ore Reserve estimate and again reported this using the JORC Code. While a Mineral Resource estimate comprises that material with potential to be exploited, an Ore Reserve comprises that material which technical studies, undertaken to at least PFS level, have already demonstrated can be exploited.

The most up to date Ore Reserve estimate for the Project was derived by SRK reported in the public domain in September 2013 and totalled 250Mt with a mean grade of 87.8% Polyhalite. This was derived from the Indicated Mineral Resource derived by SRK for the Shelf Seam only (some 820Mt with a mean grade of 87.3% Polyhalite) and was reported as a Probable Ore Reserve as defined by the JORC Code. This section also contains a summary of the process used to derive this Ore Reserve from the Mineral Resource.

2.6.2 Available data

The Mineral Resource itself is located primarily in the north of the AOI to the south west of Whitby and is centred around Doves Nest which is where the currently proposed shaft location is. Results from the southernmost drillholes, SM4, SM6, SM9, SM9A, and SM9B have confirmed that the Shelf Seam is present towards the south of the AOI but it is clear that it becomes thinner, more discontinuous and of a lower quality in this area. Table 2-1 below summarises the drilling intersections obtained by YPL to date and which were used to derive the Mineral Resource estimate presented below.

Included in this table are the results from four historical drillholes (E5, E11, E13 and SB1) where SRK considered the data of sufficient quality to be used in the estimation process.

Table 2-1: Summary of YPL's 2011 - 2013 exploration drill programme

BHID	Hole Type	Seam	Seam Thickness (m)	Mean Grade (%)	Length of Hole Depth (m)
SM1	Parent	Basinal Seam Only	31	81.8	1664.6
SM2	Parent	Shelf and Basin Seam	Shelf: 33.74 / Basin: 27.3	Shelf: 82.9 / Basin: 82.7	1597.93
SM3	Parent	Shelf Seam Only	17.67	94.6	1652.21
SM3a	Daughter	Shelf Seam Only	35.14	87.2	423.6
SM4	Parent	Shelf Seam Only	5.13	88.8	1665.51
SM4a	Daughter	Shelf Seam Only	7.16	85.6	352.6
SM6	Parent	Shelf Seam Only	1.9	87.9	1698.6
SM7	Parent	Shelf Seam Only	56.9	85.7	1625.44
SM7a	Daughter	Shelf Seam Only	60.48	91.0	358.13
SM7b	Daughter	Shelf and Basin Seam	Shelf: 28.04 / Basin: 27.44	Shelf: 86.5 / Basin: 83.6	422.6
SM9	Parent	Shelf Seam Only	2.5	88.0	1663.2
SM9A	Daughter	Shelf Seam Only	Not used in estimate	-	198.01
SM9B	Daughter	Shelf Seam Only	Not used in estimate	-	225.13
SM11	Parent	Shelf Seam Only	20.8	90.1	1580
SM11A	Daughter	Shelf Seam Only	35.7	82.3	347.5
SM11B	Daughter	Shelf Seam Only	43.6	87.7	353.5
E5	Parent	Shelf Seam only	0.91	80.4	1535.28
E11	Parent	Shelf Seam Only	9.1	79.0	1849.83
E13	Parent	Shelf Seam Only	20.0	82.9	2067.0
SB1	Parent	Basin Seam Only	26.0	64.0	2025.0

2.6.3 Resource Estimation Methodology

SRK's Mineral Resource estimate is the result of a significant amount of data review, three dimensional geological modelling, statistical and geostatistical assessment and grade interpolation. Specifically, SRK:-

1. Reviewed the historical data available and that obtained by YPL during the 2011-2013 exploration programme inclusive of the drilling, logging, sampling and assaying procedures employed.
2. Composited all of the assay data from the drillholes listed in Table 2-1 into equal 1.5m lengths so that each was given equal weighting in the statistical and geostatistical analyses and grade interpolation procedures commented upon below.
3. Reviewed the geological setting of the mineralisation inclusive of the lithological succession and the faulting and folding this had been subjected to, to help in the geological modelling process commented upon below.
4. Identified the potentially mineable polyhalite intersections in each drillhole from the drilling logs and assay results and using a 80% polyhalite cut-off to determine limits for the orebody modelling procedure.
5. Reviewed the available specific gravity data, collected during associated geotechncial testwork completed on samples of drill core by YPL, to enable the density of the polyhalite to be determined which is an input to the tonnage calculation process.
6. Modelled the footwall (bottom) and hangingwall (top) of the intersected polyhalite horizons in three dimensions using mine design software and the knowledge of the geological setting gained as commented above so as to demonstrate the continuity of these in three dimensions and to create a volume for these.
7. Undertook a classical statistical analysis of the composited sample data (2,539 continuous samples in the case of the Shelf Seam and 361 continuous samples in the case of the Basin Seam) to determine the mean grade and also the distribution characteristics of these which are important parameters in determining the most appropriate methodology for interpolating the assay data into the modelled volumes.
8. Undertook a geostatistical (variography) study of the composited assay data to determine how the grades vary spatially and so enable appropriate algorithms to be used when interpolating this data into the interpreted volumes.
9. Created a three dimensional block model within the mining software package with dimensions of 50m by 50m laterally and 3m vertically covering the extent of the modelled volumes.
10. Interpolated the composited grades from each drillhole into the three dimensional block model to give each block a unique grade and thereby create a model reflecting the variation in grade across the deposit and using algorithms determined form the statistical and geostatistical analyses and by applying rules such that information from several drillholes were used in deriving the grades for each block but at the same time preventing "over-smoothing" by not using drillholes too far from each block. Notably this process not only resulted in an estimate of the total quantity of polyhalite mineralisation present but also a model of how this varies in thickness and quality across the area explored.

11. Verified the resulting model by comparing individual block grades with composited grades in nearby drillholes and by comparing the resulting mean block grades with the mean composited sample grades.

12. Reported the resulting total tonnage in each seam by applying the derived density to the modelled volumes and reporting these along with the mean block grades using the guideline proposed by the JORC Code.

2.6.4 SRK Mineral Resource Statement

Following all of the above, SRK reported an Indicated and Inferred Mineral Resource. The reporting of the mineralisation as a Mineral Resource reflects the fact that SRK considers this material has reasonable prospect for eventual economic extraction. This conclusion was supported by the results of the PFS completed by YPL earlier in 2013 which demonstrated the economic viability of exploiting this Mineral Resource from the Doves Nest site.

SRK's limiting of the Mineral Resource and the categorisation of this into Indicated and Inferred categories was based on its confidence in the continuity of the polyhalite horizons themselves and the accuracy of the grade and tonnage estimation. Specifically the following factors were considered:

- The quality and quantity of data used in the estimation;
- The geological knowledge and understanding, focusing on geological and grade continuity at the 80% cut-off grade used;
- The geostatistical analyses completed and interpolation accuracy; and
- Experience with other deposits of similar style.

Quality and Quantity of Data

SRK considered that both Sirius and FWSC used industry best practice methodologies during the 2011-2013 drilling programme and to monitor the precision, accuracy and repeatability of data collected. The historical drillholes used were validated by both FWSC and SRK, and SRK is of the opinion that they are of a suitable quality and the data reliable to be used for estimation purposes.

The results from the QAQC programme showed no evidence of material bias within the laboratory, no significant precision or accuracy issues, and no problems in terms of sample swaps in the drilling programme.

The electronic drilling database provided to SRK was relatively simple, the systems used for data capture and storage appeared to have been be satisfactory and there were no observable errors when importing the data into mining software packages.

Due to planning and permitting restrictions, the deposit has not been drilled on a regular grid. The current spacing between parent drillholes ranges from 1.1 to 5.7 km, and between daughter drillholes 30 to 60 m.

Bulk density measurements were undertaken as part of the SRK Geotechnical Departments investigations. These results were used to calculate the density of the polyhalite for both seams as 2.75 g/cm3.

Geological Knowledge and understanding /geological and grade continuity

The geology of the polyhalite seams in the area of interest is complex and numerous faults have been identified using seismic survey interpretations. Although polyhalite had been shown to be widely distributed throughout the area, there are variations in seam thickness between mother holes and the associated deflections at a mining scale. However the SM11, SM11A and SM11B drillholes demonstrated good continuity over a short scale, and this has been taken into account whilst classifying the resource.

SRK has used all identified large scale faults to bound the resource area. Within the resource area there are also estimated to be 125 lower displacement faults (throw 15-60m) of which 15 are traced and 110 untraced and in addition significantly more faults less with than 15m throw which are sub-resolution.

SRK has relied on estimates of the hangingwall and footwall locations which are solely reliant on the drilling and analytical information available and could change with further infill and delineation drilling.

Quality of Geostatistics and Grade Interpolation

The results of the geostatistical analysis produced variograms of poor quality. SRK noted that this is due to the wide spaced nature of the drilling and limited number of drillholes. However, short scale structures could be modelled which reflect the short scale drilling between parent and daughter holes.

The resultant block model validates well when compared to the input sample data. The validation process was completed visually and statistically, and SRK considers the model to be as robust and unbiased as possible considering the data available.

Given all of the above, SRK defined areas within the Shelf and Basin seams where intersections of polyhalite have been intersected and where it considers it prudent to extend the reported resource to laterally. Specifically, SRK's Indicated Resource comprised those areas drilled at an approximate 1-1.5km spacing and where close spaced, daughter holes had confirmed the continuity of the horizons at a mining scale while SRK's Inferred Mineral resource comprised extensions to this area where the drillhole spacing was up to 4km, in the case of the YPL drillholes, or 2km, in the case of historical holes. SRK did not include any areas where the estimate would have been based on historical data only, as the information available for these holes is less reliable (and in some cases poor) or where the intersected seams ere very thin (less than 2m) or areas where there were only isolated intersections un-supported by adjacent holes. SRK's classified estimate is tabulated in Table 2-2 below. The Indicated Mineral Resource covers a total area of some 1,230 Hectares (Ha), the Shelf Seam Inferred Mineral Resource covers a total area of some 2,950 Ha and the Basin Seam Inferred Mineral Resource covers an area of some 1,380 Ha.

Table 2-2: SRK Mineral Resource Statement for the York Potash Project dated 7 May 2013

Seam	Resource Category	Mean Thickness (m)	Tonnage (Mt)	Density	Mean Polyhalite Grade (%)	Polyhalite Content (Mt)
Shelf	Indicated	12.8	820	**2.75**	87.3	710
Shelf	Inferred		840	**2.75**	85.7	720
Basin	Inferred	14.8	1,000	**2.75**	84.7	850
All	**Total**		**2,660**	**2.75**	**85.7**	**2,280**

2.6.5 Ore Reserve Estimation

As already commented upon in this report, while the Mineral Resource represents that portion of a deposit which has potential to be exploited at a profit, the Ore Reserve represents that portion of the Mineral Resource that has been demonstrated by a detailed technical and financial assessment, of at least PFS standard, to be economic to exploit at the present time. As such it requires the completion of a significant amount of technical work covering all aspects of a project, not just geological and mining aspects but also mineral processing, tailings management, water and environmental management, infrastructure and transport requirements and capital and operating cost estimation. YPL concluded its PFS in March 2013.

In practice the reporting of an Ore Reserve also requires the application of a series of largely mining adjustments to the Mineral Resource estimate to reflect the tonnage and quality of material that will actually be removed from the mine and delivered either to a plant for processing or directly to the customer. Following its geotechnical assessment, SRK based its mine design on a maximum mining height of 40m and a pillar width of 40m between panels. Given this the application of the factors used by SRK to derive an Ore Reserve from the 820Mt Mineral Resource in this case comprised the removal of :-

- 46Mt of material below an 81% mining cut off (applied so as to ensure a mining grade of 88%).
- 44Mt of material that would be contained in the shaft pillar to ensure stability of the shaft
- 25Mt of material in fault pillars to ensure stability around these features.
- 92Mt of development pillars and as a function of the mining method and to ensure stability of workings.
- 336Mt of material in barrier and in-panel pillars and in remnant areas between panels as a function of the mining method.
- 27Mt of material assumed to be blasted but left behind in stopes as a function of mining practicalities.
- A mining stand-off distances around boreholes comprising 0.5 Mt.

2.6.6 Ore Reserve Reporting

Based on the above analysis SRK reported a probable Ore Reserve as defined by the JORC Code of some 250Mt with a mean grade of 87.9% polyhalite in September 2013.

In SRK's opinion, the exploration work undertaken by YPL has enabled the reporting of JORC compliant Mineral Resource and Ore Reserve estimates which are major steps forward in terms of the project as a whole and justify the exploration strategy developed by YPL and the decisions made during the exploration programme itself.

3 SRK ASSESSMENT OF REGIONAL POLYHALITE POTENTIAL

3.1 Introduction

The Mineral Resource given in Section 2 above is the only polyhalite Mineral Resource outlined within YPL's AOI to date or in the region as a whole and is the culmination of over three years of exploration work carried out by YPL.

In order to properly assess the potential for the development of a Mine Head at locations outside of the NYMNP, SRK has reviewed all of the relevant geological data it understands is available in the region to determine whether there is potential for the delineation of a Mineral Resource as defined by the JORC Code in areas other than that outlined by YPL to date. This has enabled SRK's assessment of these alternative Mine Head sites, to be informed not just by their relative location to the Mineral Resource already delineated but also to areas where there is potential for a Mineral Resource to be outlined following further exploration.

Specifically, SRK has:-

1. Validated and verified, to the extent possible, all historical drillhole information.
2. Undertaken an interpretation of the available seismic line data.
3. Developed a 3D fault model using a combination of seismic line interpretations, British Geological Survey (BGS) geology maps and previous structural interpretations undertaken by FWSC.
4. Developed a 3D model of the polyhalite mineralisation and enclosing stratigraphic succession using YPL drillhole data.
5. Combined the fault and polyhalite models to create a complete regional-scale 3D geological model.
6. Used all the above to determine the relative exploration potential of a number of areas to host polyhalite mineralisation within and around the AOI that could be accessed from outside of the NYMNP.
7. Commented upon the attractiveness of the above areas to an exploration company and the likelihood that such a company acting reasonably would commit to a programme of exploration of the size that would be needed to collect additional data on these areas such that a Mineral Resource estimate could be produced for such in due course and, subsequently, a mining project developed.

3.2 SRK 3D Geological Model

3.2.1 Introduction

The 3D model developed by SRK covers the stratigraphic interval from the Jurassic Whitby Mudstone Formation down to the top of the Permian Kirkham Abbey Limestone Formation and encapsulates the polyhalite seams which, as commented on above, are located within the Z2 Fordon Evaporite succession. The 3D model covers all of the onshore AOI, most of offshore AOI and extends south of the Vale of Pickering (the southern limit of the AOI) by approximately 25 km. The 3D model has been developed based on seismic data, YPL drillhole data and historical drillhole data where polyhalite has been intersected.

The sedimentary succession itself is shown in Figure 3-1 and is relatively simple from a geological perspective. SRK's work in developing the 3D model therefore focussed on the identification of the key structural features, notably faults and dykes that have disturbed this succession during and after its deposition.

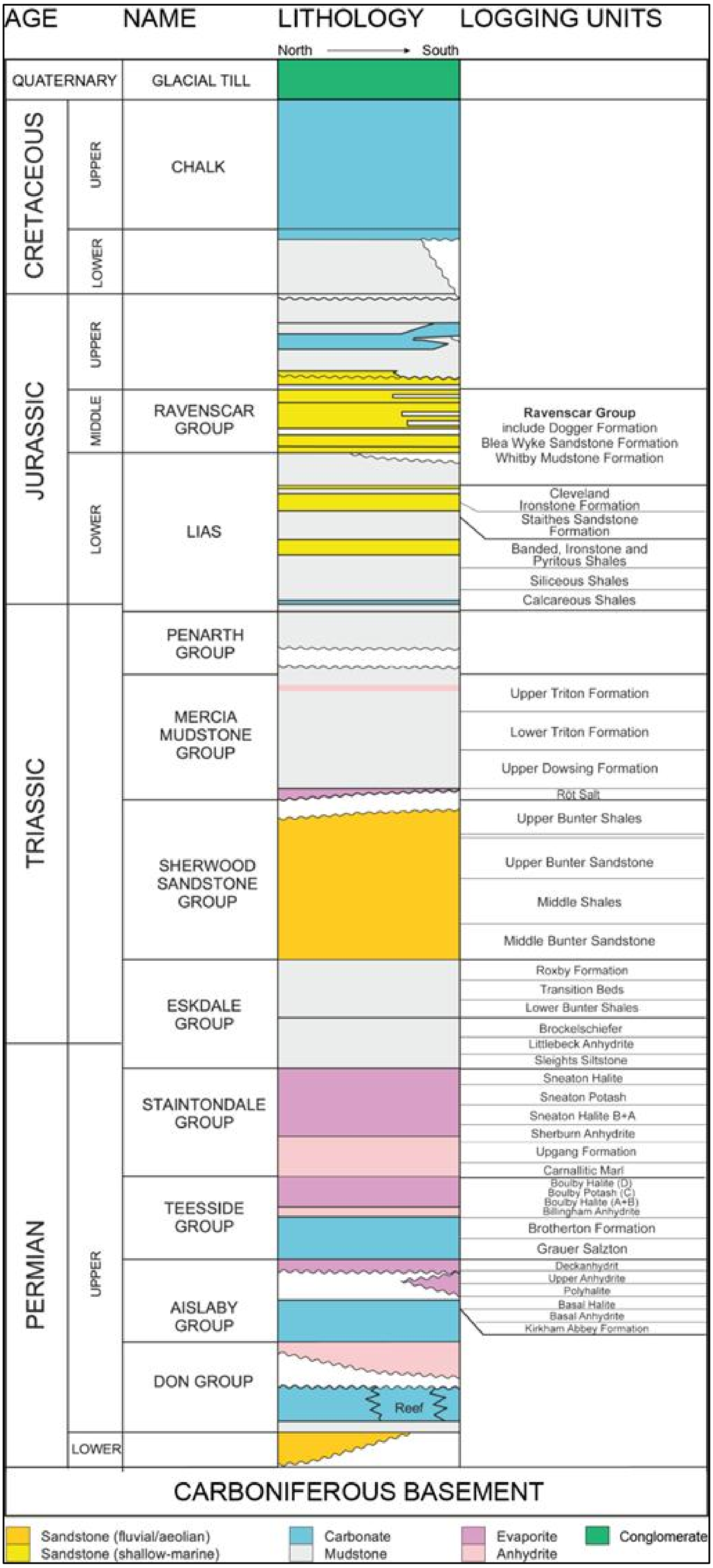

Figure 3-1: North Yorkshire Stratigraphic Column

3.2.2 Regional Geological History

The region studied comprises the southwest edge of the Zechstein Basin and is an area that has undergone a number of deformation events since the Precambrian.

Pre-Zechstein

Between the late Precambrian (ca 650 Ma) and the late Carboniferous, a number of major deformation events affected the region including the Cadomian, Acadian, Caledonian and Variscan orogenies. A number of major structural trends developed during these deformation events covering a range of orientations. Although these deformation events actually predate the deposition of the Zechstein sequence (which contains the polyhalite), and therefore do not directly influence the polyhalite, the resultant structures form weak zones within the crust which may have been preferentially reactivated during the Mesozoic and Tertiary.

Syn-Zechstein

The Zechstein is an evaporite sequence that was deposited during the Permian. The North Yorkshire polyhalite seams are all contained within this sequence. There is no evidence of active faulting in the southern North Sea area during deposition of the Zechstein (Stewart & Coward 1995), although it is generally considered that significant fault-related extension did occur during the Permian further northeast in the Central Graben (Hodgson et al, 1992).

Post-Zechstein

Significant E-W extension occurred between the late Permian and the early Cretaceous, forming what is now the North Sea Basin. This created a significant amount of faulting which affected the Z2 cycle and notably created a series of large downfaulted blocks (grabens) in the centre of the North Sea Basin and a number of mini-basins along the southern margin of the North Sea. Several of these mini-basins are oriented oblique to the regional extension direction, suggesting local trans-tensional deformation in these areas, which may be the result of reactivation of pre-Permian structures. During the late Cretaceous and early to middle Tertiary, the tectonic regime in the North Sea became contractional, causing the reactivation of some Mesozoic normal faults as reverse faults. The NW-striking Cleveland Dyke was also emplaced during the early Tertiary. In summary, therefore, the rocks formed during the Zechstein period have been subject to a significant amount of faulting since formation.

3.2.3 Interpreted Regional Structure

There are a number of faults within the AOI that developed during the geological history outlined above. Most of these faults are inferred to have formed during the Mesozoic, and therefore in a locally transtensional environment, and the majority have apparent normal or strike-slip displacements. There is, however, also evidence for reactivation of normal faults as reverse faults during the Tertiary.

The full characterisation of these faults would only be possible with extensive drilling, surface exposure or from underground development and therefore the interpreted vertical offset on modelled faults within the AOI is based solely on historical seismic data and seismic data produced by YPL and varies from the minimum that can be determined from this data (approximately 15 m) to more than 200 m. Notably, the amount of strike slip movement cannot be quantified at all with seismic data.

In developing its 3D model, SRK's work was focused primarily on modelling the higher displacement faults as these are the ones that have most impact on exploration and resource potential. Possible impacts of larger faults include offsetting of the polyhalite, folding of the polyhalite due to associated salt flow, water and/or gas ingress and geotechnical issues due to increased fracturing. The controls on fault-related deformation are complex and depend on a number of variables including the host rock, confining pressure, temperature and fluid pressure at the time of faulting. Without seeing examples of these large faults or other reliable analogues in drill core or outcrop it is not possible for SRK to accurately predict the properties of these faults and this is one of the reasons why such faults represent such challenges and risks particularly at the pre-development stage. Notwithstanding this, SRK can make the following general comments:

1. The width and intensity of any fracturing and broken rock within and adjacent to a fault tends to broadly scale with fault displacement.

2. Juxtaposition of non-evaporite rocks against evaporite rocks across the fault may also increase the probability of hydraulic connectivity between the polyhalite seams and water or gas reservoirs.

3. Three dominant fault orientations have been observed within and immediately adjacent to the AOI: NNW striking, W to WNW striking and ENE striking. Additional fault orientations cannot be excluded for the lower displacement faults, however, the orientation of high displacement faults is reasonably well constrained.

In SRK's opinion, the major structural features in the region are:-

The Peak Fault System: This is a narrow, NNW-striking graben system that runs along the Yorkshire coast. It has a length in excess of 40 km, a maximum vertical offset of more than 200 m and most likely also accounts for several kilometres of dextral strike-slip displacement.

The Vale of Pickering Fault System: This is a 3 km wide E-W-striking system of normal faults that extends for over 30 km and accommodates more than 200 m of vertical offset (down to the south).

The Whitby Fault: This fault strikes NNW, sub-parallel to the Peak Fault. Locally it also has a graben-like structure, similar to the Peak fault system. It extends for over 20 km and has a maximum vertical offset of over 50 m, but probably also has a larger component of strike-slip displacement.

The Donovan Fault: This is an approximately WNW-striking normal fault which extends for just over 10 km and has a maximum vertical offset of between 150 and 200 m. The eastern part of the Donovan Fault does not appear to penetrate up through the Sherwood Sandstone, but the western part has been mapped at surface. The Donovan Fault also includes an antithetic fault in its hangingwall (north side) and the evaporite rocks between this fault and the main Donovan Fault appear to be significantly disrupted.

The Pasture Beck Fault: This is located between the Whitby and Peak Faults and may be a dextrally offset continuation of the Donovan Fault, which has a similar geometry and vertical offset.

The Cleveland Dyke: The Cleveland dyke is a NW-striking mafic dyke that has been mapped at surface across part of the AOI and may extend across the entire AOI in the sub-surface. The major implication of the Cleveland Dyke is that it may be more fractured than the surrounding sedimentary rocks and thus may act as vertical conduit for water.

The South Fault: The South Fault is a moderately dipping, ENE-striking fault that occurs along the southern edge of the YPL's currently defined Mineral Resource. This fault has a maximum vertical offset of approximately 50 m. Folding in the hangingwall and a variable sense of slip suggests that while it was originally a normal fault, it may have been subsequently reactivated as a reverse fault. The upper termination of the South Fault probably lies somewhere below the Sherwood Sandstone.

The Lockton Fault: The Lockton Fault is an approximately 10 km long, east-west striking, steeply-dipping fault that is interpreted to occur in the vicinity of the Lockton-series drillholes. The throw on this fault is estimated at ≤50 m. The confidence associated with this fault however is very low, as it is based on a single seismic line and an earlier fault interpretation.

Figure 3-2 below shows the location of the structural features used in the model (projected to surface) while Figure 3-3 is a geological section showing the impact of some of these features on the sedimentary succession.

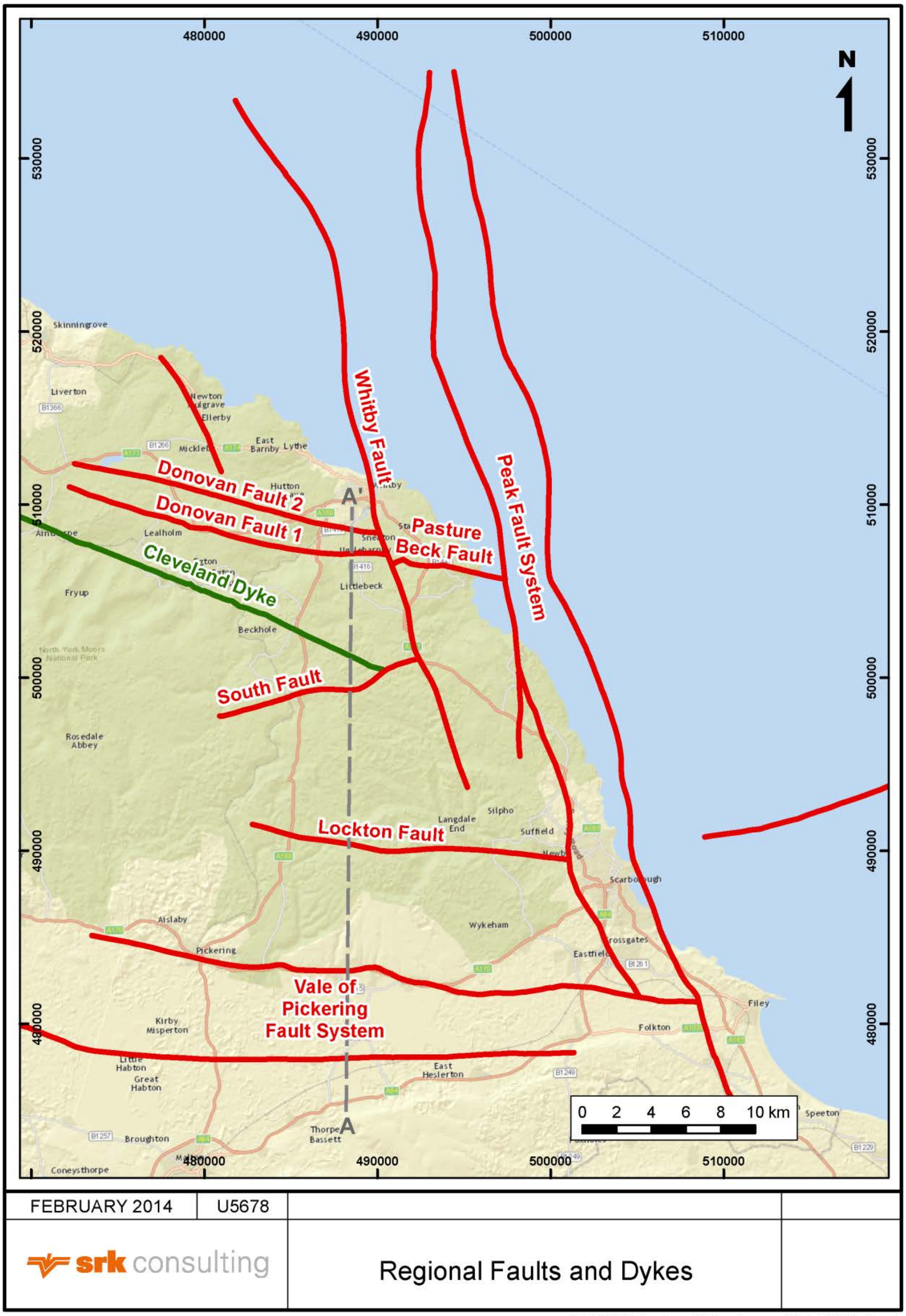

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Figure 3-2: Map showing the location of faults and dykes used in the 3D regional model. All faults have been projected up-dip to surface. A-A' is the cross-section line used in Figure 3-3.

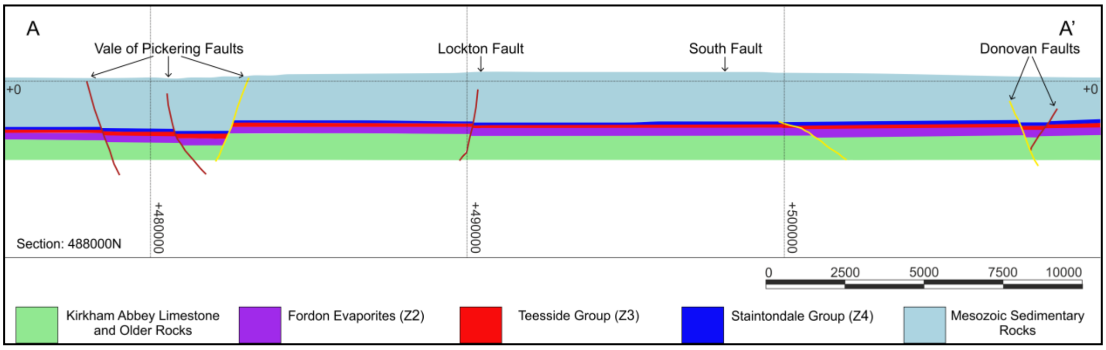

Figure 3-3: North-South section (A-A') through the regional model (looking west) illustrating how the stratigrapy is offset by the faults

3.2.4 Summary

The stratigraphy of the North Yorkshire Moors consists of a Carboniferous basement overlain by four major Permian evaporite cycles (Z1-Z4) and a Mesozoic sedimentary sequence consisting predominantly of sandstones and mudstones. At a regional scale the bedding in most of these geological formations is flat to shallow dipping (≤10°), although due to a combination of the complex sedimentary environment and later deformation, local-scale bedding in the evaporites can be steeper.

Post-Permian deformation in this area is mostly accommodated by faulting and has resulted in vertical offsets up to several hundred metres and lateral offsets up to a kilometre. While smaller displacement faults need to be considered during mining operations, it is the largest faults that are most likely to have a significant impact.

Potential effects of larger faults include offsetting of the polyhalite, folding of the polyhalite due to associated salt flow, water and/or gas ingress and geotechnical issues due to increased fracturing. All of these effects have the potential to significantly impact on the ability of a company to extract a mineral resource and as such they are often treated as bounding structures during resource estimation. Due to these potential effects on resource estimation, a sensible exploration company will take larger faults into account during the assessment of the exploration potential of a given area.

3.3 Additional Polyhalite Potential

3.3.1 Introduction

SRK has undertaken a review of the historical data within and surrounding the AOI focussing on those historical drillholes which intersected polyhalite mineralisation, and has used these to determine the relative exploration potential of a number of areas within and around the AOI not to date explored by YPL. SRK has undertaken this both with a view to determining if a Mineral Resource estimate, as defined internationally and similar to that reported by YPL in the vicinity of Doves Nest, could be produced in these other areas based on the available data; and to assess if there is sufficient promise to justify a company to undertake more exploration and collect additional data such that a Mineral Resource estimate could be produced in these other areas in due course.

SRK has restricted its assessment to the area to the south of the southerly limit of the Boulby Mine licence area and specifically to three areas where in SRK's opinion there appears to be some potential for exploitation from outside of the NYMNP. These have been termed the Whitby Area, the Lockton-Cloughton Area and the Fordon Area respectively.

Figure 3-4 covers the area assessed by SRK and shows the three areas with polyhalite potential identified by SRK, the extent of the YPL Mineral Resource, the limit of YPL's AOI, the extent of the NYMNP and both the historical drilling and the drilling undertaken by YPL

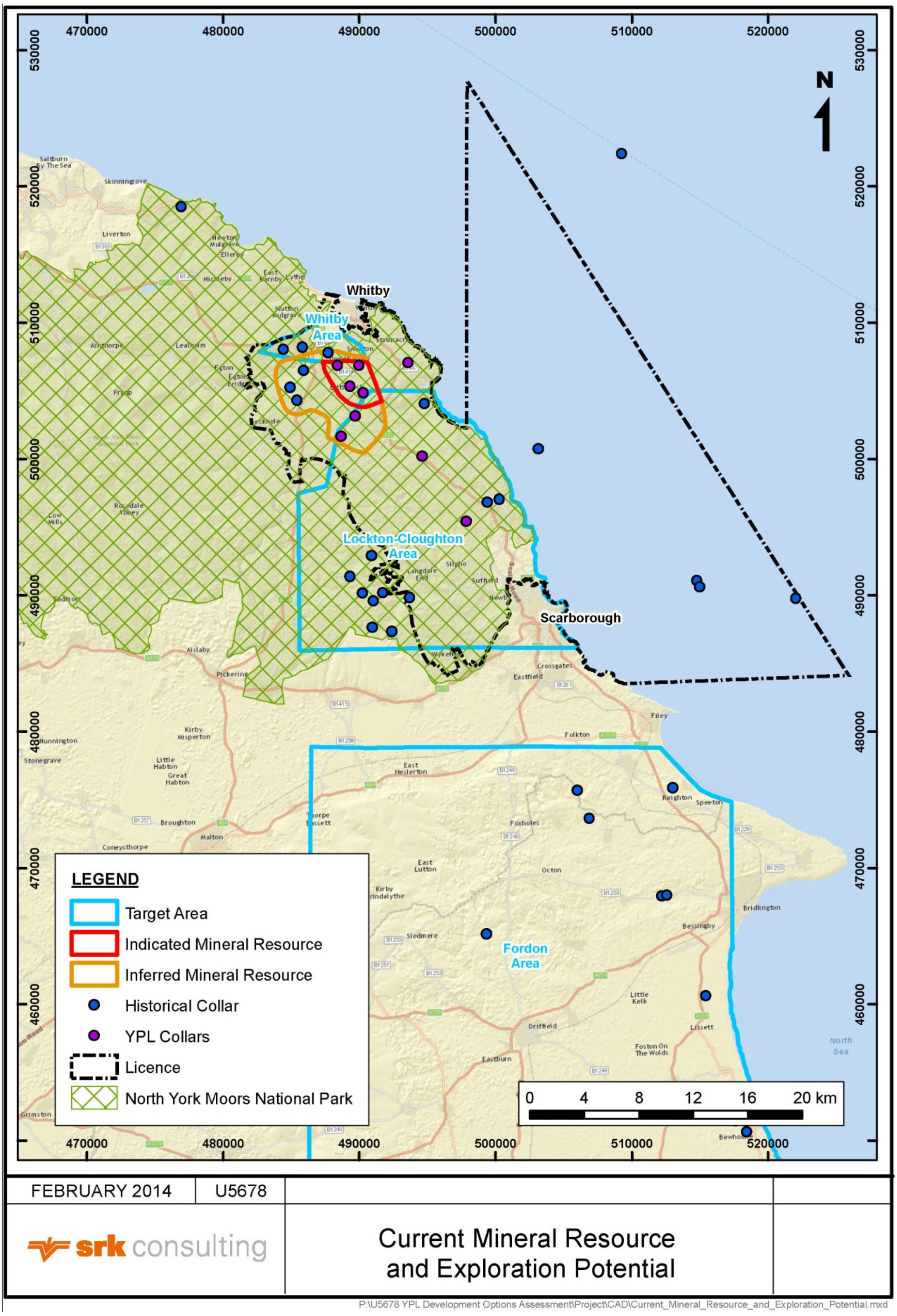

Figure 3-4: YPL AOI and surrounds, showing the current Mineral Resource location, and areas of exploration potential

3.3.2 Whitby Area

Overview

The Whitby Target Area is the northern-most area highlighted in blue in Figure 3-5 below and encompasses an area approximately 2.7 km by 5 km, which lies directly to the north of the current YPL Mineral Resource. This area is bound to the north by the Boulby Mine boundary, to the west by the limit of Shelf Seam development, to the east by the Whitby Fault and to the south by the Donovan Fault. All of these boundaries represent real features that would be used to limit any Mineral Resource estimate produced in this area. The following assessment of the prospectivity of this area has been made based on information from the current mining being undertaken to the north at Boulby Mine and the intersections of polyhalite in both historical and YPL drilled drillholes in the area.

Available Data

As already commented, there are a number of historical drillholes to the north of the current Mineral Resource which intersect Shelf Seam polyhalite and SRK has used the information from these in conjunction with the YPL drillholes associated with the 2013 Mineral Resource to assess the exploration potential of the Whitby Area.

Table 3-1 below summarises the three drillholes, and the associated polyhalite intersections and grade, historically drilled within the area itself.

In order to demonstrate the poor quality of information available and the subjectivity in determining the thickness and grade of polyhalite intersections and therefore to explain why different geologists would derive different intersection widths and grades from the same information, SRK has included the actual drillhole logs and all the supporting data available to SRK relating to E2, E3 and E12 as an appendix to this report (Appendix A).

It should be noted that the thicknesses and grades given below comprise SRK’s interpretation of the “best” intersections from a mineable/economic viewpoint. In fact in the case of E12 and E2 much wider intersections could be reported but in this case these would contain significant intercalations of anhydrite and halite and their grades would be much lower and uneconomic. In the case of E3 on the other hand the only potentially economic grades extend over a thickness of only 4ft which would not be mineable and therefore SRK has reported the wider intercalated zone, hence the lower grade.

Table 3-1: Summary of Drillhole Data in Whitby Area

Drillhole	Thickness (m)	Polyhalite (%)
E12	10	80%
E2	15	90%
E3	51	30%

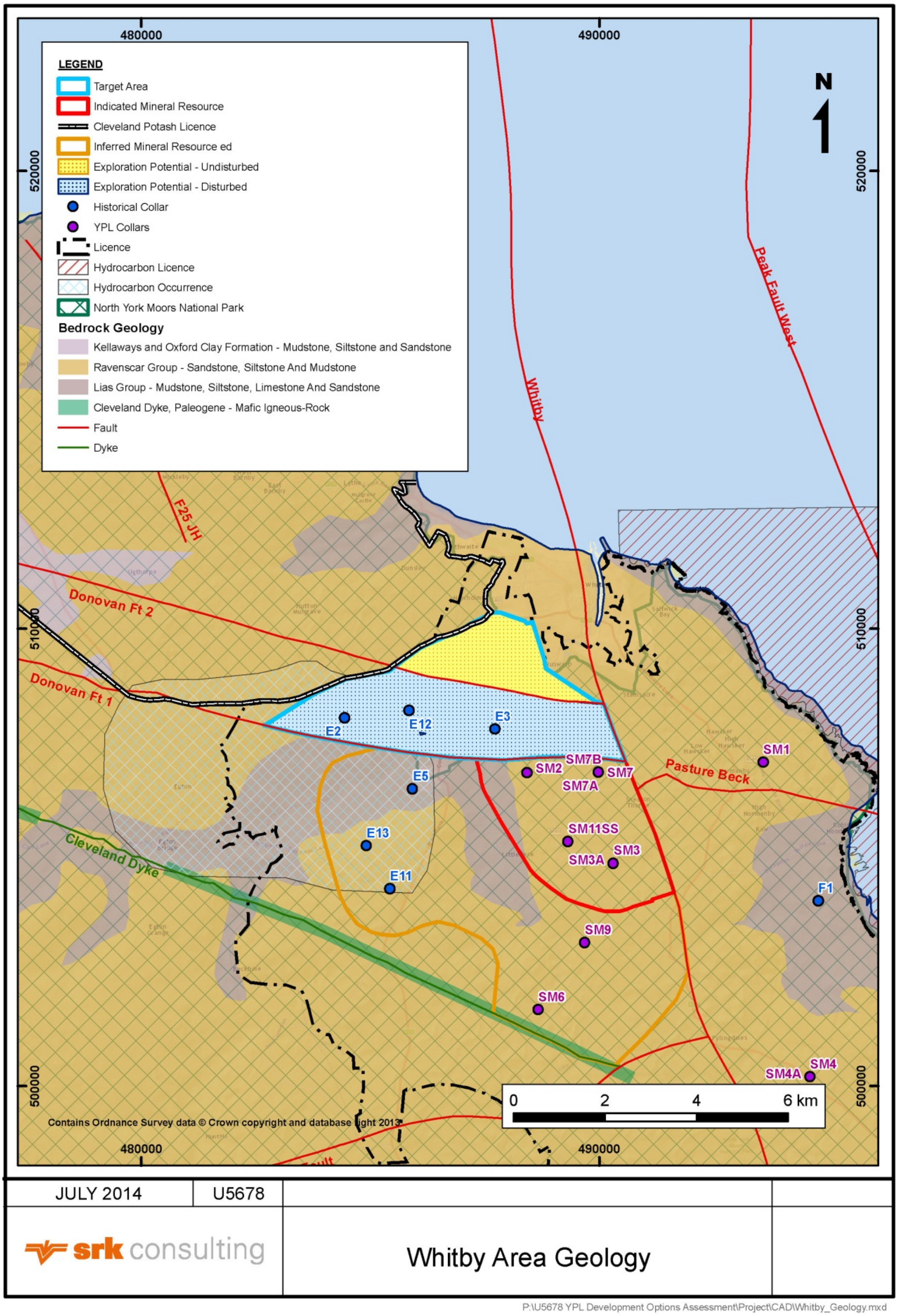

Figure 3-5: Location of the Whitby Area in its geological and structural context with drillhole collar positions delineated

Geological Setting

As stated previously, the Whitby Area is bounded to the south by the Donovan Fault, to the east by the Whitby Fault and to the north by the Boulby Mine boundary. As already commented, the Donovan and Whitby faults also bound the current YPL Shelf Seam Mineral Resource. Geologically the area can be subdivided into two domains: The area north of the Donovan 2 Fault (an antithetic fault in the hangingwall of the Donovan Fault) and the area between the Donovan Fault and the Donovan 2 Fault. These are shown in Figure 3-5 above.

Despite the limited drilling information in the area, given the defined polyhalite resources to the south (YPL) and north (at Boulby Mine) in SRK's opinion there is potential for the Shelf Seam to exist throughout the Whitby area. The information available with regards to the thickness and quality of the polyhalite however is variable and while two of the three drillholes in the area intersected polyhalite seams of reasonable thickness and potentially economic grades, one intersected a very wide zone of very low grade polyhalite that would clearly not be economic to exploit. Further, the seismic lines through the area between the Donovan Fault and the Donovan 2 Fault suggest that the evaporite sequence between these faults is, unsurprisingly, structurally disturbed and may have undergone significant salt flow and folding complicating the geometry of the seams and likely making both resource definition and mining difficult in this area.

This assumption is based primarily on the presence of a thickened Fordon Evaporites sequence and the irregular trace of seismic reflectors between these two faults. This rapid thickening of the Fordon sequence and the occurrence of irregular reflectors over such a large distance (approximately 1 km) is rare in the Fordon Evaporites, which for the most part are interpreted to be gently-dipping and relatively continuous. In fact, the only other area with a similar seismic style is in the hangingwall of the Pasture Beck Fault which based on the similar geometry (WNW-striking and N-dipping), sense of slip (normal) and throw (100 -200 m) is interpreted to be an offset continuation of the Donovan Fault. Based on the above observations, it is considered probable that the Fordon Evaporites encountered in drillhole SM1, which drilled into the hangingwall of the Pasture Beck Fault, are likely to be analogous to the Fordon Evaporite rocks between the Donovan Fault and Donovan Fault 2. The Fordon Evaporites in drillhole SM1 contain evidence of significant folding within the halite sequence and dips of up to 30° in the polyhalite. The cause of this deformation is interpreted to be salt flow within the Fordon Evaporites due to transient post-slip differences in head either side of the Pasture Beck Fault. In summary, therefore, based on the similar geological context and seismic style between the hangingwall of the Pasture Beck Fault and the area between the Donovan Fault and Donovan 2 Fault, it is considered likely that polyhalite between the Donovan Fault and Donovan Fault 2 is deformed by some combination of folding and small scale faulting, with a high probability of variably oriented, shallow to moderate dipping bedding in the polyhalite. This geometry is unlikely to be mineable using a continuous miner.

While the Basin Seam occurs in the eastern part of the southern domain and may also occur in the eastern part of the northern domain, it has a limited lateral extent and is deeper than the Shelf Seam and is not therefore likely to be a primary target for exploration in the Whitby Area.

Mineral Resource/Ore Reserve Potential

Notwithstanding the above comments, and for the purpose of this report, SRK has made an estimate of the potential mineable tonnage that could be present in the area to the north of the Donovan Fault based on the drilling information available. It should be noted that this estimate is neither a Mineral Resource nor an Ore Reserve as defined earlier in this report, is based on very little data and that further drilling would be needed to determine whether or not this is actually present.

Further, it should be noted that not only is there very little data but also that this data is of poor quality. The three drillholes were not sampled on a continuous basis but rather just chip sampled in sections that appeared of interest and the logging is relatively simple. As a result of this the determination of the length of polyhalite intersections and their grades is subjective and in fact the intersections derived by SRK reflect an optimistic interpretation of the data available. Unless supported by additional holes that gave confidence to the interpretations made, SRK would not envisage using this information directly in a resource estimation exercise and it has only been used in this case to facilitate an estimate of the maximum potential of this area given the data available.

Notwithstanding this, SRK's estimate of the potentially mineable material that could be present is between 40 Mt and 80 Mt.

The lower limit of this range assumes that the good thickness of good grade polyhalite mineralisation intersected in the two holes drilled in the west of this area is continuous throughout the western area while the upper limit assumes this then continues throughout the eastern half of the area, despite the fact that E3 did not intersect polyhalite of the required quality over a mineable thickness.

In fact, SRK has estimated there to be some 700Mt of polyhalite mineralisation in situ in this area based on the three drillholes available but given that E3 has a very low grade, albeit over a large thickness, the mean grade of this is only some 63% which would not be economic to exploit. In order to derive a potential in situ estimate with potentially economic grades SRK therefore produced two scenarios, one just for the area to the west, where there two drillholes did intersect good grade polyhalite over potentially mineable widths, and one which assumed that a higher grade section of polyhalite of similar thickness may extend into the east despite the evidence to the contrary in E3 which suggests no such thing (in fact the best intersection in this drillhole extends for only 4ft and has a mean grade of 80% polyhalite).

Taking this optimistic approach results in a range of 220Mt and 440Mt of polyhalite mineralisation at potentially economic grades in situ within the area as a whole.

In deriving a potentially mineable tonnage of between 40Mt and 80Mt from the above range SRK has used the same approach it used to derive the Probable Ore Reserve of 250Mt reported for the area to the south of the Donovan Fault from the Shelf Seam Indicated Mineral Resource of 820Mt. The lower overall extraction ratio primarily reflects the fact that the available evidence suggests that the polyhalite to the north of the Donovan fault is thinner and of poorer quality than the material to the south and that the area immediately to the north of the Donovan fault is expected to be highly deformed. Table 3-2 below though shows the factors applied while the text below explains the differences between the assumptions made in each case.

Table 3-2: Mining Factors Applied at Doves Nest and Whitby Enclave

	Doves Nest (Mt)	Whitby - West Only (Mt)	Whitby - Full Area (Mt)
In Situ Material	**820**	**220**	**440**
Material Below Cut-Off	**46**	**50**	**100**
Available Tonnes	**774**	**170**	**340**
Shaft Pillar	44	20	20
Fault Pillars	25	25	50
Village Pillars	0	10	20
Development Pillars	92	0	0
Disturbed Ground	0	20	40
Total Left in Pillars	**161**	**75**	**130**
Mineable Tonnes	**613**	**95**	**210**
Mining Losses (60%)	**363**	**55**	**130**
Hoisted Tonnes	**250**	**40**	**80**

It should be noted that:-

- The figures are more precise in the case of the Dove's Nest site as the preparation of the Ore Reserve statements involved a significant amount of design and engineering which is not possible given the limited data available in the Whitby Enclave.
- A higher percentage of material is estimated to be below cut-off in the Whitby Enclave as the potential mean resource grade is significantly lower.
- The shaft pillars are estimated to contain less tonnage in the Whitby Enclave as the though these have been assumed to be of the same extent, the polyhalite is thinner and so less ore is tied up.
- It has been assumed that a 200m pillar has been left along the Donovan Fault whereas in the case of Dove's Nest the Mineral Resource has not been extended tight up to this fault i.e. this loss has already been accounted for.
- It has been assumed it will not be possible to mine under the villages of Sleights and Briggswath.
- The Development pillar loss derived for The Doves Nest site reflects the design work done. It has been assumed that these pillars can be accommodated in the village and faults losses in the Whitby Enclave.
- The losses assumed as a function of the mining method have been assumed to be the same percentage in all cases. This allows for mining layout losses (barrier and in-panel pillars) and ore blasted but left behind as a result of mining practices.
- It has been assumed that the ground between the Donovan Fault and the Donovan 2 Fault will be disturbed and that there will be additional areas here that will not be mineable. Specifically is has been assumed that some 70% will be left behind in pillars rather than 50% in this area.

It should also be noted that the upper (80Mt) and lower (40Mt) limit estimates above are neither resource or reserve estimates as such are defined internationally and as have been reported by SRK for the area in the immediate vicinity of Doves Nest and that a significant amount of drilling would be required before such could be reported. Further, there is no guarantee that such could be reported in due course and in fact SRK's expectation is that any reserve estimate produced for this area is much more likely to be near to 40Mt than 80Mt given the optimistic assumptions made in deriving the higher limit.

Mining Potential

As commented above, SRK's estimate of the potentially mineable material that could be present in the Whitby Enclave is between 40 Mt and 80 Mt. The lower limit of this range assumes that the good thickness of good grade polyhalite mineralisation intersected in the two holes drilled in the west of this area is continuous throughout the western area while the upper limit assumes this then continues throughout the eastern half of the area, despite the fact that E3 did not intersect polyhalite of the required quality over a mineable thickness.

It is SRK's opinion that were YPL to propose to establish a mine based on a tonnage in this range that the mine would not be sufficiently economic to have a long enough life to attract the funding required. Notwithstanding this opinion, SRK has also undertaken an exercise to determine whether or not the above tonnages would justify the capital expenditure required to establish a minehead in the Whitby Enclave area in pure economic terms.

In doing this, SRK has drawn upon the most up to date technical and economic assumptions derived by YPL as part of its ongoing feasibility study so that any comparison with establishing a mine head at Doves Nest is appropriate.

In summary, SRK has looked at both a Base Case and a Resilience Case for a 40Mt and an 80Mt mine at Whitby Enclave and has assessed the potential mine in terms of its Net Present Value (NPV) at a 10% discount rate.

SRK has also assumed a constant production rate of 6.5Mtpa as clearly spending the increased capital needed to get to 13Mtpa after five years with such a small reserve would be unsupportable in either case and make the economic analysis unfairly poor. Further, no adjustments have been made by SRK in its analysis of the Whitby Enclave to reflect the fact that more exploration work would be needed before the presence of a reserve could be determined or to reflect the reduced revenues likely given the lower mean grade expected or higher operating costs given the thinner seams indicated to be present, all of which would of course decrease the ability of the tonnage to support a mine. In summary, SRK has made what it considers to be optimistic assumptions in making its analysis.

The results of SRK's analysis are as follows:-

1. The 40Mt Base and Resilience and also the 80Mt Resilience cases all have negative NPVs and internal rates of return that are either negative or less than 10%.

2. The 80Mt Base Case produces a positive NPV but this is still less than half of the capital expenditure required and also has an Internal Rate of Return (IRR) of less than 15%.

In SRK's opinion none of the above options would look attractive to an investor or lender.

SRK's conclusion based on this analysis that a minimum tonnage would be in the order of 150-200Mt. This could be used to support a production rate ramping up to 13.5Mtpa which assuming all of the same technical and economic assumptions determined by YPL for this mining rate produces a mine life of over 15years, an IRR of over 20% and an NPV at a 10% discount rate of over USD2 Billion, which is potentially much more attractive.

SRK Comments

SRK's observations on the potential of this area to host a Mineral Resource and the justification for exploring for this are as follows:

- While there is likely to be polyhalite within this area, determining how much of this is present and whether or not this is of sufficient quality or sufficiently continuous to be economic to exploit would require a drilling programme to determine. SRK estimates that as a minimum this would likely require 5 or 6 drillholes which would take some 15-21 months to complete once permissions had been obtained and cost in the order of GBP15-20 M for drilling alone. It should be noted that these are approximate estimates based on costs incurred by YPL to date. As already commented in this report, the preparation of a Mineral Resource estimate as defined by the JORC Code, or indeed any other internationally accepted resource reporting code, requires sufficient information to enable the continuity of the horizons planned to be mined to be determined throughout the area being explored as well as the variation in the quality/grade of the horizon. This therefore requires multiple intersections to be made of the horizon. In order to test the potential of this area, or indeed any area, therefore, one drillhole would be insufficient and multiple parent and daughter drillholes would be required.

  There would however be no guarantee that this exploration would prove successful and even if it did a significant portion of this would be in the disturbed area between the faults (which would make extraction of the polyhalite here difficult and more expensive, if not impossible).

- In addition, even if continuity of mineralisation was confirmed across the whole area, then in SRK's opinion this could be expected to be 80Mt at most and more likely nearer 40Mt.

- Even if 80Mt, this would in SRK's opinion not be insufficient to support a project that would look attractive to an investor or lender both in terms of mine life and economic returns and so any operation located here would need to develop through the Donovan Fault to access the Mineral Resource already delineated to the south of this by YPL.

- The Donovan Fault is however a major geological feature which was used by SRK as a boundary to the Mineral Resource it considered could be exploited from the Dove's Nest site. Given this, as commented upon in Section 5 of this report, before a decision could be made to establish a mine in this location, a significant amount of work would need to be undertaken (SRK estimates at least three drillholes drilled purely to collect geotechnical data plus a seismic survey) to determine the best approach to develop through this and the likely cost of this and also to then determine if the material to the south could be included in the mining plan i.e. while the material to the south of the fault may be reportable as a Mineral Resource for a shaft also sunk to the south, this may not be possible if the shaft was located to the north (simply because while it may be practically and economically viable to extract this from a shaft located on the same (south) side of the fault it may not be so if the access development is required to develop through this). Further, even once this has been done uncertainties would remain due to the limitations of exploring faults from surface and so there would be an increased risk attached to any plan to access the mineralisation from this point and it may not prove viable and would certainly increase the cost and technical risk associated with any mine development and increase safety concerns on an on-going basis.

Given all the above, and most notably the limited quantity and poorer quality of the polyhalite that could be present north of the Donovan Fault and therefore the reliance of any mine established in this area to be mining material south of the Donovan Fault early in the mine life with the risk of both first negotiating, and then maintaining safe operations beyond the fault, it is SRK's opinion that further exploration of this area by YPL is not justified at this time and that it is highly unlikely that any exploration company new to the area and acting reasonably would undertake exploration for polyhalite in this area in the foreseeable future.

3.3.3 Lockton-Cloughton Area

Overview

The Lockton-Cloughton Area, the middle area highlighted in blue in Figure 3-6 below, encompasses a 20 x 15 km area located in the south of the AOI. The area is bound to the east by the Peak Fault System, to the west by the limit of Shelf Seam development, to the south by the Vale of Pickering Fault System and to the north by the intersection with YPL's currently defined mineral resource.

Available Data

The inclusion of this area as one with potential is based on information from 11 historic drillholes and limited seismic data. Two historic drillholes near the town of Cloughton in the east of the area intersected polyhalite as did eight of the nine historical "Lockton Series" drillholes located in the west of the area. The Lockton series drillholes are located in a prospective natural gas field which is currently being explored by Third Energy. SRK has reviewed all of the data available for these holes which comprises wireline data and drillling logs. There is no available assay data so while it is possible to say that polyhalite is present in all these holes, it is not possible to comment on the likely quality of this polyhalite.

Based on the thinner Fordon sequence in the Lockton area, the predominance of anhydrite below the polyhalite and the interpreted western extent of the Shelf and Basin polyhalite seams, SRK has concluded that all of the Lockton Series drillhole intersections are Shelf Seam. The downhole intersection depths range between 1,543 m and 1,803 m.

The two drillholes from the eastern part of the area (CA and YP14) intersected polyhalite in what SRK interprets to be the Basin Seam. The interpretation of Basin Seam is based on the proximity of the polyhalite seams to the base of the Fordon sequence, the predominance of halite above and below the polyhalite and the lateral extents of the Shelf and Basin polyhalite seams, as interpreted by FWSC and reviewed by SRK. The downhole intersection depths for CA and YP14 are 1,584 m and 1,550 m respectively.

In addition to CA and YP14 there are two further historical drillholes that intersected Basin Seam only, located approximately 10 km further to the north-west (SB1 and F1). These holes are within the area encompassing the Basin Seam Mineral Resource outlined by YPL. SB1 had sufficient data such that a correlation could be produced between this and actual assay data and a relative polyhalite grade calculated, therefore it was deemed suitable for use in the Mineral Resource estimate. This was not the case with F1.

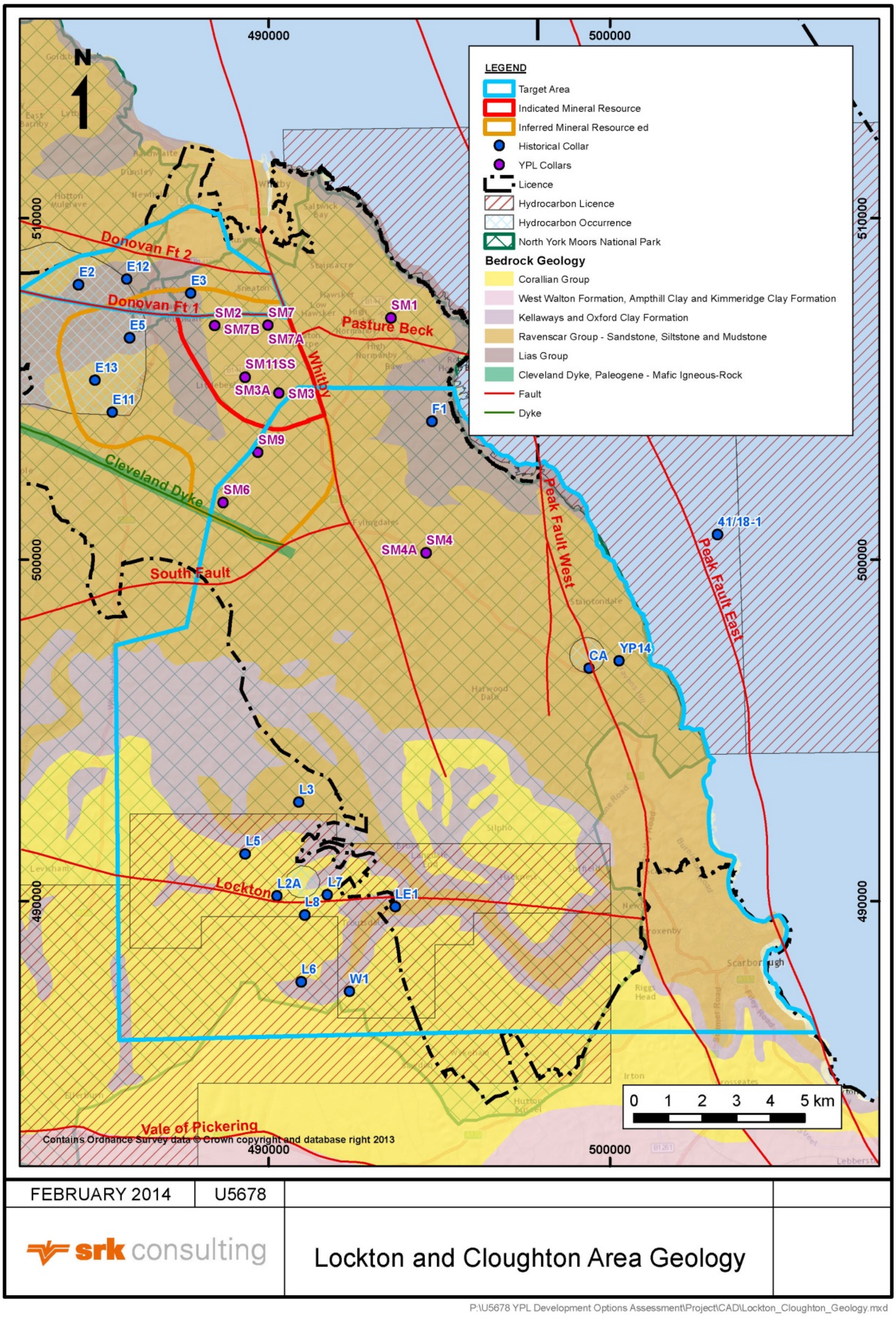

Figure 3-6: Location of the Lockton Area in its geological and structural context

Geological setting

As stated previously, the target in the western part of the Lockton-Cloughton Area would be the Shelf Seam. This area is cut by at least one moderate displacement reverse fault and possibly several other smaller faults, although seismic coverage in the area is not good. The difficulty in correlating individual polyhalite seams between the Lockton Series drillholes (see below) could be partly due to small scale faulting, however, it is likely that a significant component of this complexity is sedimentary in nature and related to the seam splitting up in this area. The splitting of the Shelf Seam towards the south is also observed within the YPL drilled SM6 and SM9 drillholes, which are located close to the southern limit of YPL's currently defined Shelf Seam Mineral Resource. The polyhalite seams in these areas are also thinner than further north.

The other important geological feature in the western part of the Lockton-Cloughton Area is the presence of the Late Jurassic Corallian Group. The Corrallian Group consists of a sequence of limestone and sandstone and is an important local aquifer. There is a likelihood that exploration drillholes completed in this area will intersect this aquifer and also that any mining in this area will disturb the aquifer, as any shaft sunk to access the polyhalite would need to be developed though this. While this is by no means impossible, there is a risk that such activities could impact adversely on water supply and this may result in limitations being imposed on these activities and would likely increase drilling and shaft development costs. It is noted that the EA's position (confirmed in a letter to YPL in September 2012) is to "*to steer the location for the minehead away from any areas of important and/or sensitive groundwater such as principal aquifers and Source Protection Zones*".

In the east of the area, while there are reliable indications of undisturbed Basin Seam, the lateral extent of this is uncertain. As stated previously, the potential to the east is limited by the Peak Fault which runs along the coast. The Peak Fault is a major feature that will significantly displace the seams being targeted, it would require significantly more exploration drilling and would require a significant amount of additional development to negotiate, and in the vicinity of which the ground will likely be of poor quality. Issues associated with mining in the vicinity of faults such as these are discussed further in Section 4 of this report. Exploration east of the Peak Fault System would also require offshore drilling. It is therefore unlikely that a company planning to establish a Mine Head here would also plan to develop through this fault and certainly it makes the area less attractive.

To the west, the exploration potential of the Basin Seam is limited by the expected nipout of this. The combination of the Peak Fault and the Basin Seam nipout provides an estimated E-W width of Basin Polyhalite Seam in the Lockton-Cloughton Area of approximately 2 km. Any development further to the west of the nipout would need to step up into the Shelf Seam. While the exact position of the nipouts is uncertain, the current evidence is that these locations are reasonably well constrained.

The other potential geological factor in this area is the Cleveland Dyke. While not mapped at surface, the possibility that it cuts the polyhalite seam at depth cannot be excluded. The Cleveland Dyke at surface tends to be more strongly fractured than the surrounding sedimentary rocks. If this fracturing continues to depth, then the Cleveland Dyke may act as a vertical conduit for water or gas. As commented in Section 4 of this report, it is likely therefore that this would prove to be a difficult feature to deal with underground and detracts from the attractiveness of this area.

A map detailing the Lockton-Cloughton Area geology and the drillhole locations is shown in Figure 3-6 above.

Mineral Resource Potential

Although the historical data indicates the presence of both Shelf and Basin Seam polyhalite in the area, which is of some interest, the lack of grade information with respect to the polyhalite means that no comment can be made with regards to the quality of this. Further, as can be seen by the intersection information tabulated in Table 3-3, the polyhalite Shelf Seam in the west (Lockton Area) is in some cases very thin and in all cases split into several bands, all of which is in line with information obtained from YPL's southernmost drillholes (SM4, SM6, SM9, SM9A, and SM9B) which are the closest holes with assay data to this area.

While three of these drillholes, LE1, L3 and L7 do contain polyhalite intersections of between 10m and 22m in width, the widest of these intersections are reported to be interbedded with anhydrite or halite which will likely mean they are very low grade. Further, even though the two most northeastely holes, LE1 and L3, do both contain potentially mineable thicknesses of polyhalite (14m and 12m respectively) with no such references, the multiple layering that is evident from the drilling logs does not give any comfort that these could join up. This will make it more difficult to generate robust geological models of these horizons to the level of confidence needed to report a Mineral Resource as defined by the JORC Code, or indeed any other internationally accepted reporting code, and will as a best case mean that more drilling is required to get to this point than was the case in the area around Doves Nest and as a worst case mean that the delineation of a Mineral Resource may not be possible.

The drillholes in the east indicate the Basin polyhalite is inter-layered with halite (and minor anhydrite) and therefore while there is a total reported thickness of 54.1 m in CA, 63.8 m in YP14 and 41.5 m in F1, these are not expected to have high polyhalite grades over this full intersection. Table 3-34 details the breakdown of polyhalite and halite beds within each drillhole as recorded in the drillhole logs in more detail and shows how the polyhalite is interbedded with halite and anhydrite. As is the case with the Lockton Area therefore, it is not possible to estimate how much polyhalite may be present in this area, how continuous the seams are and what quality it is. SRK notes that while there is potential for polyhalite Shelf and to some extent Basin Seam to exist between the Lockton drillholes in the west and the Cloughton drillholes in the east, based on the interpreted location of the polyhalite nip-outs, a significant amount of exploration would be required to prove the presence of a Mineral Resource in this area.

Table 3-3: Lockton-Cloughton Area Historical Drillhole Information

Seam	Drillhole ID	Depth From (m)	Depth To (m)	Thickness (m)	Composition	Roof Composition	Floor Composition
Basin	SB1	1418	1472.1	54.1	Polyhalite interbedded wi h Halite /Anhydrite	Halite+Polyhalite	Halite
Basin	F1	1297	1360.8	63.8	Polyhalite interbedded wi h Halite	Halite	Halite
Basin	CA	1584	1625.5	41.5	Polyhalite interbedded wi h Halite and Anhydrite	Halite	Halite+Polyhalite
Basin	YP14	1550	1609.3	59.3	Polyhalite interbedded wi h Halite	Halite	Anhydrite+Polyhalite
Shelf	L2A	1683	1684	1	Polyhalite	Halite	
Shelf	L2A	1684	1688	4	Anhydrite		
Shelf	L2A	1688	1689	1	Polyhalite		
Shelf	L2A	1689	1692	3	Anhydrite		
Shelf	L2A	1692	1695	3	Polyhalite		
Shelf	L2A	1695	1706	11	Halite		
Shelf	L2A	1706	1708	2	Polyhalite		
Shelf	L2A	1708	1718	10	Anhydrite		
Shelf	L2A	1718	1722	4	Polyhalite		Anhydrite
Shelf	L7	1648	1670	22	Polyhalite interbedded wi h anhydrite	Anhydrite	
Shelf	L7	1670	1682	12	Halite		
Shelf	L7	1682	1695	12	Polyhalite		Anhydrite
Shelf	L8	1793	1797	4	Polyhalite (?)		
Shelf	L8	1797	1798	1	Possibly Polyhalite (?)		
Shelf	L8	1798	1800	1	Polyhalite (?)		
Shelf	L8	1800	1801	2	Anhydrite/Halite		
Shelf	L8	1801	1803	2	Polyhalite (?)		
Shelf	LE1	1543	1565	22	Polyhalite (?) - interbdded with halite	Anhydrite	
Shelf	LE1	1565	1566	2	Polyhalite		
Shelf	LE1	1566	1568	2	Halite		
Shelf	LE1	1568	1569	1	Polyhalite		
Shelf	LE1	1569	1570	1	Halite		
Shelf	LE1	1570	1584	14	Polyhalite		
Shelf	LE1	1584	1586	2	Anhydrite		
Shelf	LE1	1586	1588	2	Polyhalite		Anhydrite
Shelf	L3	1622	1627	5	Polyhalite	Halite	
Shelf	L3	1627	1628	1	Halite		
Shelf	L3	1628	1642	13	Polyhalite		
Shelf	L3	1642	1643	2	Anhydrite		
Shelf	L3	1643	1654	10	Polyhalite		Anhydrite
Shelf	L5	1751	1752	1	Polyhalite	Halite	
Shelf	L5	1752	1776	24	Halite		
Shelf	L5	1776	1783	7	Polyhalite		
Shelf	L5	1783	1784	1	Halite		
Shelf	L5	1784	1786	2	Polyhalite		
Shelf	L5	1786	1786	1	Halite		Halite
Shelf	L6	1673	1680	7	Polyhalite	Anhydrite	
Shelf	L6	1680	1682	2	Anhydrite		
Shelf	L6	1682	1684	2	Polyhalite		Anhydrite
Shelf	W1	1682	1699	17	Polyhalite (wi h Halite+minor Anhydrite)	Halite+Anhydrite	Anhydrite

Table 3-4: Lockton-Cloughton Area Basin Seam drillhole information

Seam	BHID	Thickness (m)	Material
Basin	CA	6.1	Polyhalite
Basin	CA	5.5	Halite
Basin	CA	9.1	Polyhalite-Anhydrite
Basin	CA	1.5	Anhydrite
Basin	CA	4.6	Polyhalite
Basin	CA	2.4	Halite
Basin	CA	7.9	Polyhalite
Basin	CA	6.4	Halite
Basin	CA	6.1	Polyhalite
Basin	CA	2.4	Anhydrite
Basin	CA	2.1	Polyhalite
Basin	YP14	22.2	Polyhalite-Halite
Basin	YP14	14.9	Polyhalite
Basin	YP14	7.3	Halite
Basin	YP14	14.9	Polyhalite-Halite
Basin	F1	11.9	Polyhalite
Basin	F1	7	Halite
Basin	F1	15.2	Polyhalite
Basin	F1	4	Halite
Basin	F1	3.4	Polyhalite

SRK Comments

SRK's observations on the potential of this area to host a Mineral Resource and justify exploration for polyhalite are as follows:-

- The information currently available is insufficient to enable the reporting of a Mineral Resource as such is defined internationally or indeed to derive an estimate of the potential quantity and quality of polyhalite that may be present.
- The exploration required to determine if a Mineral Resource could be delineated would require a significant amount of drilling and associated technical work. Any exploration company undertaking such should in SRK's opinion expect to incur at least as much cost as already incurred by YPL to explore this area to the point at which it would be able to determine if a Mineral Resource could be reported or not. Further, it is uncertain that such a resource could be determined even following expenditure of this order.
- Any drilling conducted would need to be entirely located in the NYMNP and, were a Mineral Resource to be delineated, a suitable mine head location in this area would need to be determined, which may need to be within the NYMNP. This site therefore does not offer any benefits to that currently proposed at Doves Nest.

- The fact that the Basin polyhalite is inter-layered with halite, and the Shelf seam interlayered with anhydrite and halite will likely make establishing continuity of individual horizons between drillholes (which would be required in order to define a Mineral Resource) more difficult and therefore drillholes would likely need to be located at a shorter spacing than at Doves Nest which would in turn mean that more drill holes would likely be required to define the same size Mineral Resource to the same level of confidence.
- The location of the Peak Fault and interpreted western extent of the Basin seam based on the interpretive nip out model indicates there is potentially a limited expanse of Basin Seam polyhalite in an east-west direction within the Lockton-Cloughton area.
- The presence of the Cleveland Dyke within the Lockton-Cloughton area could also be of concern. The eastern extent of the Cleveland dyke at depth is unknown, however, it could cause fluid and/or gas ingress during any subsequent mining activities.
- There are prospective gas fields in the west of the Lockton-Cloughton area which are currently being explored, the implications of which are uncertain. While companies may be allowed to explore for gas and polyhalite at the same time, and while our understanding is that neither has priority over the other from a government or local authority perspective, the exploitation of each at the same time would likely not be practical and from a technical perspective the exploitation of one may even preclude the exploitation of the other. The fact that gas is being explored for in this area therefore makes this area less attractive from an exploration standpoint.
- Any mining of the Basin polyhalite would mean that the resulting footwall and/or hanging wall would be in halite would cause additional problems should a mine be established as this material is less strong than is the case with the material at Doves Nest. The result of this is that mining will be more expensive in this case reducing the attractiveness of the target.
- Given that there is no historical assay data, an exploration programme to prove up a Mineral Resource in either the Shelf or Basin seam would likely cost more than expended by YPL to date and would likely take longer. Based on current expenditure to date by YPL it would be estimated that a company planning to explore here would in SRK's opinion likely need to budget in excess of the GBP60 Million expended by YPL to date, of which some GBP25-35 Million would be required for the drilling alone, and be committed to an exploration programme in excess of three years.
- Further, in SRK's opinion, this area has less potential than the area where YPL has explored to date and it is uncertain that a Mineral Resource could be determined even following expenditure of this order.

Given the above, and in particular the complicated splitting of both the Shelf and Basin seams in this area, SRK considers it highly unlikely that an exploration company acting reasonably would commit to the expenditure required to develop a polyhalite Mineral Resource in the Lockton-Cloughton Area. Further any such exploration would need to be conducted within the NYMNP as would, most likely, any subsequent shaft head development.

3.3.4 Fordon Area

Overview

The Fordon Area is located approximately 15 km south of the southern extent of the YPL AOI and south of Scarborough (Figure 3-7). An area with potential to host polyhalite mineralisation has been identified by 11 historic drillholes within this area. These drillholes are located between 30 and 60 km south of the southerly limit of the current Basin Seam Mineral Resource.

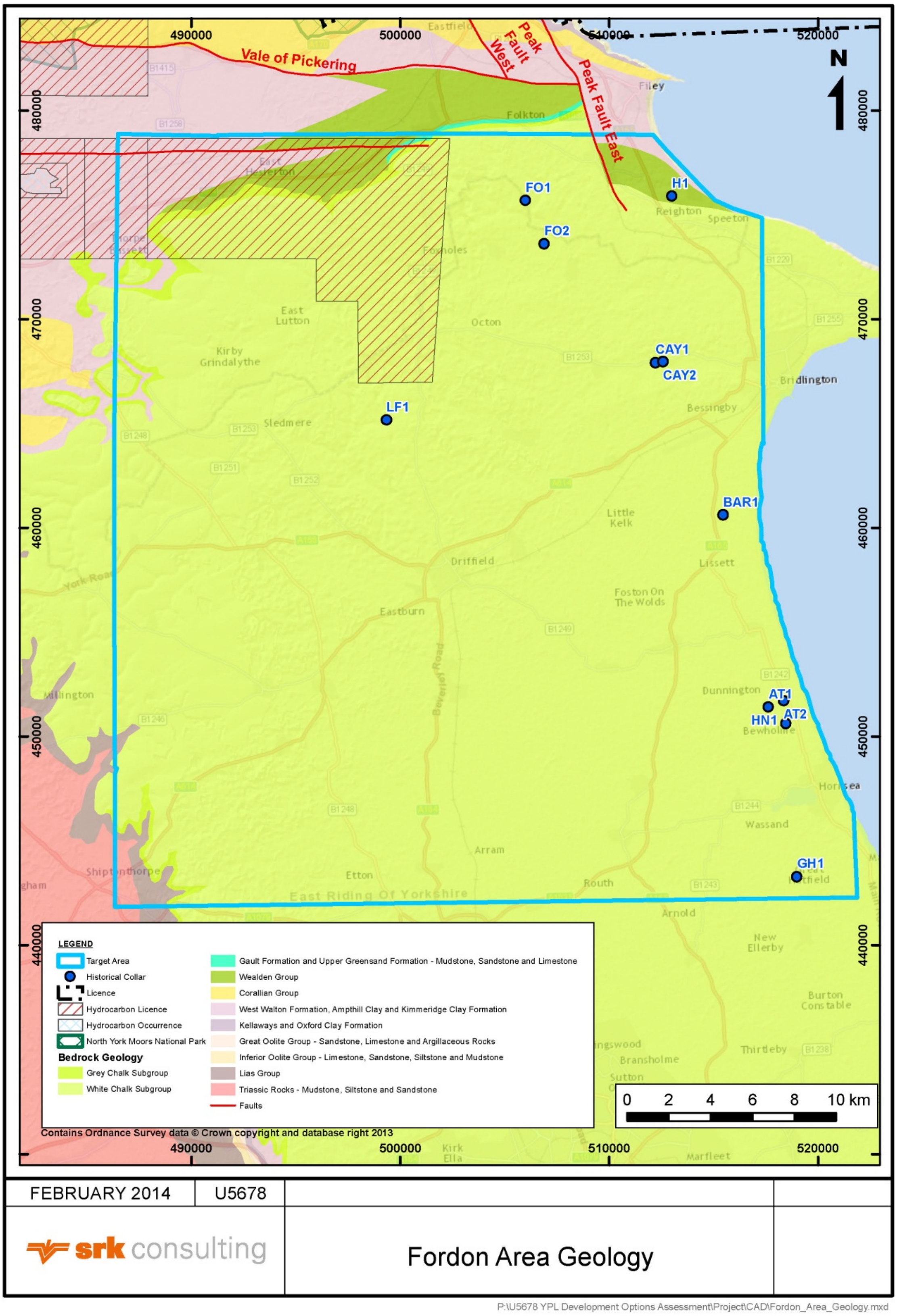

Figure 3-7: Location of the Fordon area in its geological and structural context

Available Data

Of the 11 historical drillholes in this area SRK has significant data relating to three only. The remaining eight drillholes are known to contain polyhalite (one drillhole is interpreted as Shelf Seam polyhalite, the remaining seven are interpreted as Basin Seam polyhalite), however only the interpreted thickness information is known and the quality of the polyhalite units is unknown. The three drillholes for which SRK does have data are interpreted to intersect only Basin Seam polyhalite and are drillholes FO1, FO2, H1. The table below lists all polyhalite occurrences in the Fordon South area. While the Hunmanby 1 (H1) drillhole has unreliable data, polyhalite occurrences have been delineated based on elevated Gamma Ray API units. The Gamma Ray logs (in API units) have been interpreted to assume that polyhalite occurs as variable thick seams intercalated predominantly with halite, although the occurrence of anhydrite has also been postulated.

The FO1 drillhole has been used as the type drillhole for the Fordon Evaporites sequence, as published by Stewart in 1963. Data for the historical Fordon 1 (FO1) drillhole includes a lithology log (and a gamma log published by Colter and Reed, 1980) which indicates polyhalite occurs at an approximate depth of 2,074 m and extends to 2,113 m. The polyhalite occurs as multiple seams comprised of a mixture of polyhalite, anhydrite and halite.

The historical Fordon 2 (FO2) drillhole has a more complete data set, which indicates the polyhalite extends from approximately 1,881 m to 1,975 m and is interlayered with halite and anhydrite. Again however the quality of the polyhalite cannot be determined from the data currently available.

Table 3-5: Fordon South Historical Drillhole Information

Seam	Drillhole ID	From (m)	To (m)	Thickness (m)	Composition	Roof Composition	Floor Composition
Basin	FO1	1905	2018	112	Polyhalite interbedded with halite+anhydrite	Halite	Halite+minor Anhydrite
Basin	FO1	2018	2074	56	Polyhalite with minor halite+anhydrite	Unknown	Unknown
Basin	FO2	1881	1935	54	Anhydrite+Polyhalite+ minor Halite	Halite	Unknown
Basin	FO2	1935	1939	3	Halite	Unknown	Unknown
Basin	FO2	1939	1942	3	Polyhalite	Unknown	Unknown
Basin	FO2	1942	1975	33	Anhydrite+Polyhalite	Unknown	Halite
Basin	H1	1978	2003	24	Polyhalite+minor Halite	Halite? (uncertain)	Unknown
Basin	H1	2003	2012	9	Halite and/or Anhydrite (unknown)	Unknown	Unknown
Basin	H1	2012	2027	15	Halite+Anhydrite+ Polyhalite	Unknown	Unknown
Basin	H1	2027	2051	24	Polyhalite	Unknown	Unknown
Basin	H1	2051	2067	15	Polyhalite+anhydrite and/or Halite	Unknown	Anhydrite and/or Halite (uncertain)
Basin	AT1	1810	1920	110	Polyhalite (+Unknown)	Unknown	Unknown
Basin	AT2	1840	1880	40	Polyhalite (+Unknown)	Unknown	Unknown
Basin	BAR1	1750	1838	88	Polyhalite (+Unknown)	Unknown	Unknown
Basin	CAY1	1802	1810	8	Polyhalite (+Unknown)	Unknown	Unknown
Basin	CAY2	1955	2048	93	Polyhalite (+Unknown)	Unknown	Unknown
Basin	GH1	1752	1859	107	Polyhalite (+Unknown)	Unknown	Unknown
Basin	HN1	1823	1920	97	Polyhalite (+Unknown)	Unknown	Unknown
Shelf	LF1	1530	1548	18	Polyhalite (+Unknown)	Unknown	Unknown

Geological Setting

SRK's understanding of the geology in this area is based entirely on BGS surface maps, published journal articles and drillhole data, as there is no available seismic coverage. At a regional scale, the Fordon evaporites extend for approximately 100 km south of the Fordon Area (Stewart 1963). However, they are likely to thin as the southern margin is approached (Colter&Reed 1980).

Drillhole data indicates that the evaporite stratigraphy of the Fordon Area is similar to the evaporite stratigraphy north of the Vale of Pickering Fault. The major difference between the Fordon Area and those areas further north, however, is that the Fordon Area has been dropped down across the Vale of Pickering Fault System by approximately 200 m. This has two key impacts:

1. The polyhalite seams are deeper
2. The Cretaceous Chalk Aquifer has been preserved near the surface.

The down-throw of stratigraphy in the area means that the Basin Seam occurs at depths close to 2,000 m below the surface. Mining at these depths while possible would incur greater costs than mining at shallower depths and as such the Mineral Resource required to justify a mining project would be significantly in excess of that required in the AOI.

The presence of the Cretaceous Chalk Aquifer also represents a potential challenge to both exploration and development. The Chalk Aquifer is an important regional aquifer so any exploration or development in this area will need to ensure that no contamination or local draw-down occurs and this will, as a minimum, likely add to the cost of exploration and shaft development.

The BGS maps do not indicate extensive faulting in the northern part of the Fordon Area. However, FO1 is drilled on the surface trace of a N-S striking fault with approximately 8 km of strike length and 250 m of apparent lateral movement and H1 was also drilled close to a mapped E-W striking fault. While these structures do not in any way preclude exploration in the area, they do highlight the need for additional information on the dip of these faults and on the polyhalite intercepts from the more southern drillholes before a complete assessment of exploration potential can be made.

SRK Comments

SRK's observations on the potential of this area to host a Mineral Resource and to justify exploration for polyhalite are as follows:-

- The exploration required to determine if a Mineral Resource could be delineated would require a significant amount of drilling and subsequent technical work.
- In comparison to the area north of the Vale of Pickering Fault, the Basin Seam is at a much greater depth which would make both exploration and mining more difficult and costly than in the AOI. Supporting commentary from shaft development experts TWP, based in South Africa concluded that there is an increase in the technical challenges associated with hoisting significant amounts of mineral from depths greater than 1,800 m below surface when compared to hoisting from a lesser depth both as a function of the depth itself but also because of the increased temperatures and rock pressures that would need to be managed. Factors which affect winding at these depths include: increased wear on winding ropes and the need to replace them more frequently; different types of winders; limitations of the loads carried; stronger and larger headframes; revised skip dimensions; enlarged loading and unloading areas; and increased operating costs particularly related to power consumption. These factors would negatively impact on the capital and operating cost of such an operation and have the potential to render it uneconomic.
- The (Basin Seam) polyhalite in the area appears to be inter-layered with significant thicknesses of halite and anhydrite, which as commented upon above is considered a detrimental waste mineral and less stable for roof and floor development for mining purposes.

  Given that there is no historical assay data, an exploration programme to prove up a resource would likely cost significantly more than expended by YPL to date and would have significantly less chance of success given that the mineralisation in this area appears to be both deeper and interlayered with halite and so more intersections would be required to determine the tonnage to the same level of confidence. In fact SRK considers that a company planning to explore here would in SRK's opinion likely need to budget significantly in excess of the GBP60 Million expended by YPL to date and be committed to an exploration programme in excess of three years.

- Further, there is no guarantee that such a resource could be determined even following expenditure of this order and the presence of the Cretaceous Chalk, a major regional aquifer, in the near surface throughout much of the target area is a potential issue for both drilling and the development of any future shaft or decline.

In SRK's opinion any exploration in the Fordon South Area would be highly speculative and any resource identified would occur at significant depths and require significant expenditure to investigate. Given this, SRK would consider it highly unlikely that any exploration company acting reasonably would commit to the exploration work required to embark on this.

3.4 Summary Comments

In SRK's opinion:

- There are several areas in the vicinity of the AOI and further south that have potential to contain polyhalite mineralisation. In all cases, however, the indications are that the mineralisation is either deeper, geologically more complex or constrained by geological features.
- None of these areas have been sufficiently explored to date to enable the quantity or quality of the in situ polyhalite to be assessed.
- All these areas would therefore require a significant amount of exploration work to be undertaken, and thus expenditure, before a Mineral Resource could be delineated of the size and to the level of confidence required to support a decision on establishing a mine. Notably this would require multiple polyhalite intersections, one drillhole would be insufficient and multiple parent and daughter drillholes would be required.
- Given the issues mentioned above, even if a significant amount of expenditure is incurred the likelihood of being able to report a Mineral Resource estimate of sufficient size and quality to justify the establishment of a mine on completion of this is unlikely. Certainly none of these areas are as prospective as the area drilled to date by YPL.
- Finally, some of these areas would need to be both explored, and if exploration was successful also potentially be developed, from within the NYMNP.

In summary, all of the identified areas that could contain polyhalite mineralisation have geological characteristics such as size constraints, stratigraphic complexity or increased depth that while not necessarily excluding the possibility of exploration, certainly make these areas less prospective than the area that has been assessed by YPL. Any exploration would require a significant amount of expenditure most likely in excess, and in some cases significantly in excess, of that expended to date by YPL to enable the reporting of a Mineral Resource that might have the potential to support a viable mining operation. Further, this would likely take between 15 months and three years to complete and there would be no guarantee of success and in some cases very little chance of success. Given this, in SRK's opinion it would be unreasonable to expect a company such as YPL that has already delineated a significant Mineral Resource elsewhere to explore in any of these areas and highly unlikely that any other exploration company would risk the expenditure required to commit to this in the foreseeable future or indeed that it would be able to raise the money required to fund this if required.

4 CRITERIA FOR ASSESSING MINE HEAD LOCATIONS

4.1 Introduction

SRK's opinion as stated in Section 3 of this report is that it would be highly unlikely that any exploration company would explore the other areas identified as having polyhalite potential in the foreseeable future. Notwithstanding this, and as commented earlier in this report, four alternative site locations for the Mine Head have been proposed by NLP. Section 5 of this report below, therefore, provides an account of how these could be developed and what comparative costs would be involved should a company decide to attempt to access the currently defined Mineral Resource from these sites.

The purpose of such a detailed assessment of these sites is part in recognition of the earlier conclusions of the NYMNPA in its consideration of the previous ASA that questioned the conclusions on Whitby and Cloughton. Therefore, this section provides NYMNPA with a full appreciation of the mining issues at these locations, having regard to the relevant policy considerations for development at Dove's Nest Farm, which requires an assessment of the scope for, and cost of, alternatives outside the designated National Park area.

All these alternatives would involve the development of vertical shafts from the mine head at surface followed by horizontal underground development to access the Mineral Resource. Section 5 of this report provides a relative technical and economic assessment of the cost of developing each of these sites relative to the Doves Nest location. This section of the report however rather comments on the general criteria typically applied when selecting sites to access a Mineral Resource and therefore provides some background to the more technical information presented in Section 5.

4.2 General Comments

The main issues when determining an optimum mine head location are the impact of the infrastructure on the surface environment, the proximity to the Mineral Resource delineated and the technical, and therefore economic, practicality of accessing this.

The suitability of a site therefore involves both technical and engineering considerations and socio-environmental considerations. This report focuses on technical and engineering considerations only.

When selecting a site, obvious technical issues and their impacts on costs and the economics of each location tend to be highlighted relatively quickly and a shortlist of sites can normally be developed on this basis.

For underground mining operations, the main shaft complex is typically the only regular point of access into the workings. It is through this portal that workers travel in and out, that all materials required for operations are transported, and from which all the mineral excavated is removed. The impact of selecting an unfavourable site can therefore have lasting impacts not only on the life of the operation by incurring additional capital and operating expenditures, but more importantly by introducing additional risk to workers that might arise from circumstances such as longer travel times underground.

The proximity of the shaft in relation to the planned workings affects the mine's construction and operating cost as this determines the length of tunnel required to access the mining area, which in turn affects the distance men and materials are transported. As the mine develops and workings become more distant from the shaft, the ability of mine infrastructure to meet the needs of the mine operation lessens.

Other key technical issues to consider when evaluating a mine site are the impact of known geological features and the likelihood of unknown geological features. These will include an understanding of the behaviour of the rock mass when excavated, the presence of weak strata, water bearing ground, i.e. aquifers, and possible water and/or gas inflows into excavations. The four alternative sites proposed in this case are all more distant from that proposed at Doves Nest and need to negotiate major geological features.

Sections 4.3 and 4.4 discuss the implications of these two key issues in more detail.

4.3 Proximity of the shaft to the Mineral Resource

The key impacts of locating a mine head further away from the Mineral Resource are the increased amount of access development required, the decreased flexibility in terms of the mining methods and mining sequence, the increased amount of ventilation required and the increase in the distance that the workers are required to travel to access the working areas and to travel to evacuate in an emergency if required. These are discussed in turn below.

Increased access development

Increased access development extends the construction period of the mine and delays the point at which the mineralisation can start to be exploited and a saleable product can be produced. SRK estimates that the time taken to sink, equip and commission a shaft to a depth of 1,500 m underground, such as that proposed at Doves Nest, is approximately three years. This would include the time take to sink and equip the shaft and develop the necessary shaft bottom infrastructure with materials handling and hoisting equipment, workshops, water handling and welfare facilities. Only once this infrastructure is largely in place can the development required to access the Mineral Resource be commenced. Clearly therefore the closer the mine head to the Mineral Resource the better from a timing perspective.

The development of and production ramp up of a mine is funded by capital investment into the project. More extensive development requirements have longer development periods and incur greater cost before revenue is earned and returns are made to investors and financiers. This can in turn reduce the number of potential investors that are willing to invest and either increase the cost of finance or make financing impossible.

Decreased mining flexibility

Determining optimal shaft location in relation to the Mineral Resource typically considers the concept of centre-of-gravity, the aim being to minimise the distances mineral is transported out of the mine, and to enable the Mineral Resource to be exploited in more than one direction at the same time.

In order to adopt this approach the shaft needs to be placed as close as reasonably practicable to the Mineral Resource to be exploited. In shallow dipping tabular type deposits, such as that planned to be mined by YPL, the shaft is usually developed directly into the centre of the Mineral Resource and mining districts are developed radially around the shaft. While this approach will sterilize mineral in the immediate vicinity of the shaft, as it is required to be left in place in order to maintain the integrity of the shaft, this centre of gravity approach can mitigate several risks associated with long access way developments by allowing for:

- The Mineral Resource to be developed in more than one direction at the same time. This reduces the time taken for the ramp up as mining areas are brought into production more quickly.
- The air supplied to the mine through the ventilation system to be split and utilised in more than one district. As a result, air travels shorter distances before it is utilised in working places. This improves ventilation efficiencies as there is less potential for air to short circuit, and heat loading on the air is reduced.
- Reduced travel distances as the mining areas are located radially around the shaft rather than along a long corridor.
- Less impact in the event of an emergency situation. When the mining areas are located radially around the shaft, discrete mining districts can be developed which are usually isolated from each other. This means that the consequences of an emergency situation can be contained within independent districts, resulting in less potential for loss.

Increased ventilation provision to the mine

Underground mines require air to be supplied by ventilation fans to ensure the safety and well-being of employees. Air is supplied for the following reasons:

- To provide fresh air for employees.
- To dilute and remove toxic and/or, explosive gases that may be present in the strata and which are given off as mining takes place.
- To dilute and remove dust and fumes produced during mining and by mining equipment.
- To remove excess heat from the mine working areas that has been introduced from the rock exposed by mining, equipment operation, and through compression of the air in deep mines.

As the mine develops, working areas typically become farther from the shaft. The extra distance air travels underground increases resistance to air flow in the mine, which can lower ventilating quantities. Long development tunnels also increase the number of ventilation stoppings (walls) required which will further reduce the quantity of air reaching the working area as a result of air leakage (even through well-constructed ventilation stoppings). In time, insufficient fresh air in working areas reduces production rates and more, or larger, fans are required to address the inefficiency. This increases the power consumption of the fans and in turn the operating costs of the mine.

Long development tunnels also increase the surface area of rock exposed. At a depth of 1,500 m, such as that envisaged by YPL, the rock temperature is expected to be around 50°C. The heating effect of the strata increases with rock surface exposed. Heat load in the ventilation system is mitigated by the use of bulk air cooling plants to lower the temperature of the air to industry accepted working levels. Bulk air coolers are high cost items from a capital investment and operating cost perspective.

Eventually, in mines with extensive Mineral Resources, workings often extend beyond the practical limit of fans to effectively ventilate the working areas. At this point additional ventilation shafts to surface are required in order to provide an adequately ventilated mine working area. Long developments from the shaft to the working areas of the mine, such as is required for all of the alternative sites proposed in this case, compound this problem and negatively impact on the effectiveness of the ventilation system to supply air to the mine. This increases capital and operating costs as additional ventilation capacity is required, which reduce the economic performance of the project.

Increased travel distance

As mine production areas are more distant from the shaft the time taken for workers to reach the operating areas of the mine increases. Longer travelling time to the work place reduces the effective working time of employees and in time, additional employees will be required to meet the mine’s production targets. As labour costs are a significant proportion of mine operating costs, additional labour will increase the economic burden on the operation.

Also, longer distances from the shaft to the working areas introduces a logistical problem as workers and materials need to be transported from the shaft to the working areas and from working areas back to the shaft.

Emergency egress

If the mine head location is such that long access tunnels are required this can be a potential bottleneck to the escape route from the mine.

While this can be mitigated to some extent by the development of a number of parallel tunnels and two shafts to facilitate mine egress, an increased risk remains and further, as these tunnels would typically be separated by around 40 metres and the shafts located in relative proximity, and all of this adds to the capital and operating costs.

In summary, for cost, time and most importantly safety reasons, the ideal situation when accessing a shallow dipping tabular orebody is for the access shaft to be located centrally within the Mineral Resource planned to be mined. In SRK’s opinion any mining company acting reasonably would seek to do this in this case.

4.4 Presence of major geological features

Each of the alternative sites proposed in Section 5 of this report is in the vicinity of at least one major structural feature, such as a fault or fault system, and in some cases the horizontal development required to be put in place to access the Mineral Resource from the shaft will have to be tunnelled through these features. Faults result when movement has occurred within the rock in the geological past and disrupted the strata within the earth. They often remain as zones of weakness within the earth's crust which can impact negatively on a mining operation. The extent of the impact of these features on planned mining activities can be varied and is dependent on a number of factors including the rock type that has been faulted, the type of movement that occurred, when it happened during the deposition cycle and what has occurred since.

Typical Impacts

While exploratory drilling and geo-technical investigation is required to quantify the impacts of faults on a mining operation in any specific location, typically a fault zone of reasonable size will present challenges to the design and construction of the excavation, require special measures and involve delay and additional cost. The following conditions are typically associated with faults and faulted zones:

- Poor ground conditions: Notably resulting in weak roof and floors which can extend some distance beyond the fault itself. Typically poor ground conditions result in reduced production or advance rates and increased support requirements. Poor ground conditions are also inherently more hazardous and special precautions are required in order to protect the health and safety of employees working in these areas.
- Water ingress: Faults and features often act as a conduit for water from other layers of strata. This can be of particular concern if there are aquifers in the region and water can flow, sometimes under pressure, from these regions into the mine workings.
- Gas ingress: Faults and features often act as a conduit for gas from other layers of strata. This can be of particular concern if there are aquifers in the region and gas can flow, sometimes under pressure, from these regions into the mine workings.
- Displacement of mineral horizons: Large faults can displace the target mineral horizon which, depending on the magnitude of the fault, can require extensive re-development in order to re-establish mining on the correct horizon. For example, a 50 m vertical displacement of an orebody with the geometry similar to that planned to be mined by YPL, can mean 400 m of additional tunnelling is required to traverse this and re-access the mining horizon. If a fault has not been identified ahead of mining, it can be difficult to characterise the fault or identify the direction and extent of displacement and therefore drilling is required to be conducted to assess this before mining can continue thus delaying mining and increasing costs.

Impacts of major faulting

Major faulting is, at best, a disruption to mine production and, at worst, a major risk to the health and safety of employees and can potentially threaten the viability of the mine. Schubert and Riedmüller note in the lessons learned from tunnelling through three fault zones described in their paper “Tunnelling in Fault Zones – State of the Art in Investigation and Construction, p7-15 Felsbau 18 (2000) No.2” that “Tunnelling through fault zones is costly and time consuming. Careful engineering and continuous updating of the design based on monitoring data and increased knowledge of the geological structure and material parameters at site are essential for a successful tunnel construction.”

There are a variety of approaches to mitigating the impact of faults, one of which is simply to avoid them. Mine production plans often exclude fault zones from extraction and establish buffer zones around known hazards such as the presence of water, gas or material that flows, in accordance with The Mines (The prevention of inrushes in mines) Regulations, 1979 in the HSE Approved Code of Practice. This guidance requires (amongst other things) that excavation is not permitted within 45 metres of known hazards without establishing a scheme of work designed to ensure that an inrush does not occur. Notably it is particularly important to try to avoid major faults in the immediate vicinity of any shaft as these would have the potential to affect the stability of the shaft throughout the mine life. Even small displacements in a shaft can adversely affect hoisting infrastructure.

The justification for mining through a fault is established by the context of what would be lost by not crossing the fault, and this will vary in the context of the headings’ development and size of the fault. For example, in a mine production scenario the impact of not crossing a fault may be limited to loss of production from an individual block. This might result in relatively short term production losses. Decisions may also be affected by the excavation method and equipment available. In such scenarios, it is likely that a minimum amount of development would be carried out to develop through the fault. This would often be undertaken by a specialist development team, and the production schedule would be adjusted to take into account a reduced production rate.

Where a fault might prevent a main access development that is required to access the main mine working area, far larger impacts are incurred and a greater effort to secure the development are made.

In both cases, the greatest risk is posed by mining into conditions that are difficult to control and for which adequate measures to provide safe working conditions have not been established. The most effective mitigation is to conduct cover drilling ahead of the tunnel face to provide information on the conditions that will be encountered as the heading is advanced, and to identify and prepare for problems (as required by mining regulations). This may include the presence of water flow, broken or very weak ground, voids, inflow of gas or even old workings.

It should also be noted that establishing fault characteristics from surface prior to mine development particularly in the case where mining will take place at significant depths, as is the case in this situation, is extremely difficult and it is likely that uncertainties will remain at the time a decision is made to develop the mine which may make obtaining finance to develop the mine difficult. Avoiding major faults is therefore a key aspect when planning a shaft location and/or major underground infrastructure.

Common approaches to managing poor ground in mines

Having established the type of ground conditions ahead of the face, there are a number of control measures that might be applied. Commonly:

- Pre support (spiling or forepoling) to control weak ground before the face is excavated.
- Drainage ahead of the face via probe holes and the use of sufficient pumping capacity to deal with water flow and / or gas drainage and reticulation systems prior to sealing the ground.
- Where extremely poor ground conditions are expected to be encountered in fault zones, such as flowing ground or excessive water inflow, multiple excavation stages and/or special ground treatment ahead of the excavation by grouting and drainage may be required.
- For very weak ground, installation of ground support at short excavation intervals in a carefully designed and managed excavation sequence and installation of initial support to ensure headings are never so large that they cannot be quickly excavated and quickly supported. For exceptionally poor ground partial excavation of the heading may be carried out.
- Pre-injection grouting. This consists of drilling ahead of the face and injecting grout into the profile around the tunnel. The aim of this is to consolidate poor ground and to provide a barrier to water and gas ingress. This requires specialist equipment and materials. The programme of pre-injection grouting will an often slow a headings advance to a few metres per week rather than several metres per day under normal conditions.

Tunnel engineering techniques

Civil engineering tunnelling techniques have sometimes been used for mine infrastructure construction to advance a tunnel through very difficult ground. This might include:

- The installation of a permanent tunnel lining, the ground is then stabilised behind the liner. This process can include waterproofing in an undrained design, or drainage fabric that allows water to flow around the liner into the tunnel in a drained design.
- Ground freezing - though this is a technique that is usually used for shaft sinking and is rarely used in tunnel development. High inflows encountered into a rock tunnel would tend to be concentrated at the joints present in the rock and would typically have flow rates that would prevent effective freezing except very locally, and even then it might be necessary to use liquid nitrogen through probe holes to freeze the ground ahead of mining to solidify any water in the strata and consolidate poor ground. This allows for mining to take place and for a tunnel to be established. Once the tunnel excavated and the ground secured and probably lined, the freezing process is stopped and the ground allowed to thaw. Control of gas inflows using drainage (and containment techniques), grouting of the ground and installation of tunnel liners to prevent gas inflow into the mine. However, managing the construction process through gassy ground is problematic, and may require the use of highly specialised techniques and equipment such as pressure face tunnelling techniques.

These civil engineering methods are particularly expensive and time consuming and would only be considered for use on critical tunnel developments that will be used for the life of the mining operation, if at all. Critically, to implement such methods effectively requires engineering design, and materials and equipment supply to be in place. Only then can the ground be successfully secured to allow tunnel advance to continue.

Impact of ground features on the shafts

The shaft complex is a critical item of major infrastructure and is in use for the duration of mining activities. Any ground stability issues encountered during shaft sinking and main access development are likely to be lifelong issues for the mine. Poor ground or water ingress associated with a fault in, or near, a shaft may require on-going remedial work for the life of the project. The impacts of this can be varied and can range from increased water flows in the mine, with the attendant water management issues and costs, to deteriorating shaft conditions which require regular repair throughout the life of the mine.Knowing the type of ground conditions through which a shaft is to be sunk is essential to the design of the shaft liner and shaft construction method. This obviously affects the construction time and cost, and may also constrain the design, for example the shaft diameter. Geotechnical assessments of possible shaft locations typically consist of at least one borehole down the centre line of each shaft as a minimum which is used for geotechnical and hydrogeological assessments. Seismic studies of the area may also be carried out.

The shaft design must ensure the verticality of the hoisting shaft over the life of the mine as this is essential for continued and safe operation. Skips with perhaps 30 tonnes of mineral travel at high speeds within a hoisting shaft and any deviations to their travel that arise from deformations in the shaft would result in undesirable swaying and lateral dynamic forces, as well as undue wear to the skips and their guides. Another factor is to ensure sufficient space for conveyances to pass by one another safely while travelling in the shaft. Ground movement in a shaft has potential to damage conveyances, supports and shaft furnishings and can compromise the safety of the shaft and hoisting system.

Safety Management when developing through poor ground

As previously discussed; major faulting is often associated with a number of challenging mining conditions which include fractured or friable rock and water and gas ingress. In addition to the risks posed to the business and major infrastructure which are discussed elsewhere; the process of tunnelling through major faults is more hazardous than normal mining operations. In these situations the chances of incidents occurring which could cause significant injury to employees or damage to equipment is elevated.

However, it is difficult to determine the ground conditions at the required accuracy from surface geological surveys, especially when the project is deep underground and spans an extensive area, and which may encounter complex geological structures. Carrying out the construction without sufficiently understanding the ground conditions may lead to small or large ground failures, and therefore, geotechnical assessment both prior to and during tunnel construction is necessary to understand ground conditions and to obtain adequate information for the construction.

Given all the above, and prior to mining, the characteristics of a rock mass are evaluated to determine the maximum permissible opening that can be developed, either with or without the installation of ground support elements, such as rockbolts or shotcrete. Rock masses have capacity to be self-supporting or stable when excavated at certain dimensions. This is known as the un-supported span, and it is time dependent; this being known as the “stand-up time”. More competent rock masses have a greater unsupported span and longer stand up time than a weak or more friable and broken rock mass; typically, wider spans in a particular rock type will have less stand-up time than more narrow spans in the same rock. During excavation the stand-up time is the critical period between breaking the rock and securing the excavation by installing ground support. Assessing these two factors is integral to establishing safe excavation design and implementing a safe construction method. This is particularly relevant when the un-supported span is small, and the stand-up time is short; and also when variable ground conditions are encountered. Further, a rock mass is weakened by the presence of water and in a high stress environment.

When ground conditions of the tunnel face are observed to change the tunnel excavation support or method can be adjusted to ensure the safety and quality of the tunnel construction. Cover drilling to locate geological discontinuities such as faults ahead of the tunnel face and other unpredicted geological structures is also required. Clearly, close supervision of tunnelling activities and on-going data collection and geotechnical assessment is a necessary component of safety management in tunnel construction.

The primary consideration of any mining operation is the immediate protection of employees engaged in developing this area. Any responsible mining company seeking to develop through major faults would need to establish specific procedures and processes in order to execute the work successfully.

Normal underground roof support measures would consist of roofbolts or longer cablebolts, surface support such as wire mesh pinned to the rock with rockbolts and sprayed liners such as shotcrete and fibre-reinforced shotcrete; all of which are designed to give strength to the excavation by reinforcing the in-situ rock and preventing deterioration of the rock mass. Depending on a particular rock mass and the associated excavation size and depth, ground support design may include some or all of the above ground support elements, or if conditions warranted it, the use of steel arches or concrete segments.

In badly faulted or weathered ground the unsupported span of an excavation and the rock mass stand-up time are greatly reduced. The size of the opening that can be made needs to be reduced sufficiently for the ground to be adequately secured after excavation. Mining dimensions are often designed for use of the development; this means that the width or height of the development can often not be altered. Therefore, the forward advance can be shortened and / or the tunnel face is excavated in a series of partial steps. This reduces tunnel advance rates and increases total costs.

In addition to the reduction of ground strength, major faulting can also be geo-technically active. Ground stress is inherent in all mining, but the risks associated with it can be exacerbated when working around faults, as the ground is already disturbed, and increases the potential for ground failure or deformation around the faulted area. These stresses can result in failure of the tunnel roof or sidewalls, floor heave and, in extreme cases, could result in tunnels being closed off entirely.

The presence of water or gas in faulted areas will increase difficulties associated with poor ground conditions as it weakens the rock mass and also increases the risk of inundation by gas or water that might result from accumulations within the fault or by connectivity through the fault to naturally formed underground water or gas reservoirs.

In order to develop through major faults and the associated disturbed zones, mine and tunnel design is required to mitigate an increased risk of:

- Roof and sidewalls failures as a result of less competent ground;
- Ground movement as a result of ground stress acting on the fault plane;
- Water inrush resulting in inundation and flooding; and or
- Gas inrush resulting in asphyxia and/ or an explosion.

Whilst these hazards, and the associated life threatening consequences, are present throughout the mine, major faults and disturbed zones adjacent to major faults are considered higher risk areas that require greater mitigation measures to prevent harm to employees working in the construction of tunnels in these areas.

Typically mines would employ specialist contractors experienced in this type of work, or would have a mine team dedicated to developing through faults, that are well trained in the conditions likely to be experienced. This training notwithstanding mining through major faults and the associated disturbed zones does represent an increased risk to the health and safety of mine employees and as such would not be undertaken unless there was a compelling reason to do so.

General comments

In general, due to the complexity and risk associated with mining through major features, it is considered best practice, where possible, to avoid a mine layout that requires a shaft or permanent access development through a major fault. If this is not possible, then a detailed characterisation of the rock is required to enable comprehensive planning for the excavation and support of access tunnels through the faulted zone. This will start with investigations from surface, but will require "…continuous evaluation of all data recorded during construction…" to "facilitate an optimisation of the tunnel construction, with specifically tailored support elements and excavation sequences adjusted to the behaviour of the rock mass in the fault zone. " (Schubert et al, 2006). This plan with its associated construction requirements, cost, inherent risk and chances of success would then be considered as part of the overall feasibility of the project.

In summary, while it is generally possible to mine in the vicinity, and in some cases through, major faults, this is typically done once a mine is established and has the ability to conduct extensive exploration from underground. When evaluating the location of mine head and shaft and future access to a mineable reserve, any reasonable mining company would seek to avoid such features not only for technical, economic and above all safety reasons but also because the need to negotiate such features would make the obtaining of funding for mine development harder to obtain.

5 ASSESSMENT OF SHORTLISTED MINEHEAD SITES

5.1 Introduction

The four alternative mine head sites to Doves Nest commented on in this section are the results of a comprehensive study for such undertaken by NLP on behalf of YPL.

Two of these sites are in the Cloughton area, one west of the village of Burniston and one west of the village of Cloughton; and two in the so called Whitby Enclave, one to the north, and the other to the northeast, of the village of Briggswath.

This section of the report describes each of these four sites and presents an assessment of the technical and economic implications of establishing a mine head at each of these locations rather than establishing a mine head at Doves Nest as currently proposed. In each case, this assessment draws upon the conclusions derived in the preceding sections of this reports, namely that:-

1. The only polyhalite mineralisation identified to date in the region that is sufficiently well explored to enable the reporting of a Mineral Resource and therefore has been delineated to the level of confidence required to justify a decision on the establishment of a mining operation is that reported by YPL in the north of its AOI.
2. While there are indications of the presence of polyhalite elsewhere, inclusive of the areas in which the proposed alternative sites are located, in no cases are the targets sufficiently promising to justify exploration at the current time and it is highly unlikely that any other exploration company would risk the expenditure required to commit to this in the foreseeable future or indeed that it would be able to raise the money required to fund this if required.
3. When accessing a shallow dipping tabular orebody at depth, the ideal situation is for the shaft to be located centrally within the Mineral Resource planned to be mined.
4. While it can be possible to mine in the vicinity, and in some cases through, major faults, a reasonable mining company when evaluating potential locations for a mine head and shaft would, for technical, economic and most importantly safety reasons, seek to avoid such features if at all possible.

5.2 Site Descriptions

5.2.1 Cloughton Area

General comments

The village of Cloughton is located approximately 16 km to the southeast of the Doves Nest site as shown in Figure 5-1. Figure 5-1 also shows the NYMNP boundary highlighted in blue, the Doves Nest site to the northwest of the image and the Cloughton sites to the southeast of the image (both highlighted in purple). Figure 5-2 shows the locations of the Cloughton Sites in more detail and Figure 5-3 the major structural features, in this case the faults that intersect the area.

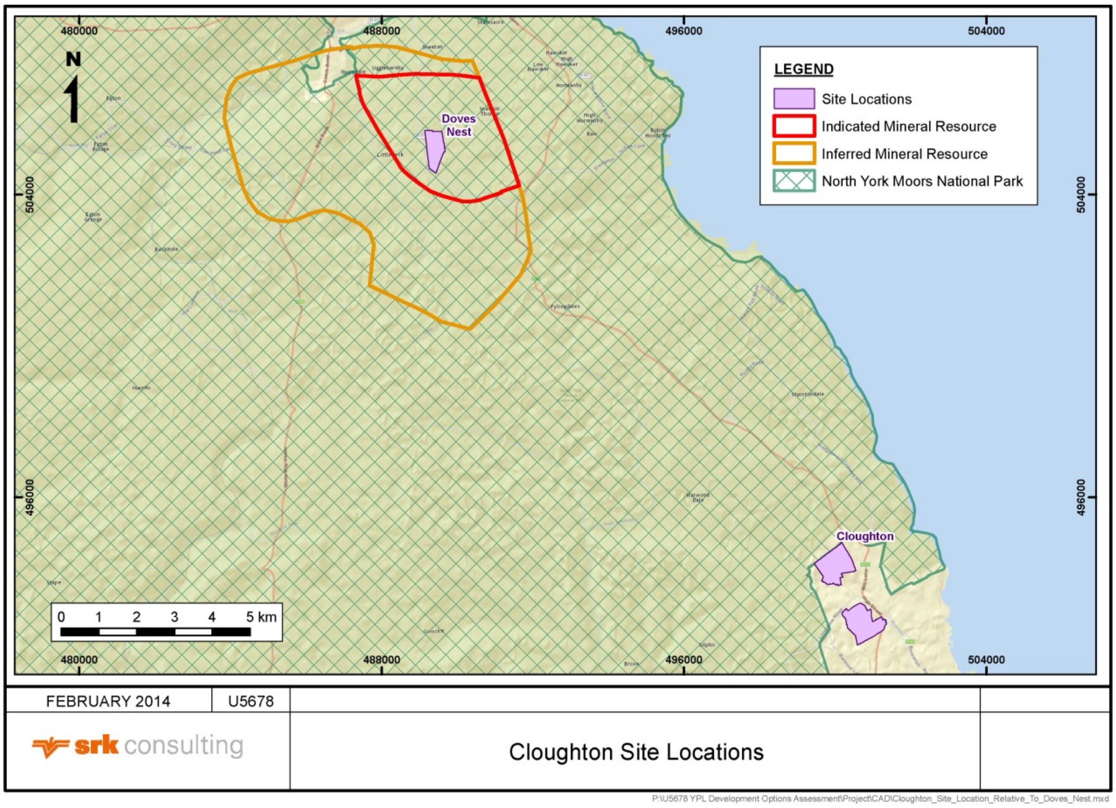

Figure 5-1: Cloughton site locations relative to the Doves nest site

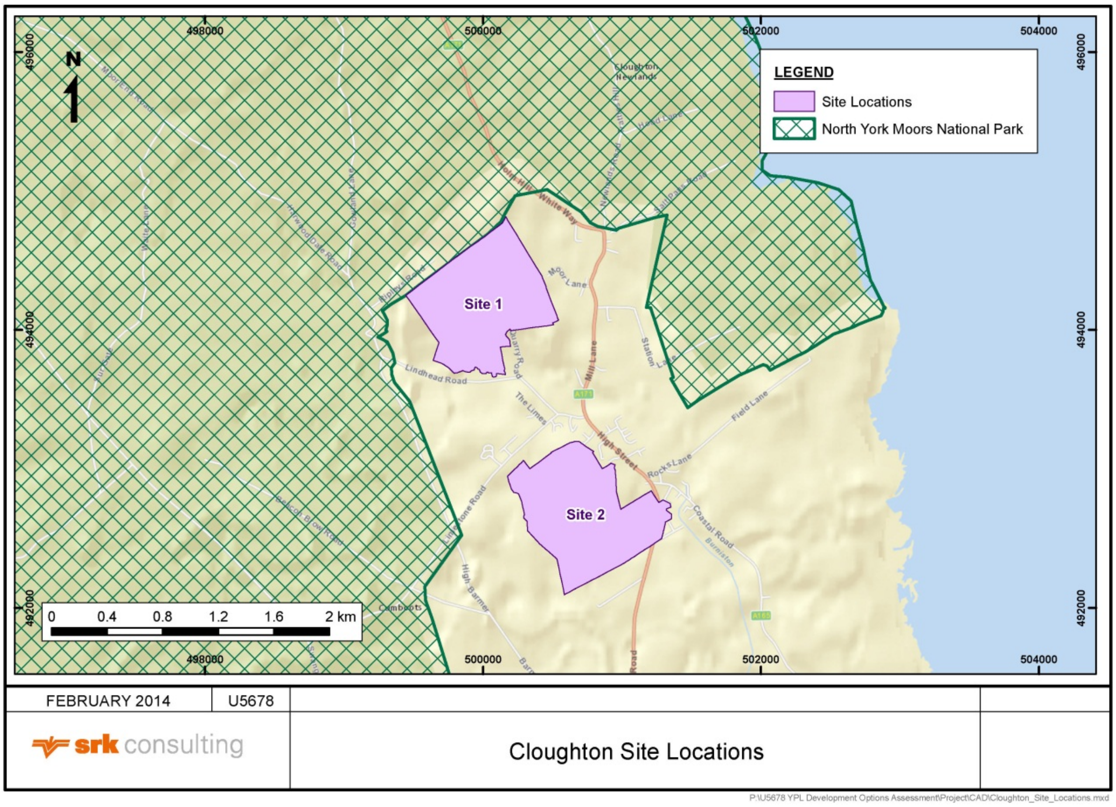

Figure 5-2: Cloughton sites in detail

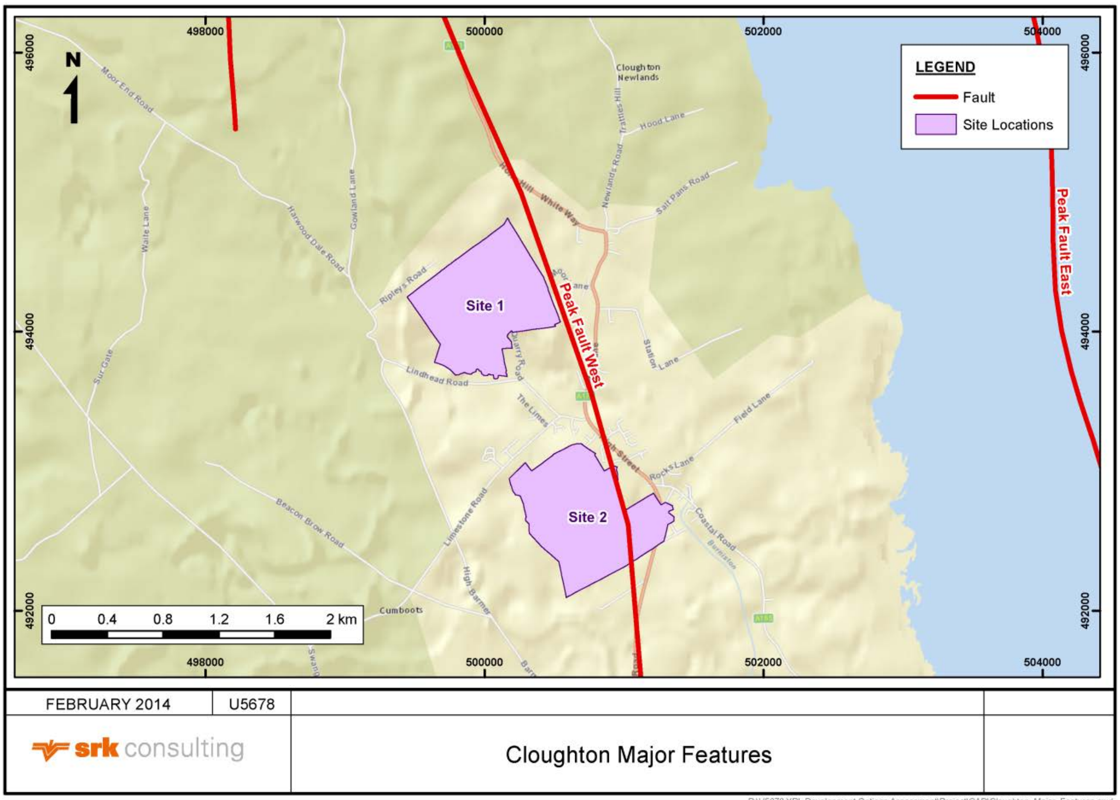

Figure 5-3: Major features in the vicinity of Cloughton

What is clear from Figure 5-1 is that the Cloughton sites are a significant distance from the YPL Mineral Resource area while Figure 5-3 shows the presence of a major fault system running approximately north-south in the Cloughton Area and in the vicinity of all of the sites proposed. This is the Peak Fault and its surface expression is shown in red in Figure 5-3 and is reasonably well constrained based on surface mapping carried out by the BGS. While the impact of this fault is likely to diminish as mining moves to the north and west towards the YPL Mineral Resource, simply because this feature moves further to the east, this development would still need to pass through the Whitby Fault which is another major fault system located to the north west between the Cloughton sites and the known Mineral Resource.

Potential for the exploitation of additional resources at Cloughton

Given the information presented in Section 3 of this report, the potential for the delineation of a Mineral Resource in this area is relatively low. While polyhalite has been demonstrated to be present this appears to be relatively thin and to occur in multiple bands - the continuity of which would be difficult to prove by drilling from surface. Notwithstanding this, in looking at the potential for establishing a mine head in this area, SRK has not only assumed that polyhalite will be intersected and that development towards the YPL Mineral Resource will be able to be advanced in this but also that should the exploration of the area prove successful the mine would commence mining this material as a priority. SRK has used this optimistic approach given that the distance from these sites to the YPL Mineral Resource is such that it would be inconceivable that any mining company acting reasonably would seek to access the YPL Mineral Resource from either of these sites.

Site 1 comments

Site 1 is immediately adjacent to, but outside of, the NYMNP boundary. The village of Cloughton lies to the east of the site and Burniston lies to the south. The site is relatively flat lying to the north and steepens to the south. The site is marginally further away from residential areas than Site 2 and is the closest to the YPL Mineral Resource so less development would be required compared to that needed for the other option.

Figure 5-4 below shows how the underground development and shaft infrastructure would need to be arranged in the immediate vicinity of the shaft in order to access the YPL Mineral Resource from this site.

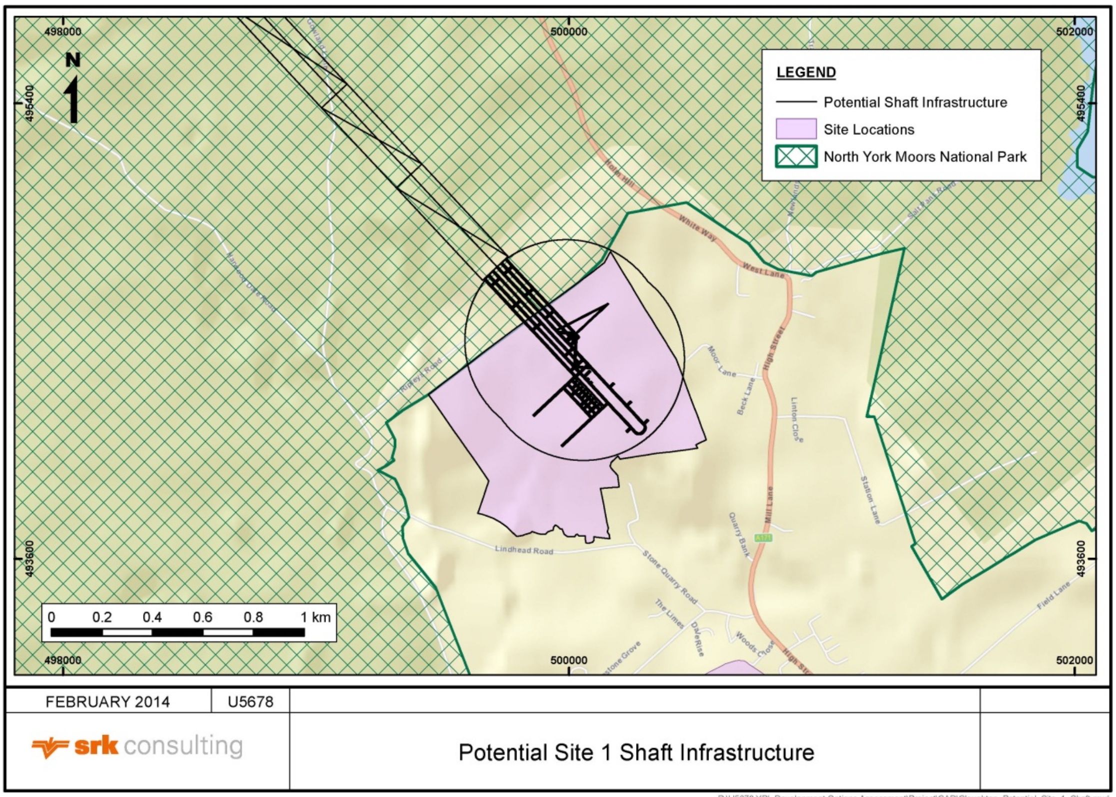

Figure 5-4: Potential Site 1 Shaft infrastructure layout

Site 2 comments

Site 2 is located immediately adjacent to the west of Burniston village and as such is surrounded by residential properties to the north and east. The site is relatively flat lying, climbing gently to the north and east.

Figure 5-5 below shows how the underground development and shaft infrastructure would need to be arranged in the immediate vicinity of the shaft in order to access the YPL Mineral Resource from this site. It is clear from this that in order to access the Mineral Resource from this site the development would need to pass directly underneath Site 1. The combination of proximity to residential properties and the further development required to access the Mineral Resource mean that site is less favourable than Site 1.

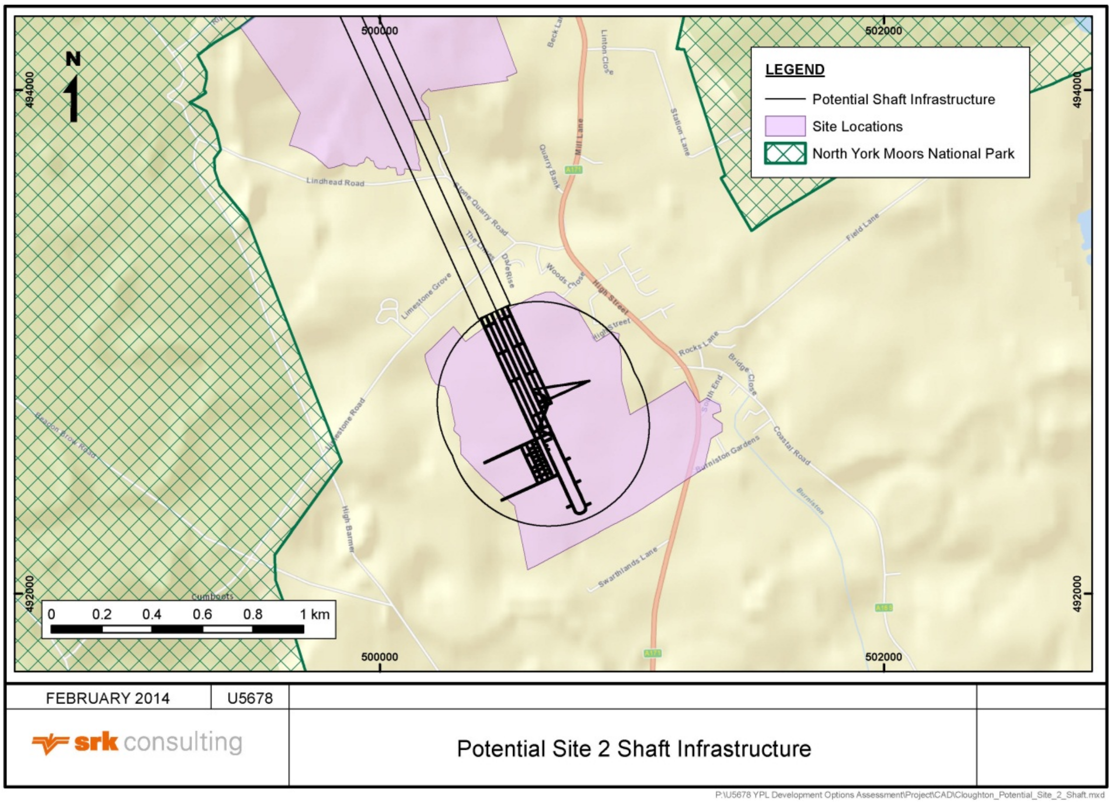

Figure 5-5: Site 2 Shaft Infrastructure layout

5.2.2 Whitby Enclave

General comments

The so-called Whitby Enclave is located approximately 5 km to the north of Doves Nest and adjacent to the town of Whitby. The Whitby Enclave is relatively densely populated and as such just two locations have sufficient surface footprint meet the mine's requirements. The sites, named Site 3 and Site 4 in this report, are located on opposite sides of the A169 trunk road, southwest of Whitby. Both are also clearly further from the YPL Mineral Resource than the Doves Nest site and would require more development to access than from this, though not as far away as the Cloughton sites.

Figure 5-6 below shows the Whitby Enclave sites in the northwest of the image relative to the Doves Nest site in the south. The NYMNP boundary is shown highlighted in blue. The town of Whitby is located to the northeast of the two sites. Figure 5-7 shows the main structural features in the area.

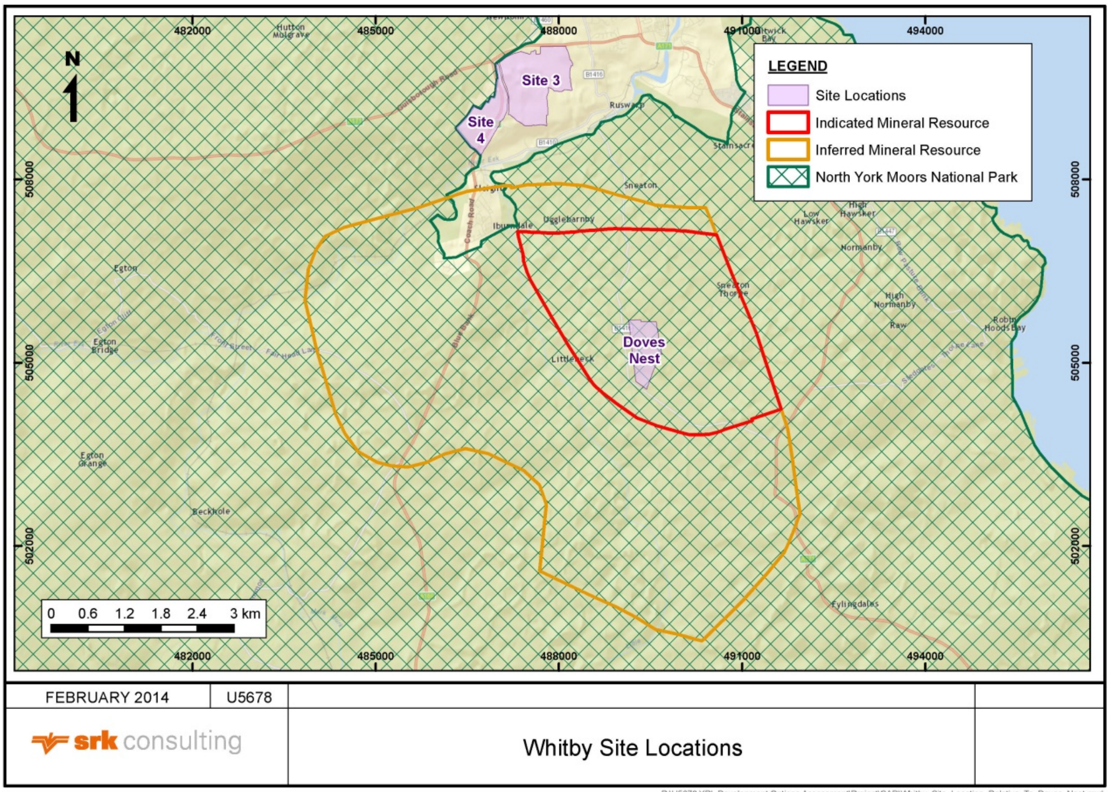

Figure 5-6: Whitby Enclave sites relative to the Doves Nest site

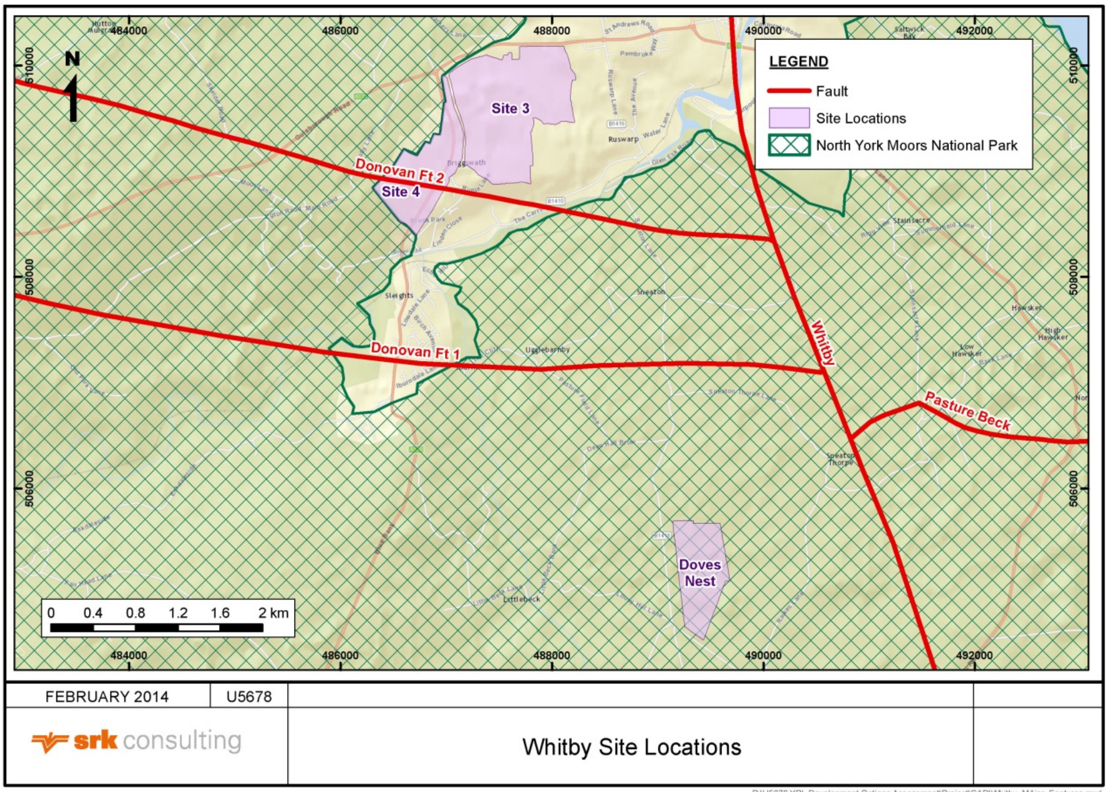

Figure 5-7: Faulting in the Whitby Enclave

Figure 5-7 shows the estimated vertical projection of the Donovan and Donovan 2 faults projected to surface. A 2D seismic survey of this area indicates that strata to the north of the Donovan Fault have been displaced downwards along the fault by approximately 150 m. While any shaft developed at these sites may not actually need to be developed through either of these faults they would certainly be in the near vicinity and any development put in place to access the known Mineral Resource would need to develop through these.

Potential for the exploitation of additional resources in the Whitby Enclave

In the case of the Whitby Enclave, and again based on the information presented in Section 3 of this report, it is possible that a drilling programme from surface could delineate a Mineral Resource in the immediate vicinity of the alternative site locations.

If this was the case then SRK would envisage a similar mining strategy to that planned at Doves Nest, i.e. the establishment of several mining areas radially around the shaft pillar. There are, however, some constraints to production areas at the Whitby Enclave site. Notably:

- The southern boundary of the Boulby Mine licence lies immediately to the north limiting mining in that area.
- That, as commented in Section 3 of this report, the rock strata between the Donovan Fault 1 and Donovan Fault 2 will likely be very disturbed which will not only increase the costs of mining but may have resulted in polyhalite mineralisation between these faults being significantly deformed to the extent that it does not occur as mineable units.

Given this, the need to access the YPL Mineral Resource through the Donovan Fault system would remain fundamental to the project’s success and this would require extensive assessment to be undertaken before the best way to negotiate this could be determined and the practicality and cost of doing this assessed and a decision on the viability of sinking a shaft in this area could be determined.

SRK’s assessment of the Whitby Enclave scenarios therefore assumes that a geotechnical study of this would need to be done, inclusive of drilling and possibly a seismic survey, in addition to the envisaged exploration drilling. While this might not delay the project, as its possible this could be done alongside the exploration drilling, it would certainly increase the costs and SRK’s assessment reflects this.

Site 3 Comments

Site 3 is located west of the outskirts of Whitby. The site is bounded to the north by the A171 and to the west by the A169 and as such can be considered to have good site access. The site is relatively flat and dips gently to the south. The southern edge of the site is bounded by a steeply dipping hillside and to the southwest is the village of Briggswath, which lies on the River Esk.

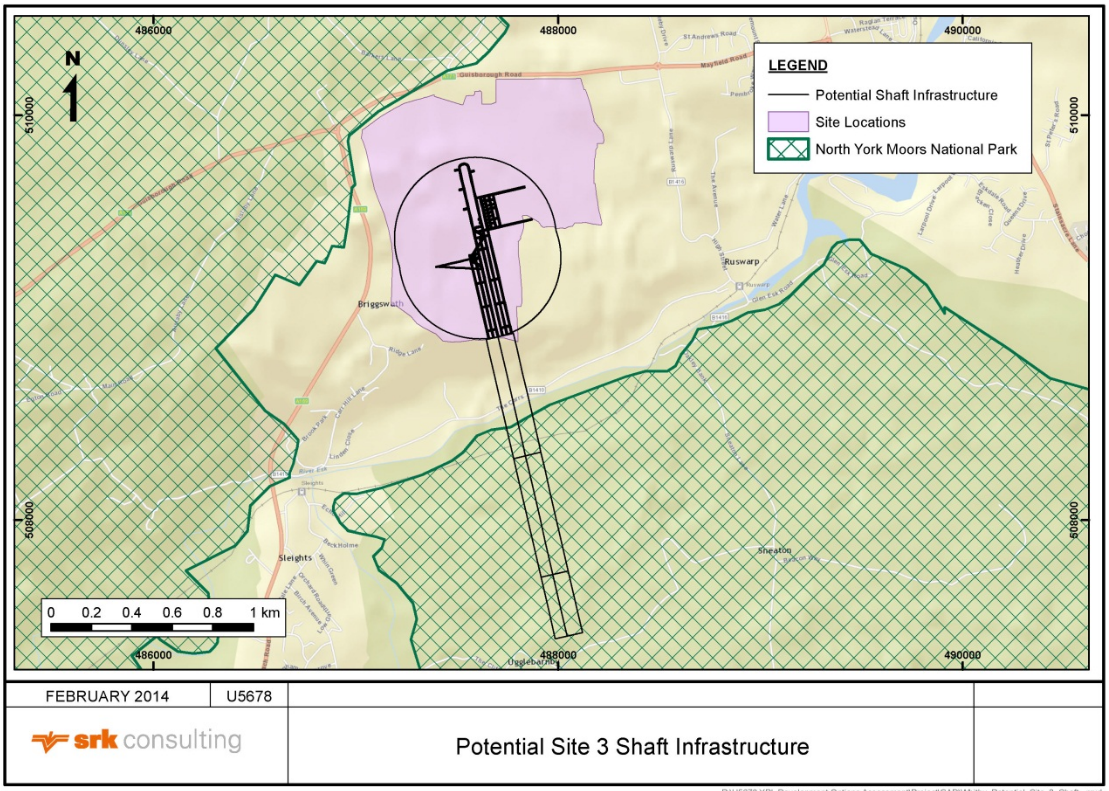

Figure 5-8: Site 3 Infrastructure

Site 4 Comments

Site 4 is located immediately adjacent and to the A169 northwest of the village of Briggswath (Figure 5-9). Mining development from Site 3 would pass directly underneath the road and the village of Briggswath.

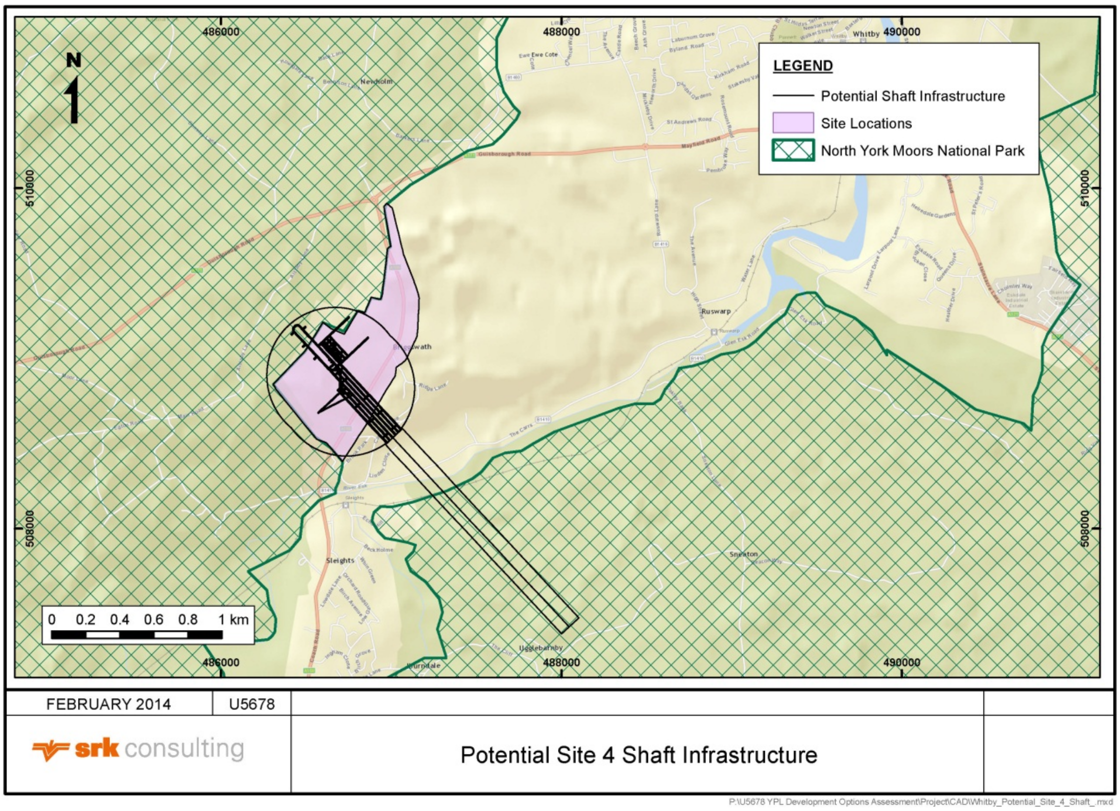

Figure 5-9: Site 4 Infrastructure

5.2.3 Summary Comments

In SRK's opinion of the two sites in the Cloughton area, Site 1 appears marginally more favourable than Site 2 as there would be less horizontal development required from the shaft to access the YPL Mineral Resource. Notwithstanding this, the horizontal development to access the YPL Mineral Resource from both Site 1 and 2 is significant.

With regards the sites in the Whitby Enclave, there is little to differentiate Site 3 and Site 4 in terms of location with respect to the already defined Mineral Resource as the development required to access the Mineral Resource is similar, as would be the depth to the Shelf Seam, assuming this is present in this area. Site 3 though has a larger available surface footprint and also the vertical projection of the Donovan 2 Fault runs through Site 4 and while this is not a major fault it would be preferential to avoid this if possible for the reasons outlined in Section 4.

For the purpose of its more detailed technical and economic comparison with the Doves Nest site presented later in this report therefore SRK has selected Site 1 as the most promising alternative site in the Cloughton area and Site 3 as the most promising site in the Whitby Enclave. For the reasons started in Section 4 of this report, however, both of these are clearly less attractive propositions than Doves Nest from a safety and a technical perspective as they are further away from the only Mineral Resource delineated to date, in more structurally complex areas and need to negotiate major faults to access this Mineral Resource.

As commented in Section 3 of this report, while there is potential for the occurrence of polyhalite in the vicinity of the all of the alternative sites proposed, SRK does not believe that this potential would justify the undertaking of an exploration programme to assess whether this was sufficient to justify the establishment of a mining operation. Having noted this, and as commented earlier in this section of the report, were a company required to establish a mine head in these sites to access the YPL Mineral Resource then any such company acting reasonably would explore for such prior to committing to the expenditure required to sink a shaft. This is particularly so given that these locations are all technically and economically less attractive than the proposed site at Doves Nest and bring significant additional safety concerns if the YPL Mineral Resource is required to be accessed to make the project economic.

5.3 Alternative Site Assessments

5.3.1 Introduction

This section presents SRK's technical assessment of what would be required in order to access the YPL Mineral Resource from all four sites, and to mine an undefined polyhalite resource near to the proposed shaft locations; an economic assessment of doing this for the most favoured site at each of the two locations and a comparison of the results of this with the technical and economic analysis already done by YPL for Doves Nest.

In order to make this comparison, SRK has planned the surface infrastructure required at each site and also the shaft and underground development required in each case which clearly varies from site to site. In doing this, SRK has planned the development in such a way so that if there is polyhalite mineralisation present between the shaft and the YPL Mineral Resource area, the development is placed within this such that the amount of waste material mined is minimised.

Further, while SRK has assumed that the primary intent of any mine development at these locations would be to access the Mineral Resource already delineated by YPL, as this is the only Mineral Resource delineated to date, SRK has also assumed that prior to any construction commencing, a programme of exploration and evaluation would be required such as has already conducted at Doves Nest. This reflects SRK's opinion that it would be inconceivable, given that these sites are further from the Mineral Resource than the proposed site at Doves Nest and therefore, given the observations made in Section 4 of this report, clearly less attractive from a safety and technical perspective, that any mining company acting reasonably would establish such without first exploring the potential of the immediate area to contain polyhalite mineralisation that could be mined using the same infrastructure.

Thus SRK has generated four scenarios for the development of the YPL Mineral Resource which it has compared from a technical perspective with the currently proposed Doves Nest site, and then two economic scenarios (for the best site in each area) which it has then compared with the economics of accessing this from Doves Nest.

5.3.2 Surface Footprint

The minimum surface footprint required for the construction phase and on-going use is a 40 ha site, such as that planned for Doves Nest, and this has been assumed to be the case for each site.

In addition, and for each site, SRK has identified a sensible shaft location using 3D topographic data and map images, the simple criteria being to locate the shaft as close as possible to the centre of each site and where the surface gradients on site were deemed to be suitable that would provide flexibility for future arrangement of site infrastructure and not unduly favour one site relative to another.

This work has been done at a conceptual level and for comparative purposes only. Were one of these four sites to actually be used then more detailed ground surveys and site engineering assessments and design would still be required to determine the optimal shaft location. Further, while the Doves Nest site has provided the basis for design, the amount of waste rock needed to be stored will be more for each of the four sites considered and the ability of the sites to handle this, and the surface impacts of this, would also require further investigation.

5.3.3 Assumed Mining target

The exploration and evaluation work undertaken by YPL to date has delineated an extensive tonnage of polyhalite mineralisation that has potential to be exploited in the north of the AOI comprising some 2,660 Mt of polyhalite mineralisation. Of this material some 820 Mt has been classified as an Indicated Mineral Resource.

YPL has also undertaken a PFS on the portion of Mineral Resource classified as Indicated (the minimum level of geological confidence from which an Ore Reserve can be declared) which has comprised extensive mine planning, mineral processing, infrastructure and environmental studies. These studies together have demonstrated that this Mineral Resource could support a viable mining project and enabled SRK to report a probable Ore Reserve of some 250Mt with a mean grade of 87.9% polyhalite.

The polyhalite within the AOI has been shown to occur in two separate roughly parallel seams, the Shelf Seam and the Basin Seam. The PFS has targeted the Shelf Seam in its mining plan as this is where the mineralisation has been shown to be of higher quality and continuity than elsewhere and sufficiently well delineated for the mineralisation to be reported as an Indicated Mineral Resource, which is the standard minimum geological requirement used to support the technical and economic studies necessary to declare the feasibility of extraction in a PFS.

Given the above, in order to determine the viability of the alternative site locations, SRK has assumed that the primary target for the development is the same as that targeted by the YPL PFS i.e. the Shelf Seam Mineral Resource.

5.3.4 Development Requirements

As commented in the introduction to this section, in developing its various development scenarios for the alternative site locations SRK has where possible taken account of the polyhalite potential in these areas. It should be noted though that while there is potential for this mineralisation to be present this may not be the case and there is no guarantee that the benefits assumed will be realised. SRK has taken this approach simply to limit the assumed amount of waste mining in each case and to give each scenario the best chance of having a favourable comparison with the Doves Nest site. The key assumptions SRK has made in this regard for each site are as follows.

Cloughton Area sites

SRK has used the 3D geological model and structural interpretation commented upon earlier in this report to estimate an approximate depth below surface the Basin Seam, the only potential mining target in this area as commented upon in Section 3 of this report, is likely to be intersected and this was then used to determine the depth to which a shaft located here would be sunk so as to enable it to access this horizon. The assumption was then that the development would proceed along this horizon towards the YPL Mineral Resource area but that at the point where it would then need to cross the Whitby fault, it would transition from the Basin Seam to the Shelf Seam (thereby minimising the extent of the development that would be in waste material). Negotiating this transition zone would likely require tunnelling through approximately 600 m of non-mineralised strata with poor ground conditions, with consequent increases in cost.

Before committing to sinking a shaft at Cloughton, and given the comments in Section 4 of this report, prior to mining through the Whitby Fault an investigation would need to be undertaken to characterise the rock mass in and around the fault, so that a plan to negotiate this fault could be made. This would include a drilling programme from surface of at least three and possibly more holes, and may include a seismic survey.

All of the above have been taken account of as part of SRK's technical and economic assessment of developing the Cloughton Area sites.

Whitby Enclave Site

Using a similar approach to that used for the Cloughton site, SRK used its 3D geological model to determine the approximate depth of the Shelf Seam, this being the best mining target in this area as commented upon in Section 3 of this report, so as to estimate the depth to which the shaft would need to be sunk. It was then assumed that development would proceed to the south to access the YPL Mineral Resource which in this case would require negotiating the Donovan Fault and the splay to the north from this.

As with the Whitby fault, an investigation would need to be undertaken to characterise the rock mass in and around the Donovan Fault, so that a plan to negotiate this fault could be made. This would include a drilling programme from surface of at least three, and probably up to six holes and may include a seismic survey. This work would need to be conducted on the south side of the Esk valley, west of Briggswath. SRK considers that it would be inappropriate for any mining company to commit to such a project and commence shaft construction until such a study had been completed. This study would likely comprise planning, permitting and completion of the drillholes, assessing the results of the investigation and developing of a mining plan. This would likely in the order of three years assuming appropriate permits could be obtained and would result in a plan involving a significant amount of additional work to ensure that any development remains stable.

SRK's technical and economic assessment of accessing the Mineral Resource from the Whitby Enclave sites allows for the cost and time incurred in undertaking this work as well as the development required to reach the mining area.

5.3.5 Mining/Surface infrastructure assumptions

SRK has assessed the excavation volumes required for the construction and pre-production development for the four sites selected and also the change in length of the material transport system required to convey the mined ore to the port at Teesside once at surface.

To further compare the two preferred sites, Cloughton Area Site 1 and the Whitby Enclave Site 3, the following assumptions were also made:

- Modified shaft bottom infrastructure layouts to take into account that mining would only take place in one direction from the shaft bottom.
- As demonstrated by the PFS, the need to develop five underground roadways in order to provide sufficient cross-sectional area to efficiently move the required volume of air from the shaft bottom area to ventilate the workings. This would comprise two air intake air roadways and three return air roadways.
- Excavation within the shaft pillar for permanent mine infrastructure such as the materials handling system, workshops, stores and welfare facilities that support mining activities is common for all the alternatives and would follow the Base Case schedule and cost.
- For the purpose of developing access from the alternative sites to the Mineral Resource, SRK has assumed a best and worst case scenarios: namely, that the Basin Seam from the Cloughton, and the Shelf Seam, from the Whitby Enclave sites, is at best, continuous and provides the same polyhalite quality as in the Mineral Resource which can be processed and sold; and at worst would need to be developed in waste material that would be stored on surface.
- On the basis that mineralisation of sufficient grade and continuity is found at the alternative sites, mining production would commence from these locations prior to access development and exploitation of the Mineral Resource.

The mine development layouts have been developed for each option to reflect the above assumptions and used to derive the quantities that are summarised in Table 5-1.

5.3.6 Technical comparison summary

Table 5-1 compares the physicals (development metres and ore and waste generation) from the Cloughton and Whitby Enclave sites with Doves Nest, and shows the potential range in these.

With current plans there is insufficient capacity in the waste dump design at Doves Nest to accommodate all the waste material from the shaft sinking, underground development, the first 6 km of the Material Transport System and other surface excavations that is assumed to be stored there. SRK assumes a plan will be developed to store the waste material elsewhere. This might include temporary storage at Doves Nest before transport off site – potentially by using the MTS facility.

Table 5-2 provides a qualitative technical assessment of Site 1 and Site 3 with the site at Doves Nest based on the Best Case options for the two alternative sites.

The following assumptions were made in undertaking this analysis:-

- The Mineral Transport System MTS) is planned to be excavated at 6.0 m diameter. It is assumed that the waste generated from the first 6 km section of tunnel excavated from the site towards Teesside will be stored at the mine head. The remaining waste volumes from the MTS will be removed from the tunnel at access points along the tunnels length, and stored elsewhere.
- Material extracted from the shaft is based on two shafts, each having an excavated diameter of 9.0 m.
- A bulking factor of 1.3 has been applied to the waste volumes extracted to estimate required dump volume.
- The best case scenarios for the Cloughton and Whitby Enclave sites assume that access development from the shaft to the Indicated Resource is within polyhalite that yields saleable quality mineral, which does not need to be stored on site.
- The worst case scenarios for the Cloughton and Whitby Enclave sites assume that access development from the shaft to the Indicated Resource yields un-saleable waste material that is required to be stored on site.

Table 5-1: Physicals for Site 1 and Site 3 compared with Doves Nest

		Doves Nest	Cloughton		Whitby Enclave	
	Material type		Site 1		Site 3	
		Base Case	Best Case	Worst Case	Best Case	Worst Case
Shaft depth (m)		1,540	1,680	1,680	1,520	1,520
Mineral Transport System for 6km excavation (m^3)	Waste	256,140	256,140	256,140	256,140	256,140
Material extracted from shafts (m^3)	Shelf	10,900			4,500	
	Basin		11,000			
	Waste	364,610	411,490	422,490	423,660	428,160
Shaft Bottom development (m^3)	Shelf	207,400			202,100	
	Basin		240,800			
	Waste	60,900		240,800	35,800	237,900
Access development to Indicated Resource (m^3)	Shelf		650,500		187,500	
	Basin		3,143,700			
	Waste		193,400	3,987,600	284,000	471,500
Total Material Extracted (m^3)	**Total**	**899,950**	**4,907,030**	**4,907,030**	**1,393,600**	**1,393,700**
Waste extracted (m^3)	**waste**	**681,650**	**861,030**	**4,907,030**	**999,600**	**1,393,700**
Mineral extracted (m^3)	**mineral**	**218,300**	**4,046,000**		**394,100**	
Waste transported off site (unbulked) (m^3)	Waste	102,430	102,430	102,430	102,430	102,430
Waste Stored on site (unbulked) (m^3)	Waste	579,210	758,600	4,804,600	897,170	1,291,270
Required dump volume for bulk waste (m^3)	**Waste**	**752,970**	**986,180**	**6,245,980**	**1,166,320**	**1,678,650**

Table 5-2: Qualitative comparisons of alternative shaft location options with Doves Nest

Assessment Criteria	Doves Nest	Cloughton (Site One)	Whitby Enclave (Site Three)
Shaft Depth	**1,540m**	**1,680m (9%)**	**1520m (-2%)**
	The shaft depths are similar and although final hoisting design will need to accommodate technical issues such as winding speed and skip capacity, it is not expected to make a material difference to the technical design of each location.		
Headframe arrangement	The sunken headframe concept, which has been adopted to mitigate the surface impact of the mining infrastructure, will be adopted across all three sites. This concept adds complexity to the design which will make this option more expensive and take longer to construct than conventional mine headframe and hoisting arrangement. Different topographical, hydrological and geotechnical conditions between the sites will alter their construction cost and schedule, but this cannot be assessed at this stage, and so is assumed to be the same between the sites.		
Site topography and ground conditions	Ground conditions are believed to be hard and competent. The rock mass will require substantial excavation for mine facilities.	Unknown ground conditions, so considered neither better nor worse.	Potentially favourable topography with an elevation difference that might facilitate construction of the sunken headframe by enabling access into the hill side.
Shaft construction		The proximity of residences may limit the construction activities for example: blasting times, working time, and on-off site traffic movements.	
Access development distances from shaft bottom to Ore Reserve panels	**400m** Production panels are located adjacent to the shaft protection pillar	**13,200m (+3,200%)** A five roadway drift totalling 66km of tunnel heading northwest beyond the shaft pillar is required to access the Mineral Resource. Additional means of egress and provision of new intake ventilation to mitigate the long distances will require a third shaft located in the NYMNP.	**1,900m (+375%)** Development distances to the Mineral Resource are acceptable with respect to mine ventilation and second means of egress.
Excavation volume of polyhalite to access the Ore Reserve	**218,300m^3** This is located in the Shelf Seam and is identified as saleable material	**4,046,000m^3** This is located in both the Shelf and Basin Seam and reflects the Best Case.	**394,100m^3** This is located in the Shelf Seam and reflects the Best Case
Total waste excavation required to reach Mining Target (including shaft)	**425,510m^3** As the shaft is sunk into polyhalite mineralisation there is limited waste development required at the shaft bottom.	**1) 604,890m^3** Best case assumes that all material developed in the Basin Seam from the shaft location to the Ore Reserve is saleable. **2) 4,650,890m^3** Worst case assumes that all material developed in the Basin Seam from the shaft location to the reserve is unsalable and has to be stored as waste.	**1) 743,460m3** Best case assumes all material developed in the Shelf Seam from the shaft location to the Ore Reserve is saleable. **2) 1,137,560m^3** Worst case assumes all development from the shaft location to the Ore Reserve is unsaleable and has to be stored as waste.
Pre-construction activities	**12 months**	**59 months**	**47 months**

	Shaft geotechnical and hydrogeological assessment followed by shaft design.	Shaft geotechnical and hydrogeological assessment followed by shaft design Mineral Resource drilling of Exploration Potential. Geotechnical investigation of Whitby fault.	Shaft geotechnical and hydrogeological assessment followed by shaft design Mineral Resource drilling of Exploration Potential. Geotechnical investigation of Donovan fault.
Construction period to reach shaft bottom	**36 months** Surface construction and shaft sinking and shaft equipping to enable hoisting	**36 months** Surface construction and shaft sinking and shaft equipping to enable hoisting	**36 months** Surface construction and shaft sinking and shaft equipping to enable hoisting
Access development to the Mineral Resource	**0 months**	**67 months** Additional access to workings areas is a major undertaking. that would significantly add to the cost and timeframe to access the Mineral Resource. Specific men and materials handling infrastructure will be required to service the mine over these long distances.	**9 months** Additional access to production panels is required through the Donovan fault. There is potential to require significant work to secure access through the fault and may involve delays of several months for potential water management and ground control measures to be installed. Long term stability of the fault and survivability of the roadways passing through it with respect to seismic activity will need to be considered. Mining between the faults could potentially go through poor overlying strata rather than the more competent Fordham evaporite sequence further compounding the delays and costs.
Total period to access mineralisation	**4 years**	Best case: mineral resources discovered at the shaft location: **8 years** Worst case: mineral resources not discovered at the shaft location **13-14 years**	Best case: mineral resources discovered at the shaft location: **7 years** Worst case: mineral resources not discovered at the shaft location **8 years**

Exploration potential	Basin Seam is not currently targeted but is present at depth. However, the area with the greatest exploration potential lies in the Shelf Seam immediately west of Doves Nest and is adjacent to classified Mineral Resource. . The area would be explored from underground as there is limited access for surface drilling from the overlying moorland.	The Basin Seam is considered to be the principal exploration target. It is thought that the access development would be within the Basin Seam, although the presence, grade, continuity and extent of mineralisation is not known. Drilling from surface would be required to explore for Mineral Resources. The access roadways would provide the platform for an underground exploration corridor that is perhaps 2 km wide.	There is some exploration potential for polyhalite on the northern side of the Donovan fault but this is limited as CPL/YPL licence area Boundary is located immediately to the north of the shaft location. Drilling from surface would be required to explore for Mineral Resources in this area.
Construction risk arising from access location		Development through 13 km of ground with unknown ground conditions will provide significant construction risk. Mitigation measures will require a number of test holes drilled from surface. Access development crosses the Whitby fault which could present potential hydrogeological, water ingress, gas ingress and stability risk during construction. Mitigation measures will require a test holes drilled from surface.	Access development crosses the major Donovan fault which could present potential hydrogeological, water ingress, gas ingress and stability risk during construction. Mitigation measures will require a test holes drilled from surface.
Operational risk arising from access location		Long travel times reduce available working time. Mine operating costs are increased as a result of additional time, power and infrastructure required for movement of men and materials. Extended distances travelled underground increases personnel exposure to accident. Ground instability arising from re-activation of the Whitby fault would need to be assessed and appropriate controls put in place.	The risk of ground instability at the Donovan fault arising movement as a result of future seismic activity causing accesses to become blocked would need to be assessed. Control measures would need to be implemented to minimise risk to workers.
Additional ventilation infrastructure (required when working areas are some 6-7km from the intake shaft)	An additional ventilation shaft is not required by the current mine plan. An additional shaft will be required to extract Mineral Resources not currently converted to Ore Reserves.	An additional ventilation shaft located in the NYMNP will be required in order to extract the current Ore Reserve as these workings will be too distant from the intake and return air shafts at the mine head for effective ventilation. This is a consequence of air volume losses due to leakage between intake and return air roadways, and an increase in air temperature that arises from moving air over long distances.	

Length of Mineral Transport System (MTS)	**36.5km** Route to Teesside is defined.	**52.0km** This assumes that Teesside port facility would remain the preferred option for a shaft located at Cloughton, which is consistent with the information presented in the Alternative Site Assessment prepared by NLP. This new route would require new design and planning permission and ventilation/access shafts in the NYMNP for construction and operation of the MTS.	**34km** This assumes the route avoids Boulby Mine and goes via Ladycross Plantation.
Waste disposal requirements	579,210 m^3 of waste storage capacity is required for shaft and underground mine development and the first 6km of the MTS. Additional waste storage from surface excavations is also expected.	Between 758,600 and 4,804,600 m^3 of waste storage volume estimated for shaft and underground mine development and 6km of MTS excavation. Additional waste storage from surface excavations is also expected.	Between 879,170 and 1,291,270 m^3 of waste storage volume estimated for shaft and underground mine development and 6km of MTS excavation. Additional waste storage from surface excavations is also expected.

SRK's overall summary of the information contained in this table is that both of the alternative sites have significant disadvantages compared with Doves Nest and that while the Whitby Enclave has some advantages, overall the disadvantages outweigh these.

5.3.7 Economic comparison

Pre-Development Activities

To compare the Cloughton and Whitby Enclave locations with Doves Nest, SRK has outlined a series of work programmes that would need to be completed at the two alternative sites to enable construction to commence at those sites. Obviously Doves Nest is the most advance and would take the least time and cost less to compete.

At Cloughton and Whitby Enclave the first phase would be to explore for polyhalite so that a Mineral Resource might be delineated, and if so, then conduct technical studies to establish an Ore Reserve, if possible.

Exploration drilling comprising a series of parent holes and daughters holes will be drilled to find and describe the presence and extent of polyhalite, if any. Geotechnical drill holes will be drilled to assess rock mass characteristics in areas that will be excavated, for example access shafts from surface to the polyhalite horizon and when developing through faults.

Engineering design for the shaft infrastructure needs to be completed at all three sites.

Table 5-3 below indicates the timeframe SRK estimate would be needed to complete the above work. In this schedule SRK has assumed that:-

- The time taken to drill an exploration drillhole parent hole is 75 days.
- The time taken to drill a daughter hole from an exploration drill hole is 30 days.
- Around ten parent and five daughter holes would be required for Mineral Resource drilling at Cloughton.
- A minimum of five parent and five daughter holes would be required for Mineral Resource drilling at Whitby Enclave.
- Three geotechnical holes and a seismic study would be required to assess each fault that would be traversed, the Donovan Fault in the case of the Whitby Enclave site and the Whitby Fault in the case of the Cloughton site.
- A minimum of one geotechnical hole would be required at each shaft location. A second hole would likely also be required.
- Each geotechnical hole is scheduled to take 75 days to drill.
- There would be a three month lead time following planning permission before the first drill can commence work on new sites.
- There would be a six month period following completion of the last drillhole to conclude Mineral Resource Estimation and technical studies.
- Shaft geotechnical drilling and engineering studies at Cloughton and Whitby Enclave would not commence until a Mineral Resource of sufficient size was demonstrated.
- Shaft geotechnical drilling and the investigation into the Donovan and Whitby faults could be conducted concurrently.

- A three month period will be required on conclusion of site investigations and detailed engineering to finalise the project design and prepare for construction.

Table 5-3: Estimated pre-construction timeframe for alternative sites from receipt of planning permission, compared with Doves Nest

Description	Critical Path	Doves Nest	Cloughton	Whitby Enclave
Exploration Activities to June 2014				
	(months)	48		
Mineral Resource and Ore Reserve Definition				
Identify drilling sites and obtain planning permission for drills (1)	(months)	Na	3	3
Drilling programme	(months)	Na	30	18
Data Analysis, Mineral Resource Estimation and technical studies	(months)	Na	6	6
Complete Engineering				
Conduct shaft geotechnical drilling (2)	(months)	5	5	5
Detailed engineering design and scheduling for the shaft complex	(months)	9	9	9
Conduct investigations on regional fault (3)	(months)	Na	8	8
Detailed engineering design of excavation across Donovan / Whitby Fault (4)	(months)	Na	6	6
Final engineering design	(months)	3	3	3
Pre-construction period time frame	**(months)**	**12**	**59**	**47**

1. *Initial lead time before drilling commences, on-going drill site planning and permitting will occur concurrently with drilling.*
2. *Undertaken concurrently with detailed engineering.*
3. *Programme could be conducted during the Resource drilling programme, but likely to utilise the same equipment, so extending the programme.*
4. *Conducted in parallel with other engineering programmes so not extending programme.*

What is apparent from the above assessment is that the likely elapsed time between the commencement of the required work and the point at which the viability of establishing a shaft at the alternative sites could be determined in both alternative cases is significant when compared to that for the current site at Doves Nest.

Pre-Development Costs

SRK has estimated a cost for works that would be required to develop each of the above three scenarios to the same point at which a decision on development could be made and this is summarised in Table 5-3 below.

The cost assumptions used by SRK for this analysis are as follows:

- Drilling costs are based on YPL actual costs to date, which are GBP 2.4 million per parent hole and GBP 0.62 million per daughter hole.
- A 10% contingency is added to Cloughton drilling costs due to the wide extent of ground being drilled and potential for more variable conditions.
- Direct costs for identification and obtaining planning permission estimated to be in the order of GBP 40,000 per site.

- Order of magnitude engineering study costs (±50%).
- Annual in-direct costs for the operation of the Sirius Minerals organisation GBP 9.5M per year for land costs to maintain option agreements with land owners; employee and office costs (Scarborough) which includes property, IT support and staffing; and, corporate overheads for corporate development, investor relations and external affairs, legal, finance, and senior management employment costs.
- It should be noted that the exploration drilling costs derived for Cloughton and Whitby Enclave only assume that the immediate areas of these would be explored, as would naturally be the case if shafts were developed in these areas. In fact, neither would be developed in practice had the Mineral Resource in the vicinity of Doves Nest not already been delineated by YPL. The costs in the table therefore relate to exploration and assessment work that would be undertaken from this point onwards and not the true cost of exploration/assessment that would have been required for these options if considered on a standalone basis which would be significantly more.

Table 5-4: Estimated pre-construction costs compared with Doves Nest

Description	Unit	Doves Nest	Cloughton	Whitby Enclave
Exploration Activities to June 2014				
	(GBP million)	60		
Declare Mineral Resources and Ore Reserves				
Identify drilling sites and obtain planning permission for drills	(GBP million)		0.4	0.1
Drilling programme	(GBP million)		30.0	17.0
Data Analysis, Mineral Resource Estimation and technical studies (1)	(GBP million)		2.0	1.0
Complete Engineering				
Conduct shaft geotechnical drilling	(GBP million)	4.8	4.8	4.8
Detailed engineering design and scheduling for the shaft complex	(GBP million)	2.0	2.0	2.0
Conduct investigations on regional faults	(GBP million)		9.2	9.2
Detailed engineering design of excavation across regional faults	(GBP million)		1.0	1.0
Final engineering study (2)	(GBP million)	2.0	2.0	2.5
Pre-construction period time frame		**12 months**	**59 months**	**47 months**
Sirius Minerals in-direct expenditure	(GBP million)	10	48	38
Total estimated pre-construction expenditure	**(GBP million)**	**19**	**99**	**76**

1. *Fewer exploration drill holes will reduce the extent of engineering studies possible at the Whitby Enclave hence the reduced cost assumed for this site.*
2. *The Whitby Enclave being located close to Whitby and the associated higher population density and levels of activity around the site will probably require additional or more extensive assessment of engineering aspects and controls hence the higher cost for this option.*

5.3.8 Summary comments

It is SRK's opinion there is no advantage gained in accessing the existing known Mineral Resource from either Whitby Enclave or Cloughton and that given this, any exploration or mining investment at these alternative sites would need to be for the purposes of delimitating a Mineral Resource at these locations.

It is however clear from the above assessment that all of the alternative sites require a significant amount more work to be done in order for the viability of a shaft to be assessed than remains the case at Doves Nest. This will require significant amount of additional expenditure at either the Cloughton or Whitby Enclave alternatives with, as commented earlier in this report, no guarantee of success in defining a Mineral Resource at these locations, or of developing a viable mine plan based on Indicated Mineral Resources sufficient to declare an Ore Reserve that would enable the company to raise capital for the project from the investment market.

It is therefore unrealistic to expect that any exploration or mining company would risk the expenditure required to commit to the exploration and development work required to assess the merits of establishing a mine head at either of these locations at the present time, or indeed in the foreseeable future, or that it would be able to raise the funds to do so if required.

5.3.9 Technical risks

SRK's comparison of the alternative sites presented in the above sections takes account of the work that would need to be undertaken to assess these sites and develop mine heads at these but assumes that ultimately this work will be positive. There is a high risk however that this will not be the case and it should therefore be noted that all of these sites have additional risks associated with them not directly reflected in SRK's comparison. The nature of these risks is summarised below.

Cloughton

1. **Geological knowledge**

   The geological information available means that it is unlikely it will be possible to define a Mineral Resource in the area. Whilst there is exploration potential for Polyhalite, the presence of mineral can only be confirmed by drilling. It is therefore possible that SRK's assumption that it will be possible to develop along the Basin Seam horizon is optimistic.

2. **Geotechnical knowledge**

   There is a gap in the understanding of likely mining conditions. In order for a detailed engineering design to be applied, pilot drilling would be required for the shaft and access development. While SRK has allowed for the time and cost of this, it is possible that this will reveal ground conditions that render the proposal inappropriate.

3. Underground access development

The requirement for some 13 km of access development at around 1,500 m below ground level to access the current Mineral Resource, through largely unknown ground conditions, presents substantial risk that the access will not be completed within budgeted cost and to schedule. A tunnel at this depth presents significant engineering challenges including: preclusion of significant pre-construction site investigation along its length; and provision of emergency controls and escape methods during construction and operation.

4. Pre-production construction period

The total pre-production construction period of around 13 years including pre-construction works and shaft sinking (although mineral may well be produced during access development). In SRK's opinion, this will exclude many investors from participation in this project and make financing any mine extremely difficult if not impossible.

5. Additional ventilation shaft required

Ventilating air traveling long distances underground is heated by the surrounding rock and operating equipment which reduces its ability to provide sufficient cooling to mine operations. A ventilation intake shaft will be required in close proximity to the mining area, which would put it within the boundaries of the NYMNP to provide suitable mine ventilation.

6. Whitby Fault

Development of an access through the Whitby Fault could present significant technical and operational challenges to the mine. Hazards associated with mining through major faults as previously discussed, include the inflow of water, inrush of gases and poor ground conditions that result from weak and fractured rock.

The location of the Whitby Fault has been interpreted from surface mapping and seismic data. The pervasiveness, position and condition of the ground in the fault zone at the mining horizon is speculative in the absence of any specific investigative drilling. Consequently the impact of the fault on mine development could vary between, no effective delay to mining to very serious delays that might extend over several months or which could even lead to abandonment.

7. Peak Fault

The presence of the Peak Fault in the Cloughton region presents a potential technical challenge to the development of a shaft in this area. Whilst the fault is interpreted to outcrop to the east of Site 1, the magnitude of the impact zone of the fault is unknown. Geotechnical investigations would be required to establish the shaft design and construction method.

Whitby Enclave

1. Geological knowledge

There is currently a gap in the geological knowledge at the site location. Whilst the potential exists for there to be polyhalite present, this is currently unknown.

2. **Pre-production construction period**

   Although the construction delays in the Whitby Enclave are not likely to be as significant as those encountered from the Cloughton sites, this does not include provision for any delays that may be encountered in securing the appropriate permissions and land access issues that may arise.

3. **Donovan Fault**

   Development to the current Indicated Resource from the Whitby Enclave will entail development of tunnels through the Donovan fault. This will present similar challenges to mining as the Whitby Fault will from Cloughton, and includes the increased potential for water inflow, gas inundation or poor ground conditions as previously discussed.

   As with the Whitby Fault, the location of the Donovan fault has been interpreted from surface mapping and seismic data. The pervasiveness, position and condition of the ground in the fault zone at the mining horizon is speculative in the absence of any specific investigative drilling. Consequently the impact of the fault on mine development could vary between, an additional delay to the mining plan to incorporate control measures and appropriate responses to different conditions, to very serious delays that might extend over several months or which could even lead to abandonment.

Summary

There are significant risks in committing to a programme of additional work to establish the viability of establishing a mine head at any of the alternative sites as while it is possible to plan the work needed to be done based on the information already available, it is not possible to predict the results of this. There is therefore a high risk that on completion of this work and having spent a significant amount of additional money over a significant additional period that the results will demonstrate that establishing a mine head in these locations is not viable strengthening SRK's opinion that it would be unrealistic to expect any exploration or mining company to risk the expenditure required to commit to such investigation in the foreseeable future or indeed that it would be able to raise the money required to fund this if needed.

5.3.10 Summary Comments

Of the four sites proposed by NLP, two of these, one at the Whitby Enclave and one at Cloughton, were selected by SRK for further assessment as alternative sites to Doves Nest.

Both of these sites present technical challenges to the development of the project. In particular the lack of a defined Mineral Resource in the immediate area of the alternative sites would require an exploration programme to be conducted before the viability of either could be properly assessed. Both areas have exploration potential identified, but they are constrained geologically and, in the case the Whitby Enclave site, by the Boulby lease boundary. This means that as well as the presence, continuity and quality of mineralisation not being proven, there is an expectation the quantity available to mine from these areas would be less than is possible from the Doves Nest site. Certainly, geologically, they are less promising areas and it is for this reason that they have not yet been drilled by YPL.

For both cases, SRK assessed how to extract the defined Mineral Resource already delineated in the vicinity of Doves Nest from the alternative sites. In SRK's opinion, the Cloughton site is too remote from this to support the cost and time that would be required to access and extract this. Therefore, any project established at the Cloughton site would rely on Mineral Resources being found in the immediate vicinity of this.

Further, at Cloughton, only the Basin Seam has been identified and nothing is known of the quality of the mineralisation in this location. Generally, the Basin Seam extends over a greater depth than the Shelf Seam, however, it is interlayered and overlain with halite making it a secondary target when compared to the latter. The presence of interlayered halite may reduce continuity of grade on a mining scale, and possibly result in more difficult mining conditions. These aspects make the Basin Seam a lesser target for exploration.

The Whitby Enclave site is relatively close to the Mineral Resource already delineated by YPL but the Donovan Fault System divides the two areas of ground. While there is likely to be polyhalite in this area, there is insufficient data available to estimate the tonnage of this and the data that is available suggests that the polyhalite grade is variable and that the ground, at least between the faults, is very disturbed. Given this, SRK would expect a technical and economically feasible mining operation accessed from the Whitby Enclave would require extraction of the existing Mineral Resource via access developed through the Donovan Fault system as well as any resource delineated in its immediate vicinity.

The extent of what is known about the Donovan Fault system is derived from large scale mapping and interpretation of drill hole SM1 located around 3 km from the Whitby enclave site near Briggswath. The fault system is a major geological feature of the area extending for 18 km from 472200E/511100N to 490000E/507200N. This report outlines potential risks that might be encountered when tunnelling through the fault, but it is not possible to quantify those risks without detailed and targeted investigation and even when this is complete risks will remain that can only be fully quantified when the fault has been intersected by underground development. Based on the outcomes of future investigation, a plan to safely develop and maintain access through the Donovan Fault would be prepared and submitted to the Health and Safety Executive for their approval as part of mine regulations covered under the Approved Code of Practice, "The prevention of inrushes in mines". Currently, it is not possible to determine what tunnelling methodology might be required; and importantly, whether an excavation plan could actually be adequately defined from surface investigations alone.

To determine the suitability of both the Cloughton and Whitby Enclave sites as alternative sites, surface drilling, geological, geotechnical and hydrogeological investigations would be required to support mine planning and feasibility studies. Additional studies into the nature of the sites, including their environmental and social sensitivities, ground conditions, flood risk, and accessibility will also be required.

Given all the above, SRK considers that:

- The Cloughton site would effectively be a completely new project, requiring geological exploration and a full feasibility study before a decision could be made on implementation. This process, which SRK estimates might take at least five years and cost some GBP 100 million, carries a substantial risk that the outcomes may prove to be unfeasible.

- The Whitby Enclave site would also require significant geological exploration, geotechnical investigations and feasibility studies to develop sufficient confidence in the achievability of a life of mine plan, which includes access through the Donovan Fault. SRK estimates this process might take some four years and cost over GBP 70 million. In the worst case, the need to develop access across the Donovan Fault may result in the project being technically/economically unfeasible.

The overall project risk profile of the two sites is also significantly higher when compared with the Doves Nest Site. Notably, at the Whitby Enclave:

- There is added risk of tunnelling through the Donovan Fault. Unless this can be effectively mitigated with investigations from surface and project planning, effectively all the project capital investment, including the large scale investment for sinking a shaft is at risk.

While at the Cloughton site:

- There is risk that any exploration programme undertaken to develop a mineral resource to support mining of polyhalite accessed from outside the NYMNP is completely unsuccessful.
- Should a mineral resource be defined, there remains risk that the project site cannot be developed for other reasons that arise from the feasibility studies that would have to be completed, although this risk cannot be quantified at this stage.

In conclusion, in order for the Whitby Enclave and the Cloughton sites to be realised as alternative mine head sites to the Doves Nest site, investigations into the presence of an equivalent Mineral Resource in their immediate vicinity would be required. Feasibility studies based on the outcomes of these investigations and into the nature of the sites will also be required, in both cases taking a significant amount of time and requiring significant expenditure to complete. Given this, and the comments on the resource potential in these areas as set out in Section 3 of this report, in SRK's opinion the potential of these sites to provide viable mining scenarios is limited and it is unrealistic to expect that any exploration or mining company acting reasonably would commit to the funds required to undertake the investigative work required in the foreseeable future or indeed that it would be able to raise such funds if this was needed.

6 CONCLUSIONS

SRK's overall conclusions are as follows:-

1. In SRK's opinion the exploration programme followed by YPL was planned and carried out in a professional manner, was initially and properly focussed in an area where there was a good expectation of success, was then adapted as results became available to demonstrate both continuity between intersections and prove up a sufficient tonnage to justify the establishment of a mining operation and now forms the basis of a mining plan which has been demonstrated to be economic to exploit from a mine head at Doves Nest.

2. While there are several other areas in the vicinity of the AOI and further south that have potential to contain polyhalite mineralisation, none of these have been sufficiently explored to date to enable the quantity or quality of the available polyhalite to be assessed and all would therefore require a significant expenditure to be committed before their potential could be properly assessed. Further, all of these areas are for geological reasons less attractive targets than the Doves Nest area.

3. Some of these areas would need to be explored, and if exploration was successful also potentially be developed, from within the NYMNP. Other areas could be explored, and if the exploration was successful potentially be developed, from outside the NYMNP.

   In SRK's opinion, however, none of these areas represent attractive exploration targets, it would be unreasonable to expect a company that had already delineated a significant Mineral Resource elsewhere to explore these and it would be unrealistic to think that an exploration company new to this region would be prepared to risk the expenditure required to commit to this in the foreseeable future or that it would be able to raise the money required to fund this if needed.

   Further, given the limited quantity and poorer quality of the polyhalite that could be present north of the Donovan Fault and therefore the reliance of any mine established in this area to be mining material south of the Donovan Fault early in the mine life with the risk of both first negotiating, and then maintaining safe operations beyond the fault, it is in SRK's opinion of SRK that further exploration of this area by YPL is not justified at this time.

4. Four alternative sites have been identified in the region where mine heads could be located to access the existing Mineral Resource and/or the other areas with potential to host polyhalite resources in the region. There are however significant technical challenges associated with all of these. Notably, these are all further from the delineated Mineral Resource than the Doves Nest site and any access development to this would need to negotiate some major structural features. Technically this is likely to be possible but a significant amount of further technical work inclusive of drilling needs to be done in all cases to investigate these features and the local stratigraphy generally which would delay the Project by four years, possibly longer, and incur considerable additional expenditure before a decision could be made on developing the mine. In addition there is a reasonable chance that this work may prove these sites not to be technically viable.

   Regardless of the above, accessing the YPL Mineral Resource from the sites at Cloughton would almost certainly be economically unviable even if this work yielded positive results, while accessing this from the Whitby sites would both be less economic than accessing this from the currently proposed site at Doves Nest, possibly to the point that it would be uneconomic, and would require the access infrastructure to negotiate a major fault the characteristics of yet are currently unknown. In fact, in all cases, the practicality and additional safety issues incurred would likely render access from these sites inappropriate from a mining perspective. Establishing a mine head at all these sites therefore requires a Mineral Resource to be delineated in these areas which, as commented above, SRK considers would not be an attractive proposition to a mining company at this time and which SRK would not recommend YPL or any other exploration or mining company to embark upon.

5. All of the proposed sites are located closer to residential areas than the Dove Nest site and it is likely that any planning permission for these sites if attainable will have significant working restrictions during construction and operation in relation to traffic movements, noise and vibration abatement. This is likely to introduce further delay and additional cost to the project.

6. Given all the above, SRK would not recommend that YPL undertakes any more work to investigate the viability of establishing a mine head at any of the locations commented upon in this report. It is also SRK's opinion that it would be unrealistic to expect that any other exploration or mining company would risk the expenditure required to commit to the exploration and development work required to assess the merits of establishing a mine head at any of these at the present time, or indeed in the foreseeable future, or that it would be able to raise the funds to do so if required.

For and on behalf of SRK Consulting (UK) Limited

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SRK Consulting (UK) Limited

APPENDIX

A HISTORICAL DRILLHOLE LOGS

43 F1

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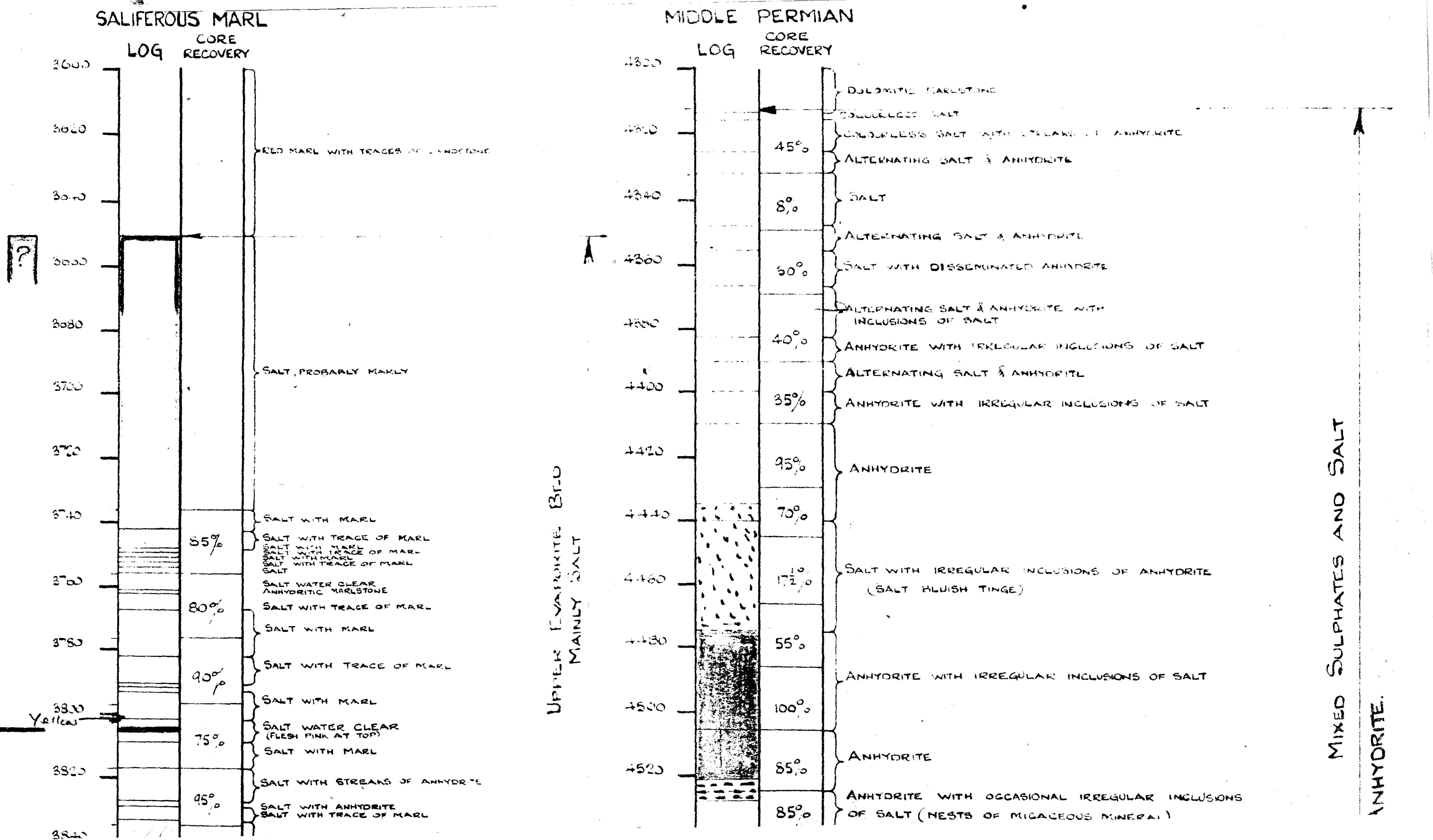
43/9B

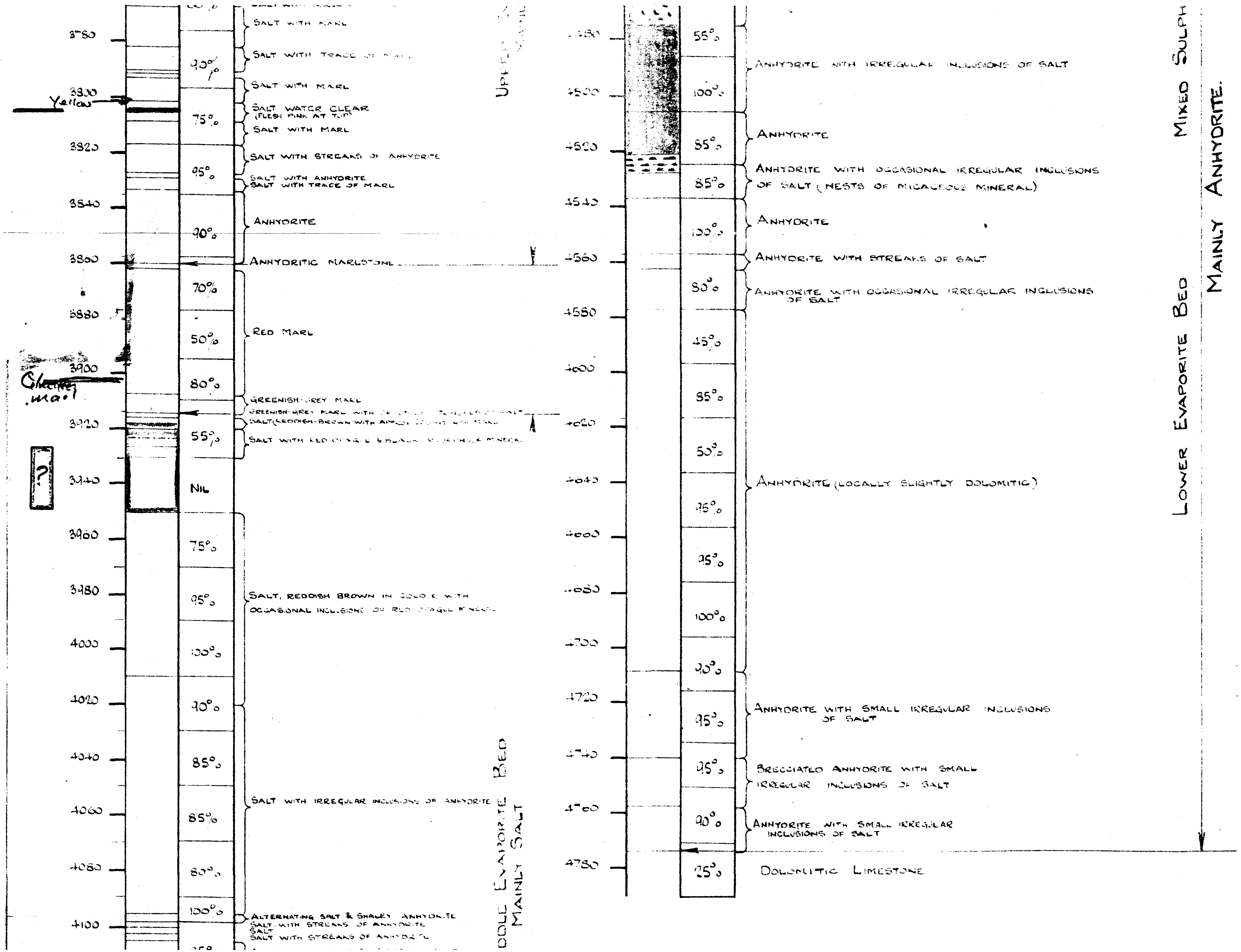
ESKDALE No 2

DETAILED LOGS

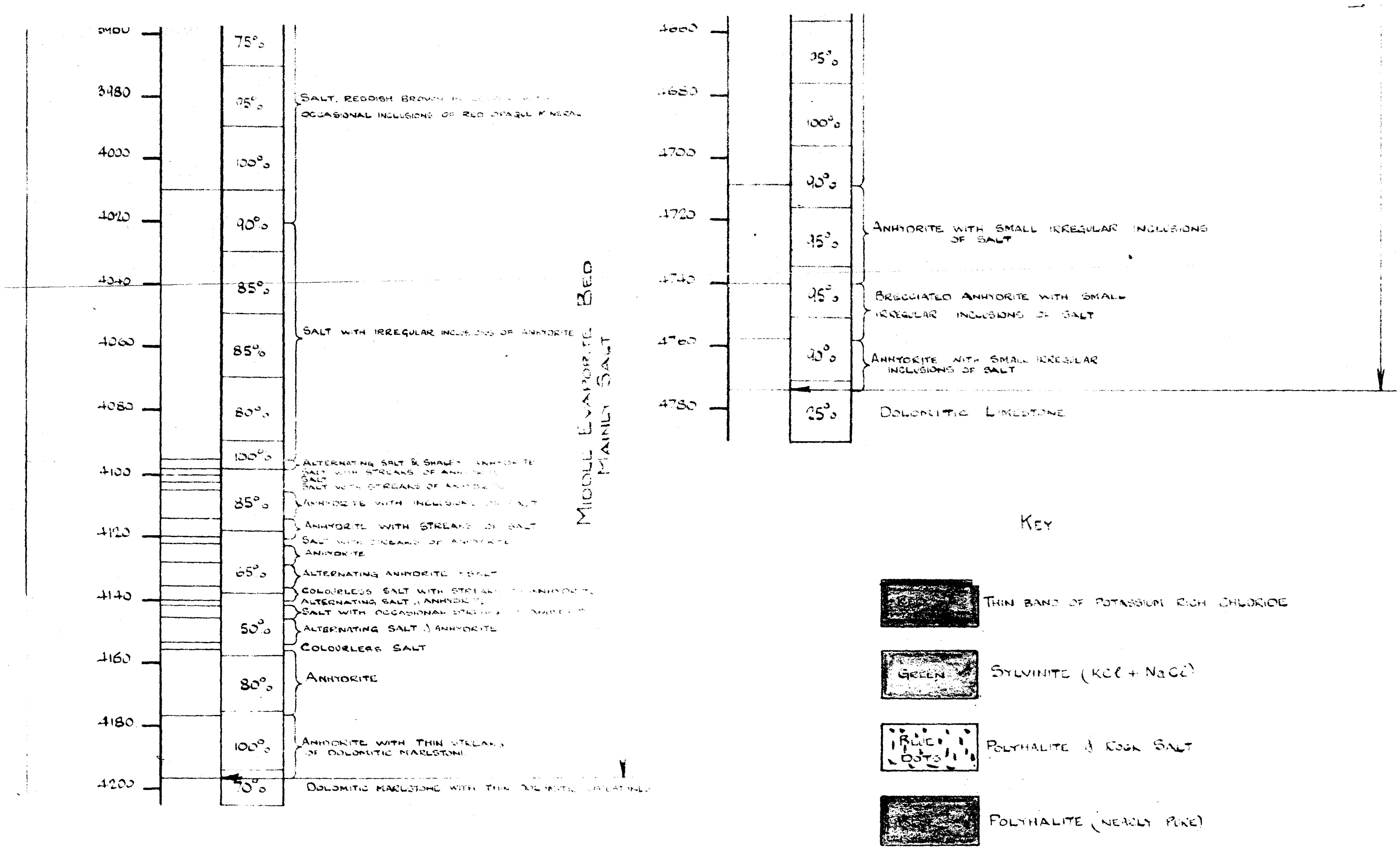
OF THE

SALIFEROUS MARL & MIDDLE PERMIAN SALT & ANHYDRITE GROUPS.





3780
3800
3820
3840
3860
3880
3900
3920
3940
3960
3980
4000
4020
4040
4060
4080
4100
Yellow
Cheetley marl
?
90%
75%
95%
90%
70%
50%
80%
55%
NIL
75%
95%
100%
90%
85%
85%
80%
100%
SALT WITH MARL
SALT WITH TRACE OF MARL
SALT WITH MARL
SALT WATER CLEAR (FLESH PINK AT TOP)
SALT WITH MARL
SALT WITH STREAKS OF ANHYDRITE
SALT WITH ANHYDRITE
SALT WITH TRACE OF MARL
ANHYDRITE
ANHYDRITIC MARLSTONE
RED MARL
GREENISH-GREY MARL
SALT WITH RED OPAQUE & BLACK MICACEOUS MINERAL
SALT, REDDISH BROWN IN COLOUR WITH OCCASIONAL INCLUSIONS OF RED OPAQUE MINERAL
SALT WITH IRREGULAR INCLUSIONS OF ANHYDRITE
ALTERNATING SALT & SHALEY ANHYDRITE
SALT WITH STREAKS OF ANHYDRITE
SALT
SALT WITH STREAKS OF ANHYDRITE
UPPER
MIDDLE EVAPORITE BED
MAINLY SALT
4480
4500
4520
4540
4560
4580
4600
4620
4640
4660
4680
4700
4720
4740
4760
4780
55%
100%
85%
85%
100%
80%
45%
85%
50%
95%
95%
100%
90%
95%
95%
90%
25%
ANHYDRITE WITH IRREGULAR INCLUSIONS OF SALT
ANHYDRITE
ANHYDRITE WITH OCCASIONAL IRREGULAR INCLUSIONS OF SALT (NESTS OF MICACEOUS MINERAL)
ANHYDRITE
ANHYDRITE WITH STREAKS OF SALT
ANHYDRITE WITH OCCASIONAL IRREGULAR INCLUSIONS OF SALT
ANHYDRITE (LOCALLY SLIGHTLY DOLOMITIC)
ANHYDRITE WITH SMALL IRREGULAR INCLUSIONS OF SALT
BRECCIATED ANHYDRITE WITH SMALL IRREGULAR INCLUSIONS OF SALT
ANHYDRITE WITH SMALL IRREGULAR INCLUSIONS OF SALT
DOLOMITIC LIMESTONE
MIXED SULPH
LOWER EVAPORITE BED
MAINLY ANHYDRITE.



3980
4000
4020
4040
4060
4080
4100
4120
4140
4160
4180
4200
75%
95%
100%
90%
85%
85%
80%
100%
85%
65%
50%
80%
100%
70%
Salt, reddish brown
Occasional inclusions of red opaque mineral
Salt with irregular inclusions of anhydrite
Alternating salt & shale
Salt with streaks of anhydrite
Anhydrite with streaks of salt
Anhydrite
Alternating anhydrite & salt
Colourless salt with streaks of anhydrite
Salt with occasional streaks
Alternating salt & anhydrite
Colourless salt
Anhydrite
Anhydrite with thin streaks of dolomitic marlstone
Dolomitic marlstone with thin dolomitic limestones
Middle Evaporite Bed
Mainly Salt
4660
4680
4700
4720
4740
4760
4780
95%
100%
90%
95%
95%
90%
25%
Anhydrite with small irregular inclusions of salt
Brecciated anhydrite with small irregular inclusions of salt
Anhydrite with small irregular inclusions of salt
Dolomitic Limestone
Key
Thin band of potassium rich chloride
Green
Sylvinite (KCl + NaCl)
Blue dots
Polyhalite & Rock Salt
Polyhalite (nearly pure)

3 COMMERCIAL CONFIDENTIAL 80 NW/15

E2

ESKDAIE No. 2. Borehole.

…ON OF

…Map (County and Quarter Sheet)

	Thickness. feet.	ins.	Depth from Surface. feet.	ins.
-do-	4052	-	4054	
-do-	4054	-	4056	
-do-	4056	-	4058	
-do-	4058	-	4060	
-do-	4060	-	4062	
-do-	4062	-	4064	
…ery coarse pink halite with dark marl inclusions	4066	-	4068	
…ery coarse pink halite with irregular anhydrite wisps	4070	-	4072	
…do-	4072	-	4074	
…ainly grey halite with large irregular anhydrite inclusions	4074	-	4076	
…ink halite with small irregular anhydrite wisps	4076	-	4078	
…rey and pink halite with anhydrite inclusions	4078	-	4080	
…io-	4080	-	4082	
…io- with 2" band of slightly marly anhydrite	4082	-	4084	
…io-	4090	-	4092	
…io-	4092	-	4094	
…io-	4094	-	4096	
…ey slightly marly anhydrite with shale partings	4096	-	4098	
…nk and grey coarse halite with infrequent anhydrite inclusions	4098	-	4100	
…ter clear coarse halite with some anhydrite inclusions	4100	-	4102	
…arse halite with much siltymarly anhydrite	4102-	-	4104	
…ter-clear and pink halite	4104	-	4106	
…ey marly anhydrite with halite inclusions	4106	-	4108	
…o-	4108	-	4110	
…o-	4118	-	4120	
…ightly marly anhydrite with large halite inclusions	4120	-	4122	
…o-	4122	-	4124	
…o-	4124	-	4126	
…ey halite and marly anhydrite	4126	-	4128	
…rly anhydrite with grey halite inclusions	4128	-	4130	
…ey anhydrite with irregular fine halite inclusions	4130	-	4132	

(68/3963) Wt. 4194/23 2000 6/39 M. & St. Ltd. G 88

	Thickness. feet. ins.	Depth from Surface. feet. ins.
ate -clear and pink granular halite	4132 -	4134
rey halite with anhydrite inclusions	4134 -	4136
ater-clear and pink granular halite with very little anhydrite inclusions	4138 -	4140
rey silty anhydrite with granular halite inclusions	4140 -	4142
ater-clear granular halite with fine anhydrite streaks parallel to bedding plane	4142 -	4144
do-	4146 -	4148
oarse granular water-clear halite	4148 -	4150
seudo-brecciated slightly dolomitic anhydrite	4176 -	4178
ater-clear halite and very little anhydrite	4312 -	4314
ater-clear halite	4314 -	4316
alite with anhydrite streaks	4356 -	4358
ark grey anhydrite	4415 approx.	
Polyhalite and halite inclusions	4445 -	4447
nhydrite with fine halite inclusions ?polyhalite	4559 -	4561
lightly dolomitic anhydrite with halite inclusions	4742	
nhydrite with small halite inclusions ?polyhalite	4760	

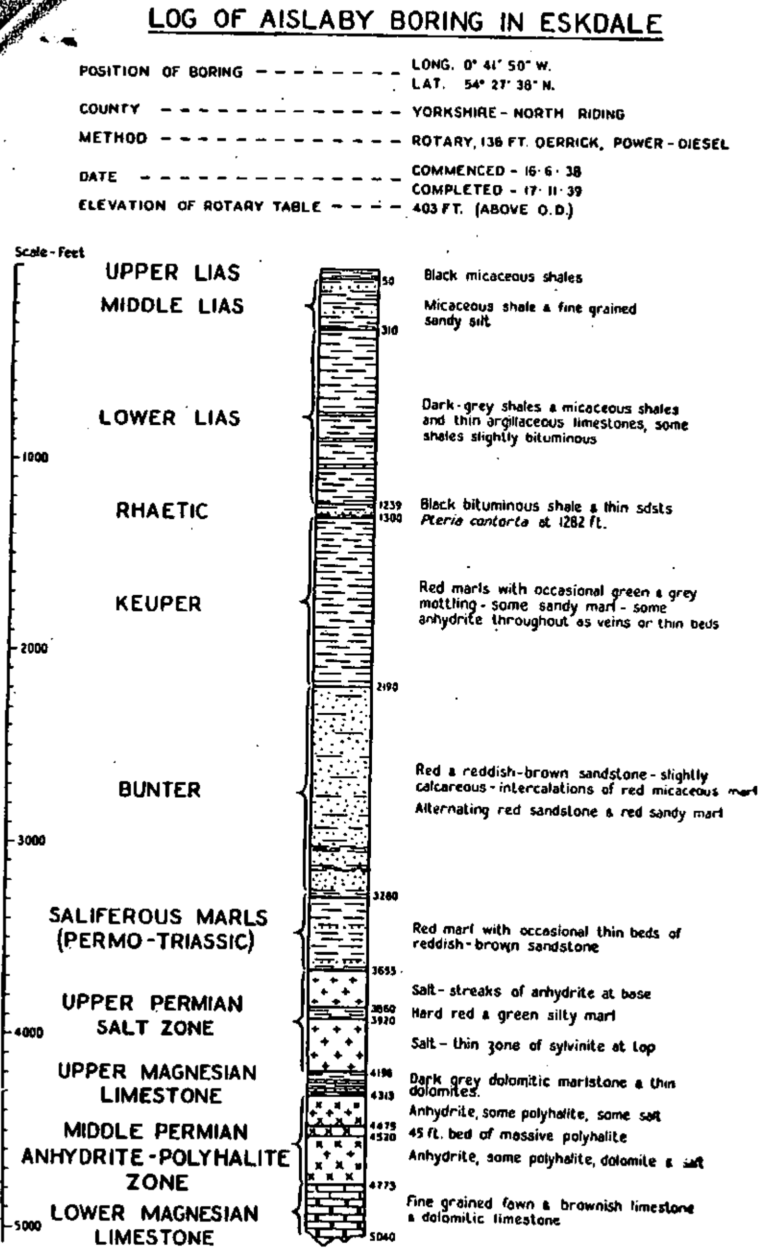


FIG. 1. Log of the Aislaby boring (Eskdale no. 2).
Taken from Lees & Taitt, 1946, (Quart. Journ. Geol. Soc., vol. 101, p. 268.)

minerals. The more soluble minerals are not preserved. From a study of these cuttings the upper limit of a mineral can be fixed with reasonable precision, but the lower limit can be found only approximately.

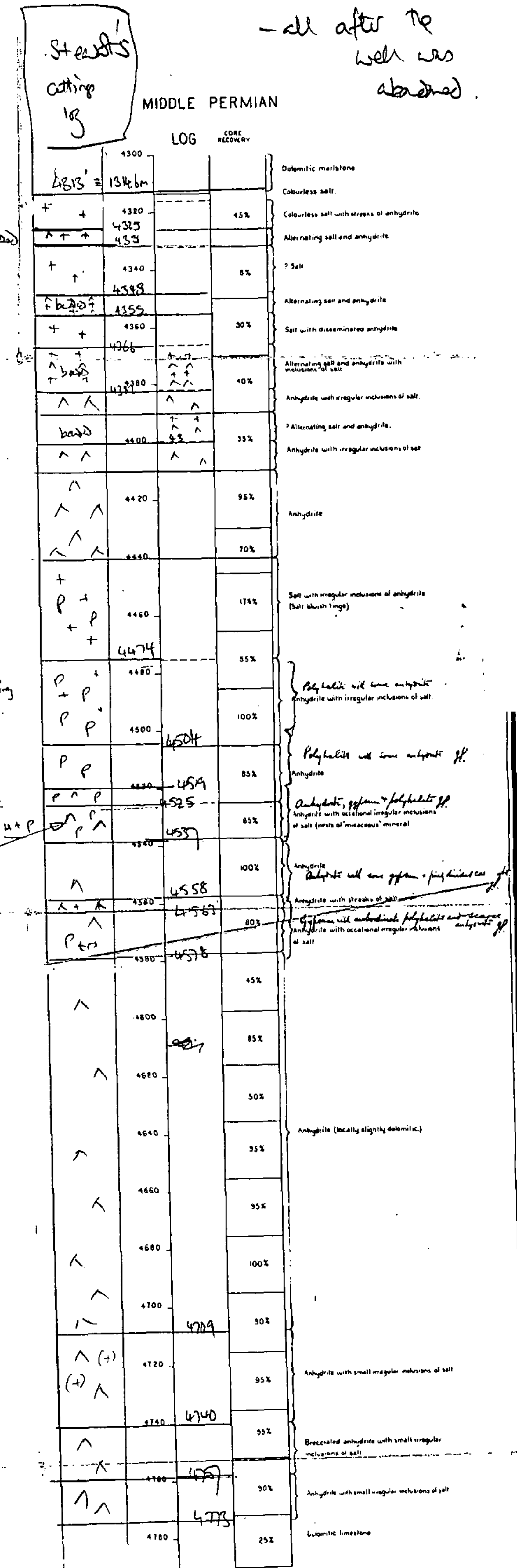
III. GENERAL SUCCESSION IN THE LOWER EVAPORITE BED.

Since so few core samples of known depth have been preserved, our knowledge of the succession is incomplete. The relative distribution of salt, anhydrite, and polyhalite is given in the following table. The distribution of salt and anhydrite is based on the D'Arcy Exploration Company's detailed log of the boring. It is not known whether other chlorides than halite are present, but it is considered probable that they did not occur in significant amount, if at all, as two specimens from the top 3 feet of the bed show colourless halite with no other chloride. The distribution of polyhalite in the table is based on a study of the well cuttings.

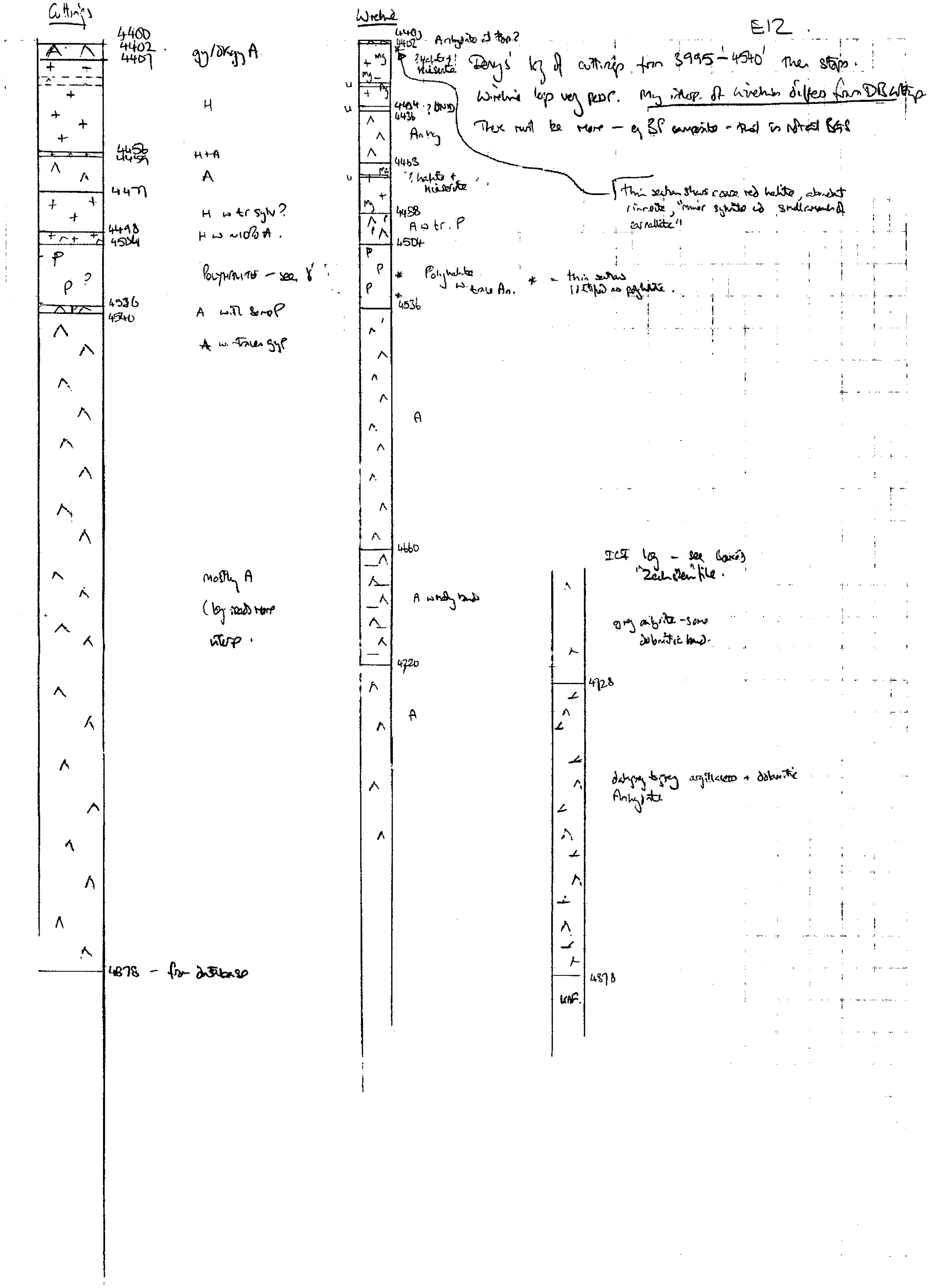
		Thickness in feet.
4313 feet		
Halite-anhydrite zone	Colourless salt ...	2
	Colourless salt with streaks of anhydrite ...	10
	Alternating salt and anhydrite ...	6
	Salt ...	17
	Alternating salt and anhydrite ...	7
	Salt with disseminated anhydrite ...	11
	Alternating salt and anhydrite ...	16
	Anhydrite with irregular inclusions of salt ...	7
	Alternating salt and anhydrite ...	10
4399 feet		
Upper anhydrite	Anhydrite with irregular inclusions of salt ...	11
	Anhydrite ...	30
4440 feet		
Polyhalite zone	Salt with irregular inclusions of polyhalite and anhydrite (salt bluish tinge)...	34
	Polyhalite with irregular inclusions of salt ...	30
	Polyhalite ...	15
	Anhydrite and polyhalite ...	6
4525 feet		
Lower anhydrite	Anhydrite with occasional irregular inclusions of salt (nests of micaceous mineral)* ...	12
	Anhydrite ...	21
	Anhydrite with streaks of salt ...	5
	Anhydrite with occasional irregular inclusions of salt ...	15
	Anhydrite (locally dolomitic) ...	131
	Anhydrite with small irregular inclusions of salt ...	31
	Brecciated anhydrite with small irregular inclusions of salt	17
	Anhydrite with small irregular inclusions of salt ...	16
4773 feet		
	Dolomitic limestone ... to bottom of boring	

* The micaceous mineral mentioned in the boring log probably refers to talc.

E2 – note there is a lot of disagreement in detail between handwritten notes – all after the well was abandoned.



Eskdale 2



E12
Cuttings
4400
4402
4407
gy/dkgy A
H
4456
4459
H+A
A
4477
H w tr sylv?
4498
4504
H w ~10% A.
Polyhalite - see
4536
4540
A with some P
A w. traces gyp
Mostly A
(log needs more interp.
4878 - from database
Wireline
4401
4402
Anhydrite at top?
? halite + kieserite
Denys' log of cuttings from 3995-4540' then stops.
Wireline logs very poor. My interp. of wireline differs from DB cuttings
There must be more - eg BP composite - not in NHM BGS
4434 ? BND
4436
Anhy
4463
? halite + kieserite
This section shows coarse red halite, abundant kieserite, "minor sylvite and small amounts of carnallite"
4488
A w tr. P
4504
Polyhalite w. trace An.
* - this section "logged as polyhalite.
4536
A
4660
A w dolomitic bands
4720
A
ICI log - see Bossi's "Zechstein" file.
grey anhydrite - some dolomitic bands
4728
dark grey to grey argillaceous + dolomitic Anhydrite
4878
KAF.

CONFIDENTIAL

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SECTION OF ESKDALE NO. 3 BOREHOLE (Continuation of Log)

Six-inch Map (County and Quarter Sheet)

	Thickness. feet.	Thickness. ins.	Depth from Surface. feet.	Depth from Surface. ins.
			4207	-
Dark grey anhydrite with abundant Filograna ? permiana preserved in dolomite.	3	-	4210	-
Dark grey fine-grained dolomite with anhydrite	3	-	4213	-
Dark fine-grained dolomite with discrete lenses of white anhydrite up to 1 x 1/4"	3	-	4216	-
Gap, no core taken.	15	-	4231	-
White and grey anhydrite, composed of lenticles separated by shaly films	6	-	4237	0
Dolomite rich in Filograna ? permiana with coarse white anhydrite; cavities contain separated tubes of the fossil, probably left after solution of anhydrite and halite.	11	-	4248	-
Dark dolomite with streaks of anhydrite and pyrite	2	-	4250	-
Gap, no core taken.	50	-	4300	-
Coarse white anhydrite		6	4300	6
Dark grey dolomite with pyrite.	3.	6	4304	-
Gap, no core taken.	36	-	4340	-
Dark grey shaly dolomite with anhydrite, in part edged with pyrite, dip 10 - 15°	14	-	4354	-
Dolomite with vein of halite	1	-	4355	-
Dark grey shaly dolomite with pyrite	6	-	4361	-
Gap, no core taken	22	-	4383	-
Dark halite showing flow texture and distorted lenses of anhydrite	18	-	4401	-
Colourless halite	1	-	4402	-
Dark grey halite, shaly parting with coarse talc.	1	-	4403	-
Dark grey halite with ? distorted streaks of anhydrite and some dolomite.	7	-	4410	-
do. with coarse (plates) flats of talc		3	4410	3
Paler halite with white anhydrite streaks, grain size c. 5 mm., dip about 20°	13	3	4423	6
White slightly opaque halite showing lineation, grain size increasing downward	76	6	4500	-
Similar halite, with spongy anhydrite, disturbed	12	-	4512	-
White rather opaque halite	2	6	4514	6
Colourless halite, crystals c.15 mm., little anhydrite	15.	6	4530	-
Halite enclosing broken up anhydrite, dip possibly about 25°	26	-	4556	

4.6

	Thickness feet	Thickness ins.	Depth from Surface feet	Depth from Surface ins.
			4556	-
White anhydrite with irregular bands of colourless halite	37	-	4593	-
Mainly anhydrite, white	4	-	4597	-
White anhydrite with irregular lenses of halite	34	-	4631	-
Very folded and distorted white anhydrite, invaded by halite	6	6	4637	6
White anhydrite	7	6	4645	-
White anhydrite with irregular veins of halite	31	-	4676	-
Opaque grey halite	8	-	4684	-
Contorted anhydrite invaded by halite	6	-	4690	-
Anhydrite with pronounced vertical growth	31	6	4721	6
Anhydrite with halite, polyhalite, contorted dolomite and a little ? langbeinite		6	4722	-
Gap, no core taken (Mounts of cuttings show polyhalite with some anhydrite at 4774,4798,4842,4876 ft E.23155-8)	170	-	4892	-
Polyhalite with anhydrite, magnesite and dolomite	13	-	4905	-
Anhydrite, halite and polyhalite	7	-	4912	-
Gap, no core taken (mounts of cuttings show polyhalite at 4946,4968,4998,5032 ft. E.23159 - 63)	120	-	5032	-
Polyhalite with kieserite and magnesite	1	6	5033	6
Gap, no core taken, (Polyhalite in mount of cuttings at 5093 ft. E. 23164)	137	6	5171	-
Halite with thin anastomosing streaks or mesh containing polyhalite, magnesite and anhydrite.	44	-	5215	-
Cores not examined (?box missing)	19	-	5234	-
Halite with thin mesh of anhydrite and some polyhalite	16	-	5250	-
Halite with less streaks but with irregular patches of anhydrite	25	-	5275	-
Dark halite, coarse, spalls off parallel to sides of core, crystals up to 25 mm., some irregular platy anhydrite	20	-	5295	-
Coarse halite, 15 - 20 mm.	18	-	5313	-
Halite with mesh of anhydrite, becoming coarse downwards; dolomite appears; dip ?20°	42	-	5355	-
Mesh of anhydrite with halite, beds of dolomite increasing in number downwards	109	6	5464	6
Grey massive anhydrite	1	6	5466	-
Gap, no core (Anhydrite to 5478 in cuttings, with dolomite) Finely lam dol to base at 5500	30	-	5496	-

E. 3

Lr. JURASSIC	MIDDLE LIAS	43'	(shales, sandy shales and silty beds
	LOWER LIAS	1070'	(grey shales with thin calcareous bands and pyrite doggers)
	RHAETIC	1137/1138'	(grey black and brown shales, sandstones and soft grey mudstone)
TRIAS	KEUPER MARLS	2132'/33'	(red brown and some green marls, gypsiferous bands and some rock salt)
	BUNTER SANDSTONE	3220'	(red quartz sandstone with much iron oxide)
PERMIAN	SALIFEROUS MARLS AND UPPER EVAPORITE GROUP	3586'3"	Red marls
		3588'9"	Anhydrite
		3598'	Marl
		3742'	Rock salt with Sylvinite
		3769'	Anhydrite
	MIDDLE EVAPORITE GROUP	3817'	Carnallite Red marls
		4142'	Rock Salt with Sylvinite
		4192'	Anhydrite and salt
		4200'	Anhydrite
		4383'	Dolomitic marlstone
	LOWER EVEPORITE GROUP	4556'	Rock Salt with Anhydrite
		4722'	Anhydrite with Rock Salt
		5171'	Anhydrite and Polyhalite
		5464'	Rock Salt with Anhydrite
		5478'	Anhydrite and Dolomitic Marlstone
		5500'	Dolomite Limestone

in the basal portion. Fissures and some cavities are present in the dolomitic marlstone, the fissures often exhibiting light brown dolomite crystals growing from the walls. The cavities often contain white massive pure anhydrite inclusions in which may be crystal inclusions of light brown dolomite. Some cavities are also lined with what are probably worm casts - called Fyllograna ? permiana. They are crowded in the rock as well as encrusting the walls of the cavities.

In the basal part of the dolomitic anhydrite rock salt is present in the form of veins.

Between 4231' and 4238'6" is a seam of light grey friable anhydrite which is very much cracked and fissured giving the rock a phacoidal appearance. The cracks are infilled with hard black dolomitic mudstone.

The Lower Evaporite Group

Thickness penetrated - 1117 ft.

Range - 4383 ft. - 5500 ft.

The General Section is as follows:-

4383' - 4424'	Rock salt with some anhydrite
4424' - 4496'	Rock salt
4496' - 4556'	Banded rock salt and anhydrite
4556' - 4722'	Anhydrite with some rock salt
4722' - 5097'	Polyhalite with anhydrite
5097' - 5226'	Polyhalite and anhydrite with some rock salt grading down to rock salt with some polyhalite and anhydrite.
5226' - 5464'8"	Rock salt with some anhydrite and dolomite mainly at the base
5464'8"- 5478'	Dolomitic marlstone and anhydrite. Anhydrite decreases to base.
5478' - 5500'	Dolomite limestone.

4383' - 4424'

The formation is 80% rock salt. The rock salt is composed of colourless crystals often lathe shaped and set in parallel alignment indicating that the salt has "flowed". The anhydrite inclusions are dirty and are elongated parallel to the bedding planes. Some bands composed of dirty anhydrite containing disseminated rock salt and micro inclusions of rock salt. H2S smell is strong on a fresh surface. No K is present.

4424' - 4496'

Rock salt composed of colourless crystals. Some alignment of the crystals is evident but decreases with depth. When the crystals are not lathe shaped and in alignment the texture is granular. The H2S smell is not strong. No K is present in this rock salt.

4496' - 4556'

Mainly broad alternating bands of grey anhydrite containing veins and irregular inclusions of colourless granular rock salt and bands of rock salt containing irregular inclusions of anhydrite - sometimes it approaches a honecomb structure. The anhydrite contains disseminated rock salt in a patchy fashion and some of the rock salt contains disseminated anhydrite.

4556' - 4722'

Grey white anhydrite containing disseminated rock salt in patches i.e. there are "inclusions" of anhydrite containing no rock salt. Irregular inclusions of colourless rock salt are present. Much contortion and slumping is evident in the formation especially between 4631' and 4638' where the anhydrite containing the disseminated rock salt has behaved as an incompetent bed and exhibits squeezing out and lensing. Some at least of the irregular inclusions of rock salt are post slumping in age i.e. they transgress across the slumped beds showing no apparent distortion.

4722' - 5097'

Mixture of grey anhydrite and grey polyhalite - both appear to be massive. The proportion of polyhalite to anhydrite varies from band to band but polyhalite predominates according to chemical analysis. (See also the detailed description of the Stratigraphy). The polyhalite is composed of an aggregate of Zenomorphic crystals averaging 30 microns in length and with their axis orientated in no particular direction (Quote Dr.Dunham H.M. Geological Survey).

5097' - 5226'

Approximately at 5097' rock salt becomes apparent and increases in relative proportion to 95% of the formation at 5226'. The rock enclosing the salt (even when it is only 5% of the formation it forms a mesh and encloses the rock salt) is as above, i.e. mixed grey anhydrite and grey polyhalite and becomes dolomitic towards the base. The salt contains some K.

5226' - 5453'

Rock salt composed of mainly colourless well formed often large crystals, some are however granular. Minute buff coloured wispy inclusions of slightly dolomitic anhydrite exist from 5226' - 5254'. From 5254' - 5420' the inclusions are of dirty slightly dolomitic anhydrite but are so ragged and patchy and can only be accurately described as smudges. From 5420' - 5453' the salt is enclosed in a honeycomb of dolomitic anhydrite and some dolomiticmarlstone. Little K is present in the upper few feet of this rock salt.

5453' - 5454'

Grey black dolomitic marlstone.

5454' - 5464'8"

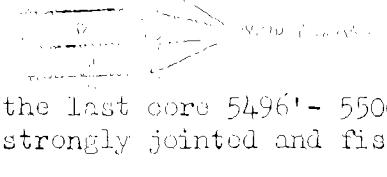
Fine grained granular colourless rock salt containing inclusions of buff coloured anhydritic dolomite and dolomitic anhydrite.

5464'8" - 5478'

Mixture of grey black dolomitic marlstone and grey white anhydrite, the anhydrite content decreasing with depth.

5478' - 5500'

Buff coloured close grained dolomite limestone which is slightly muddy black hairlike shale partings which are spaced at irregular intervals throughout the limestone. The explanation for this formation is probably as follows. Mud is setting out all the year round and in the hot season the waters are warm enough to precipitate dolomite which comes down with the mud. In the cool season no dolomite is precipiated and only mud comes down and this forms a fine layer on top of the previous seasons dolomite, i.e.



From the state of the last core 5496'- 5500' it was deduced that the limestone was strongly jointed and fissured.

44/18

Analysis of Selected Samples from Bottom Salt Bed

BTJ Ref. No. of Sample	Depth at which sample was taken	Cl_2	CaO	MgO	SO_3	Loss at 105°C	K_2O	Analysed by
547	4383'	55.15	3.24	N.D.	4.48	0.14	N.D.	W
548	4384'6"	54.19	4.25	N.D.	5.92	0.11	N.D.	W
559	4399'	55.45	3.50	N.D.	4.63	0.18	N.D.	W
568	4432'	59.64	0.72	N.D.	0.88	0.07	N.D.	W
570	4443'	58.36	1.62	N.D.	2.21	0.05	N.D.	W
571	4508'-4510'	12.07	31.80	1.04	38.60	-	N.D.	W
574	4570'	28.68	22.24	0,22	31.34	-	N.D.	W
594	4687'	18.74	27.88	N.D.	38.28	-	N.D.	W
605	4710'	4.26	36.28	2.32	51.28	-	N.D.	W
607	4722'	5.96	33.26	2.68	47.28	-	1.47	W

Polyhalite

The Polyhalite band extends from about 4722' down to about 5190'. It is perhaps unfortunate that very few cores were obtained over this range, and that we have had to rely on the analysis of drillings to determine the extent of the bed. This was due to the fact that the Polyhalite bed is so hard, and the wear and tear on bits was so high, that the supply of core bits would have given out long before much coring had taken place. It was also found in the course of drilling of the Polyhalite that the calcium chloride drilling fluid extracted quite a considerable amount of potash from the Polyhalite, (this is considered in detail in Appendix No.8, entitled "Observations on the use of Calcium Chloride as a Drilling Fluid for Polyhalite"). This means that all the drillings which have been examined contain less Polyhalite - and therefore less potash - than was originally present. It was not possible by mieralogical examination of the drillings to determine how much potash was originally present in the chippings and had been replaced by gypsum. This is because when the calcium chloride reacts with ground Polyhalite the gypsum formed by double decomposition of potassium sulphate and calcium chloride is so fine that it passed through the standard sieve used for collecting drillings. However, the analyses which have been obtained, which are represented graphically in figure PH1 give a very good indication of the extent and nature of the Polyhalite bed.

Analysis of Selected Samples of Polyhalite bed

The following analyses refer to a core taken between 5032' and 5036'.

BTJ Ref.No. of Sample	Depth at which sample was taken	NaCl	CaO	MgO	SO_3	K_2O	Analysed by
749	5032'	-	17.41	6.66	48.84	13.97	W
750	5035'5"	-	16.74	8.78	44.52	12.98	W
751	5036'	10.67	13.55	8.77	40.60	11.47	W

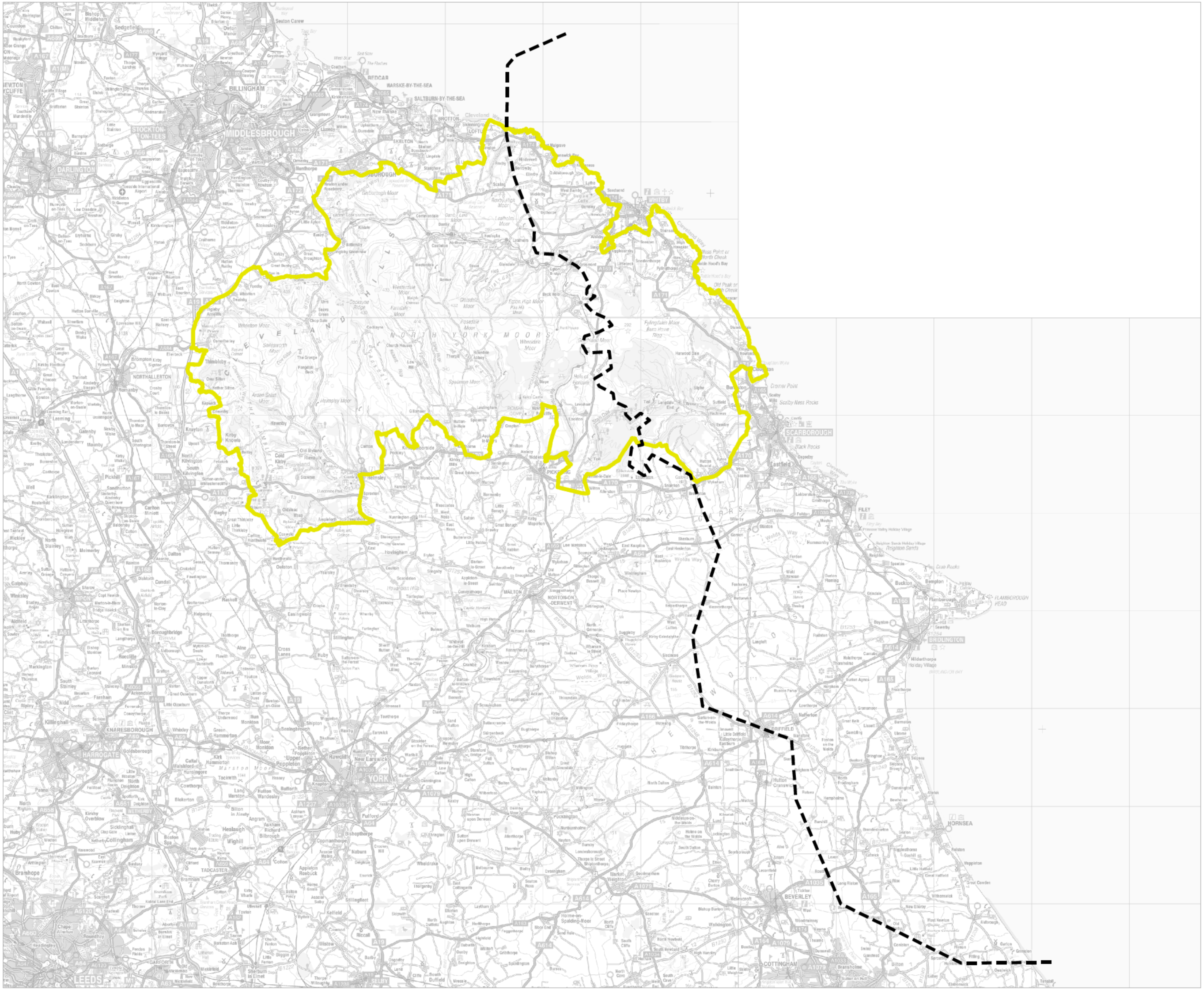
The results of the analyses of the drillings are represented graphically in figure PH1 opposite.

Lowest Salt

At a depth of 5171' salt again comes in quite sharply and extends down to 5464'. The average analysis of this last bed of salt shows it to be about 90 - 95% of sodium chloride with inclusions and meshes of anhydrite and/or polyhalite. At a depth of 5464' the Lower Limestone measures are entered.

Appendix 5

Map of Estimated Extent of Onshore Polyhalite



Key

Environmental Constraints

North York Moors National Park

Estimated Extent of Onshore Polyhalite

Nathaniel Lichfield & Partners
Planning. Design. Economics.

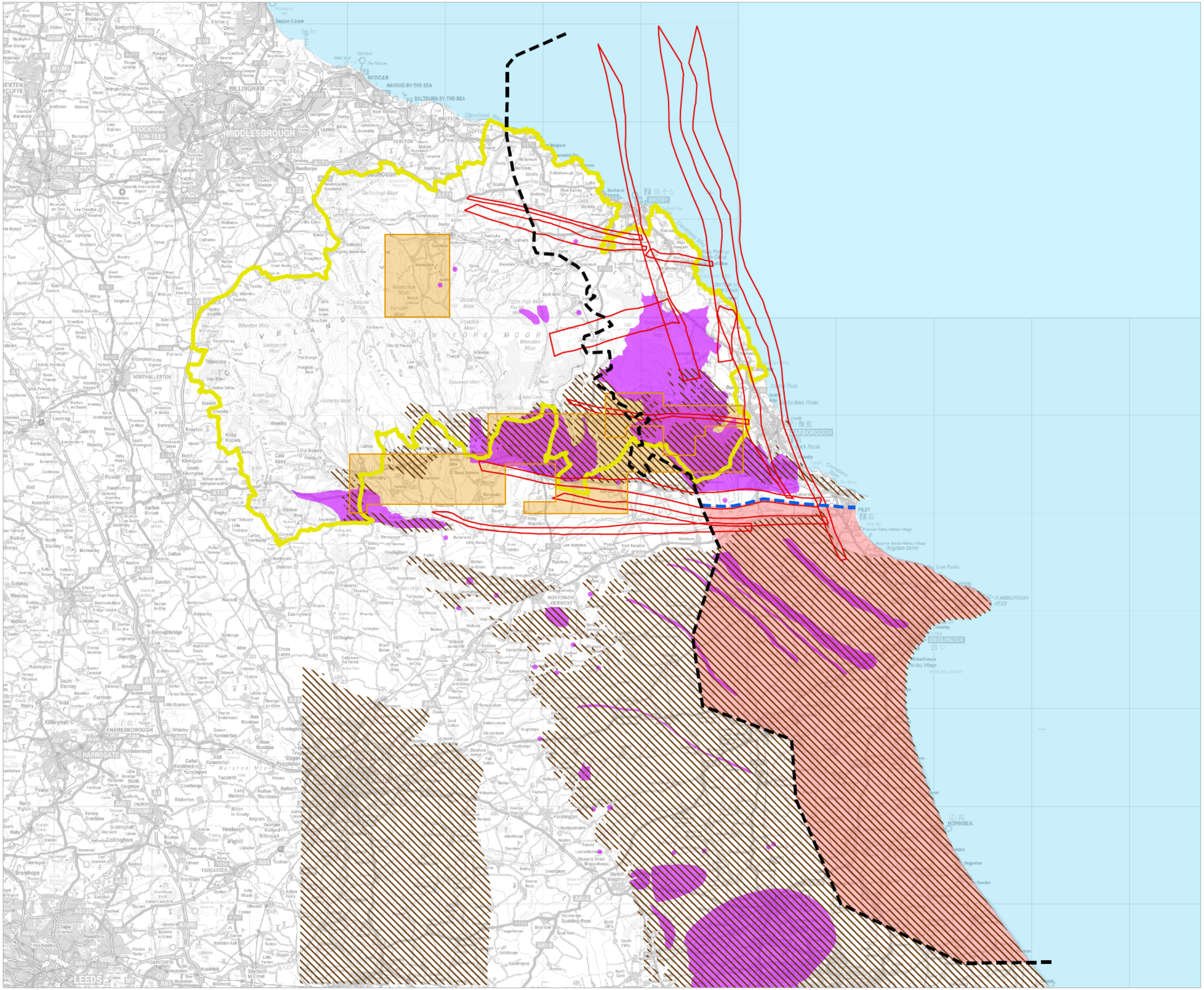
Project	Minehead Alternative Sites Assessment
Title	Stage 2: Environmental Constraints Mapping (01)
Client	York Potash Limited
Date	13.02.2014
Scale	-
Drawn by	MAR
Drg. No	GIS50303/04-01

N

GIS Reference: S:\LE50274 - York Potash Minehead\LE50303-04 - York Potash Minehead - Environmental Constraints - Map 1 - 09.12.2013.mxd

Appendix 6

ASA Mining Constraints Mapping



Key

North York Moors National Park

Mining Constraints

Fault Exclusion Zone

Principal Aquifer (Bedrock)

Source Protection Zone

The North Sea

Gas Licences

Estimated Extent of Onshore Polyhalite

Polyhalite 1800m Contour

Onshore Polyhalite at depths greater than 1800m

Nathaniel Lichfield & Partners
Planning. Design. Economics.

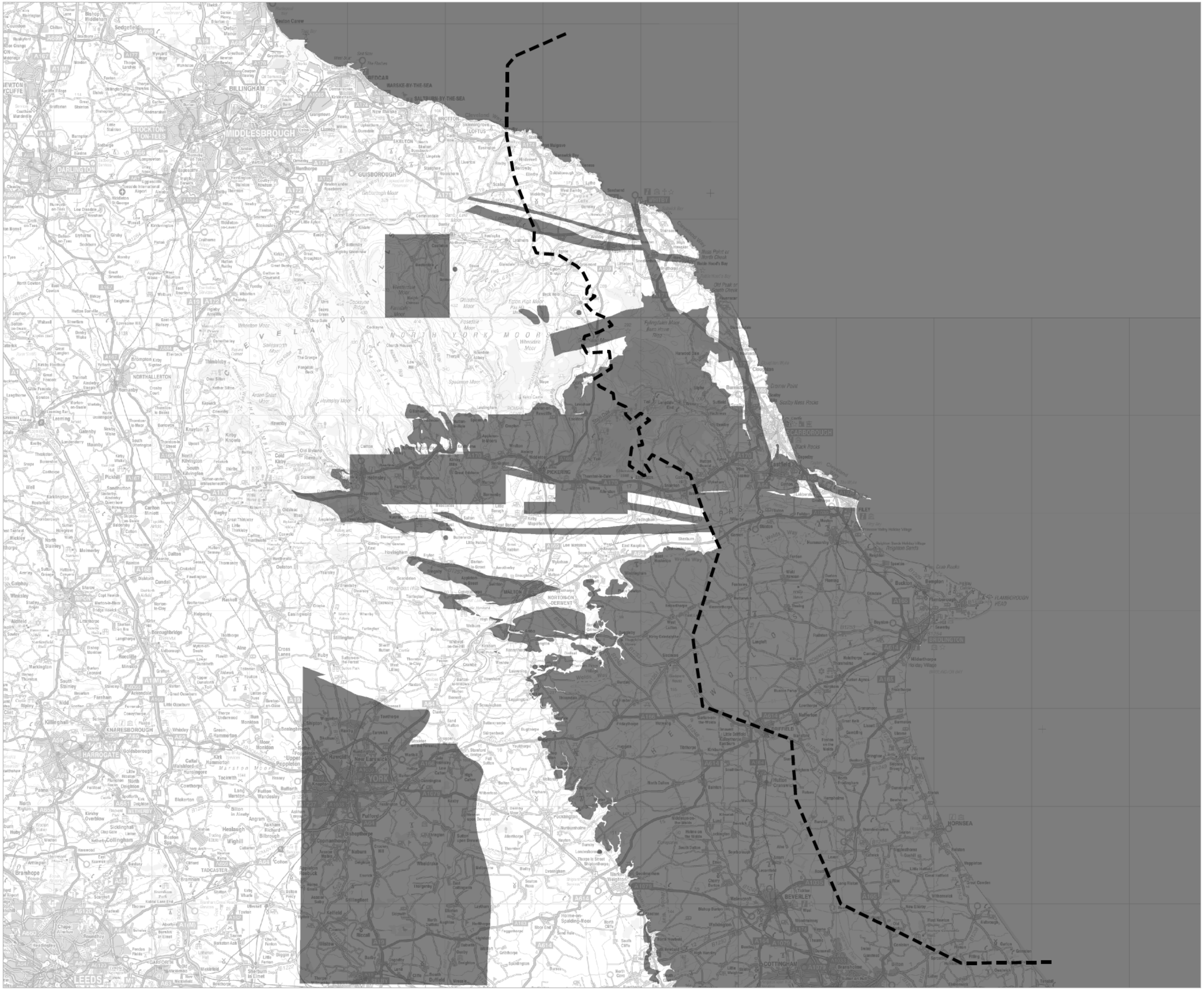
Project	Minehead Alternative Sites Assessment
Title	Stage 2: Mining Constraints Mapping
Client	York Potash Limited
Date	15.04.2014
Scale	-
Drawn by	MAR
Drg. No	GIS50303/04-13

N

GIS Reference: S:\LE50274 - York Potash Minehead\LE50303-04 - York Potash Minehead - Mining Constraints - Map 1 - 04.03.2014.mxd

Appendix 7

ASA Mining Constraints Shadow Mapping



Key

Mining Constraints

Estimated Extent of Onshore Polyhalite

Mining Constraints

Contains Department of Energy and Climate Change information © Department of Energy and Climate Change

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Planning. Design. Economics.

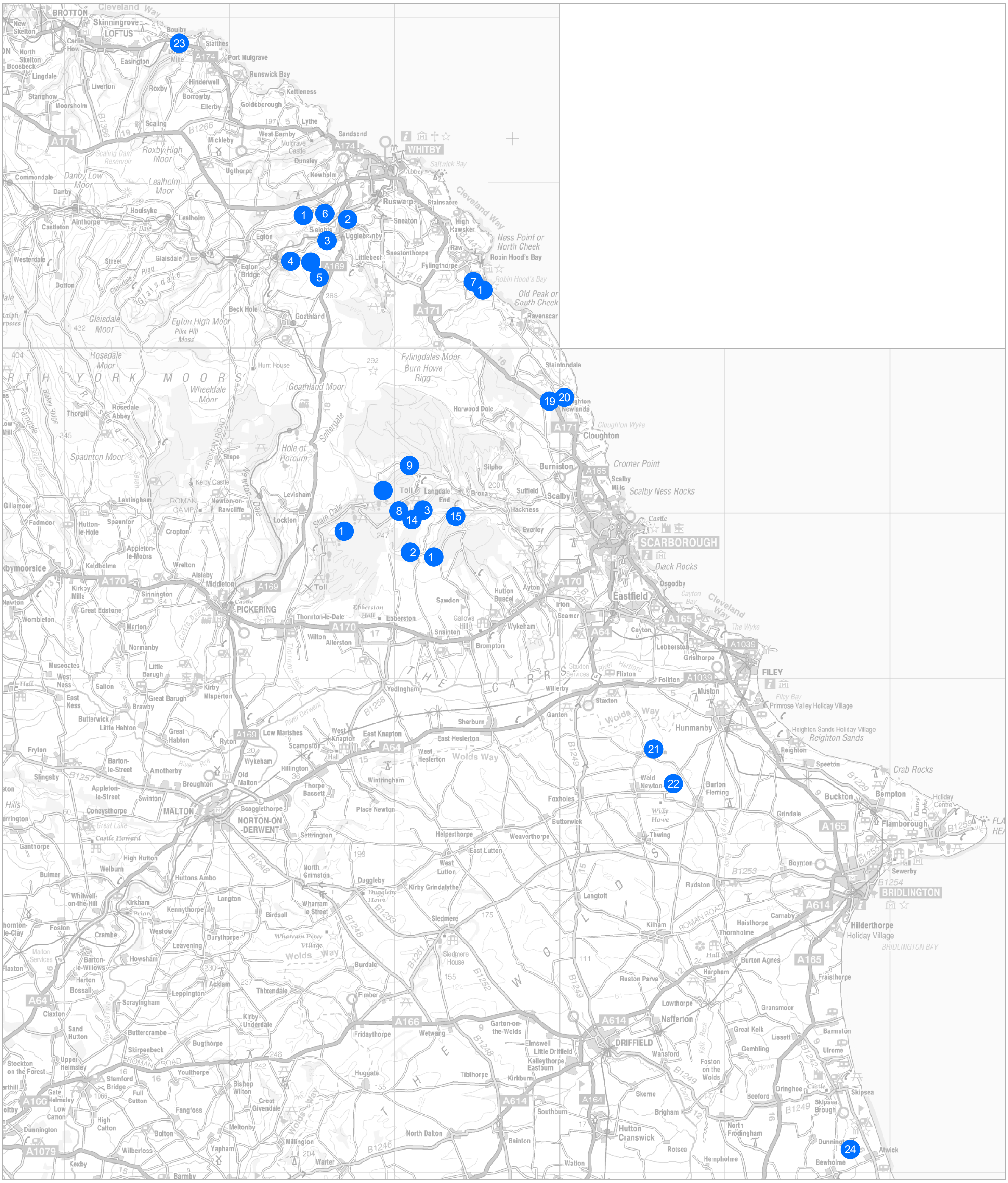
Project	Minehead Alternative Sites Assessment
Title	Stage 2: Mining Constraints Mapping
Client	York Potash Limited
Date	15.04.2014
Scale	-
Drawn by	MAR
Drg. No	GIS50303/04-14

N

GIS Reference: S:\LE50274 - York Potash Minehead\LE50303-04 - York Potash Minehead - Mining Constraints - Map 2 - 08.04.2014.mxd

Appendix 8

Mapped Location of Historical Boreholes in North Yorkshire



Key

- Historical Borehole Locations

Historical Boreholes

1. E2	9. Lockton 3	17. Robin Hood's Bay F1
2. E3	10. Lockton 4	18. Stoupe Beck BH
3. E5	11. Lockton 5	19. CA
4. E10	12. Lockton 6	20. YP14
5. E11	13. Lockton 7	21. F01
6. E12	14. Lockton 8	22. F02
7. E13	15. Lockton East	23. S1
8. Lockton 2A	16. Wykeham 1	24. Atwick 1

Nathaniel Lichfield & Partners
Planning. Design. Economics.

Project: Minehead Alternative Site Assessment

Title: Historical Borehole Locations

Client: York Potash Limited

Date: 12.09.2014

Scale: -

Drawn by: CS

Drg. No: GIS50303/04-22

N

GIS Reference: S:\LE5027 - York Potash Minehead\LE50303-0 - York Potash Minehead - Historical Borehole Locations - 11.09.201 .mxd

Appendix 9

FWS Report – Potash Exploration Target Study (January 2011)

FWS CONSULTANTS LTD
Environmental and Geological Consultants

Merrington House, Merrington Lane Industrial Estate, Spennymoor, Co Durham, DL16 7UT
Tel: 01388 420633 Fax: 01388 819705 Web: www fwsconsultants.com

TECHNICAL REPORT

POTASH EXPLORATION TARGET STUDY

<u>PROJECT 40</u>

CLIENT: York Potash Ltd
Level 12
48 Hunter Street
SYDNEY
New South Wales
Australia

1433/January 2011

FWS Consultants Ltd
Company Registration No: 3944252

C O N T E N T S

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FIGURES

APPENDICES

P R E F A C E

NOTICE

This report presents geological modelling and interpretation of an exploration prospect in NE England. Opinions are expressed on the possible scale of the deposit, so that an appropriate exploration strategy can be developed. Passing reference is made to historical assessments, by others, of “resources” or “reserves” within parts of the prospect. These are no longer valid, and cannot be relied upon. They do not conform with current practice for reserve/resource calculation or expression. The term Exploration Targets is used by the current author in this report. The figures thus presented and discussed are not Mineral Resources or Reserves. They are conceptual in nature. There has been insufficient exploration to define a Mineral Resource as such, within the project area and it is uncertain if further exploration will result in the determination of a Mineral Resource.

Exploration Targets are discussed both with respect to the entire Area of Interest within which York Potash is actively seeking mineral rights; and with respect to the acreage currently under contract.

F.W. Smith PhD. F.I.M.M.M. C.Eng. C.Sci.

TECHNICAL REPORT

POTASH EXPLORATION TARGET STUDY

PROJECT 40

1 INTRODUCTION

1.1 FWS Consultants Ltd (FWSC) has been commissioned by York Potash Ltd (York) to assess and report upon Exploration Targets in York's potash project in North Yorkshire, UK.

1.2 The project ("Project 40") is situated in the Permian Zechstein Basin, one of the best known evaporite sequences in the world. The Basin extends from Northeast England – where it edges onshore over a distance of around 140 km of coastline – beneath the Southern North Sea, and below The Netherlands, Denmark, Germany and Poland. Potash mining began in the Stassfurt district of Germany in 1860, and potash extracted from this basin recently provided ca. 20% of the world's annual output (Warren, 2006).

1.3 Potash in three seams was discovered in North Yorkshire in 1939. The deposits were initially explored in the Whitby area and three projects reached advanced stages in the late 1960s. Boulby Mine (Cleveland Potash Ltd, or CPL) commenced operations in 1969 and began production in 1973. It was recently described as producing 3 million tpa potash ore, and 0.6 million tpa rock salt (BGS, 2006), and is the only producer of potash in the UK. The other two projects were allowed to lapse, despite having been granted planning permission.

1.4 York has identified an Area of Interest (AOI) extending southwards from the boundary of Boulby Mine, and encompassing ca. 1,000 km^2 within which potash is believed to be present at depths of between one and two kilometres below surface, with geological conditions broadly similar to the area currently mined by Cleveland Potash Ltd. Contracts in relation to mineral rights totalling ca. 600 km^2 have been signed by York with major mineral owners within the AOI (onshore and offshore), and negotiations are ongoing with others. A register of mineral owners has been compiled for the AOI.

1.5 All three seams of potash are found within the AOI. The principal ore mineral in the Boulby Potash seam, currently mined by CPL, is sylvite (potassium chloride, or KCl) – or sylvinite (a term used for sylvite mixed with rock salt). A shallower seam of sylvite is also present, but is lower grade and is not currently mined in the UK. The third and deepest seam consists of polyhalite (a sulphate of potassium, calcium and magnesium), and Boulby Mine has recently commenced development into this with a view to production in the near future.

1.6 Sylvite is used in the production of muriate of potash (MOP – 95% KCl) for fertilizer.

(FOOTNOTE: Potash grades are commonly quoted as K_2O equivalent; and sometimes as % KCl or % K. Wherever possible historical data have been converted to K_2O in this report – see Glossary for Conversion Factors).

1.7 Polyhalite is an unusual mineral worldwide to find in commercial quantity and, so far as we are aware, is mined only at Boulby (where it is in early stages of development). Intercontinental Potash Corporation (IPC) proposes underground mining at its virgin Ochoa deposit, New Mexico (Gustavson, 2010), but has not yet begun. The Ochoa deposit is reported to average 2.4 m thick. Insofar as polyhalite is a complex mineral in which potassium sulphate is combined with magnesium and calcium sulphates, and water of crystallization, its potassium content (15.62% K_2O equivalent) is lower than sylvite (63% K_2O equivalent). It can, however, be processed to release potassium sulphate (SOP) that is significantly more valuable than potassium chloride. The potassium sulphate content of pure polyhalite is 28.9%. Magnesium chemicals are a potential by-product of polyhalite processing. Alternatively, polyhalite can simply be washed (to remove salt contamination), crushed, and sold direct as a lower grade, slow release fertilizer.

1.8 Historical data indicate that the polyhalite-bearing seam is likely to be present virtually throughout York's AOI, at thicknesses ranging from 10 to 50 m, and a variable but relatively high degree of purity; thereby constituting one of the world's largest and richest resources of this mineral at mineable depth

1.9 North Yorkshire is also one of the country's largest producers of rock salt (halite) used mainly for winter road maintenance, as a co-product of potash mining – and local resources of this mineral are vast.

1.10 FWSC has reviewed geological information from nearly 100 km of historical boreholes (mineral and hydrocarbon exploration) sunk in and around York's AOI, and from these has drafted a conceptual model and an exploration strategy with exploration targets, as described later. Data acquisition is ongoing, and a number of potentially useful sources have yet to be accessed (approaches having been delayed whilst York built up its mineral rights position).

1.11 The project lies largely within the North York Moors National Park (as does the existing Boulby Mine). York has appointed Planning Consultants, and the National Park Authority (NPA) has been made aware of York's proposals.

1.12 Several locations that appear potentially suitable (in terms of geology, infrastructure and landscape) for a future minehead within the AOI have been identified and preliminary scoping work commenced.

1.13 A study has also been commissioned from specialist consultants to assess alternative routes for transport of product from minehead using the national rail network to ports.

1.14 Although low grade resources of other potassium minerals, such as potassium feldspar, are known in the UK, none has ever been developed and the Zechstein potash seams of North Yorkshire are the only current source of potash in the British Isles.

2 INTRODUCTION TO THE ZECHSTEIN EVAPORITES AND LOCAL NOMENCLATURE

2.1 The only known potash evaporites in Britain formed about 250 million years ago, towards the close of the Permian Period, in or beside the Zechstein Sea (Figure 1).

Our geological knowledge of these deposits in the UK stems largely from the work of F.H. Stewart in the 1950s and 60s, and of D.B. Smith – whose work through the 60s to 90s covered the main period of potash exploration and mine opening, and hydrocarbon exploration in the Southern North Sea Basin.

The Zechstein Basin extends onshore into North Yorkshire, where potash minerals lie at mineable depth.

Halite deposits also occur in the overlying Trias (Riddler, 1981), particularly towards the Basin centre, but none has yet been described as containing potash salts in significant amounts.

2.2 The Zechstein evaporites were deposited mainly in four sedimentary cycles, referred to as Z1 to Z4 (or sometimes EZ1 to EZ4 if referring specifically to the English sequence). A fifth cycle is partially represented by a fairly persistent, but thin, anhydrite. Cycles 6 and 7 are present in Denmark, but not in North Yorkshire.

2.3 The nomenclature of the classically described Zechstein evaporite sequence in Germany (Figure 2) has been widely used (either in its original form, or an anglicized version) by hydrocarbon exploration companies active in the Southern North Sea. Its correlation with the English sequence was firmly established by D B Smith. Table 1 provides the key to the main divisions (Smith et al., 1986). The cycles of evaporite deposition are punctuated by thin beds of predominantly detrital sediments such as the Marl Slate, Grauer Salzton, Carnallitic Marl, and Sleights Siltstone.

2.4 Some problems arise with correlation and nomenclature around the basin margins, as the evaporite deposits pass landwards into shelf sequences showing diachronous facies variants (e.g. Figure 3). Since, however, these problems arise beyond the landward limit of potash deposition, they have no significant impact on Project Forty's objectives.

2.5 It is customary to subdivide the Zechstein cycle classification using the abbreviations 'Ca' for carbonate, 'A' for anhydrite, and 'Na' for halite formations; and 'K' for potash-rich members within the halite formations. We have, for shorthand, adopted the lettering given in Table 2.

2.6 Three Zechstein cycles contain potassium salts. The Z2 (Fordon) cycle is dominated by polyhalite – a complex potassium-magnesium-calcium sulphate – with minor horizons of sylvite and carnallite. Z3 and Z4 cycles contain the better known Boulby and Sneaton Potash seams, respectively, that are primarily sylvinite in the AOI. The Z3 Boulby Potash has been mined by CPL since 1970 and – as discussed earlier – the Z2 polyhalite is currently being developed at Boulby Mine.

3 REGIONAL GEOLOGICAL OVERVIEW

3.1 The Zechstein Basin is now generally believed to have originated as a complex inland drainage basin whose floor lay up to 250 m below world sea level (Smith, 1989) at a time when this area lay close to the Equator. Desert conditions predominated on the floor of the basin, with dune sands, gravel spreads and wind swept arid rock pediments all being preserved (the Rotliegendes) in our area. Marine flooding, from the Boreal Ocean in the north, created a virtually land-locked sea in which evaporation could periodically outstrip replenishment.

Sea level changes stemming from the complex interplay of several mechanisms, including glacio-eustatic oscillations and variations in the rate of crustal subsidence, affected the rate of recharge of the basin, and rapid evaporative draw-down was possible when the entrance sills became emergent during oceanic low-stands (Smith, 1995). Cyclicity, caused at least partly by these relative sea level changes, occurs on several scales and is reflected in the main cycles themselves, in subcycles and repetitions, and in incomplete marginal sequences (resulting from periodic transgression and regression over the shelf regions). Although the original Permian shorelines are not known for certain, Smith (1995) considers that the Zechstein Sea generally extended no more than a few kilometres beyond the present outcrops of late Permian strata (Figure 1).

3.2 Whilst the outline of the Zechstein Basin was to a large extent controlled by the Tatarian topography, several 'basement' features appear to have been active during sedimentation and are reflected as 'Highs' or 'Ridges' over which there is localized thinning or absence of some formations. The Mid North Sea High (Figures 1 and 4) is floored by Lower Palaeozoic basement rocks intruded by major late Caledonian granites and comprised a buoyant basement block feature, over which the Carboniferous, Permian and Triassic sequences are all condensed.

The Cleveland High, that separates the Durham and Yorkshire Provinces of the basin margin, is a more enigmatic feature, having alternated between periods of downwarping and periods of reduced subsidence (or even basin inversion) several times since the Lower Carboniferous. It was a major depositional basin during the Jurassic, extending offshore some 65 km before linking with the Sole Pit Trough. There is insufficient evidence to ascertain its role, if any, controlling potash deposition.

The southern boundary of Zechstein basin in the UK sector is formed by the East Anglian Massif, part of the London-Brabant land mass (Figures 1 and 4).

3.3 Marginal sequences are dominated by carbonate and anhydrite, passing westwards into fluvial sandstones, with red marls and siltstones (Figure 5), and are not easily differentiated or correlated with their basinal counterparts. Useful cross sections have been provided in a number of recent BGS memoirs (Berridge & Pattison, 1994; Frost, 1998; Gaunt, 1994; Gaunt et al., 1992), and clarify relations in Humberside and Southern Yorkshire; providing possible analogues for the onshore margin in North Yorkshire.

3.4 Sedimentation during the first two Zechstein cycles was strongly influenced by palaeotopography. A thick prograding carbonate-evaporite platform, including a barrier reef in County Durham, was built up around the basin margin (Smith, 1994). Up to 300 m of carbonate and anhydrite were deposited in concentric lenticular foresets, represented by less than 50 m of basin equivalents (Figure 5). The basin appears to have been more or less completely filled with Z2 evaporites and the succeeding cycles show far less pronounced lateral variation. What primary variation is present is readily accountable in terms of enhanced subsidence in the centre of the basin.

3.5 Each evaporite cycle consists of a vertical sequence of rocks deposited by gradual evaporation and concentration of brines within the enclosed basin. The order of deposition is, in broad terms, predictable and commences with carbonates, followed by sulphates, then halite and finally by potassium and magnesium salts (the bittern salts). It is significant that the present day mineralogy is rarely primary, and is the result of a complicated series of poorly understood alterations. The main processes, if it is possible to summarize them, are as follows:-

Dolomites and magnesian limestones were mostly deposited as calcium carbonate limestones that were subsequently altered by Mg-bearing brines. In some instances de-dolomitization has occurred to reverse this process (though, generally, near outcrop).

Anhydrite was mostly deposited as gypsum and underwent dehydration during settling or diagenesis. Reversion to gypsum is, again, a recent, near surface phenomenon.

Polyhalite was believed by Stewart (1963) to be partly primary and partly secondary (by alteration of gypsum or anhydrite by Mg-K brines).

Some kieserite is believed to have replaced polyhalite and other (? primary) evaporites such as epsomite (Armstrong et al., 1951, and Stewart, 1965).

The primary mineralogy of the chief potash horizons, the Z2 Stassfurt Potash of Germany, Z3 Boulby Potash, and Z4 Sneaton Potash, is of particular interest because they are believed to represent bittern salts, or the ultimate stage of evaporation of concentrated liquors. It is possible to predict, from solubility and stability data, the succession of different theoretical phases that might be obtained by evaporating brines of any given composition. In the case of normal sea water the first potash mineral to crystallise would be kainite, followed by carnallite; for Great Salt Lake brines, the first potash mineral would be leonite ($K_2SO_4.4H_2O$), then kainite followed by carnallite (Hadzeriga, 1966). In the case of Dead Sea bitterns, the first and main potassium mineral is carnallite. During commercial utilization of Dead Sea brines, carnallite is harvested from solar evaporating ponds, then decomposed by leaching with chloride brines, and converted to sylvite (Kenat, 1966). Primary deposition of sylvite (or sylvinite) seems rare in modern bitterns. Lake Bonneville is one of the few known examples.

Crystal pseudomorphs indicate that carnallite was the main primary potassium mineral in the Boulby Potash (Stewart, 1956) and was subsequently replaced by sylvite. No such evidence has been reported from the Sneaton Potash (Stewart, 1956), but there seem to have been fewer published petrographical studies. Primary sylvite has been suspected, as a minor component only, at certain horizons within the Boulby Potash (Stewart, 1965). Carnallite and kainite are significant components of the Zechstein potash ores mined in Germany. The sylvinite ores of North Yorkshire appear to be restricted to the basin margin and, carnallite is the main constituent of the Sneaton and Boulby seams further offshore, towards the Basin deep.

3.6 More than 1 km of Zechstein sediments accumulated in the centre of the Southern North Sea Basin. The sediments, being mostly evaporites, have been severely deformed by halokinesis. Consequently – within the Basin deep – the overall current

Zechstein thickness varies from less than 50 m in areas of extreme salt withdrawal, to over 2.5 km in some of the major salt diapirs (Cameron et al., 1992). Halokinetic effects are discussed further below but, so far as this project is concerned, halokinesis is a localized phenomenon, albeit highly significant to mining and has often been triggered by fault movement rather than purely overburden pressure.

3.7 The Permian evaporites are overlain by well known sequences of Triassic and Jurassic strata (see Rayner & Hemingway, 1974). Jurassic ironstones, jet, and poor quality coal seams have been mined in the past, but the southern limit of large-scale deep ironstone mining lies beyond the northern limit of Project Forty. The impact of historical near-surface mining, of any sort, on future potash exploration is likely to be very minor, if any.

3.8 The overlying Trias is of great significance to potash mining, since it contains the 275 m thick Sherwood Sandstone (formerly known as Bunter Sandstone) aquifer that presents a formidable obstacle for shaft sinking – and presents a potential hazard with respect to water ingress to workings (Cleasby, Pearse et al., 1977). It also contains the Röt Salt deposit (medium grade halite – never mined in North Yorkshire).

3.9 The AOI has been glaciated, and residual boulder clay and localized sand and gravel deposits blanket most of the surface, with isolated deposits of periglacial and alluvial deposits.

4 POTASH DISCOVERY AND HISTORICAL EXPLORATION

4.1 The Permian rock salt and anhydrite deposits of NE England have been studied and exploited since their discovery at Teesside in the 1880s, and led incidentally to the creation, by ICI and its forebears, of a major chemical industry centred upon Billingham and Middlesbrough. The detailed geology of the principal evaporite cycles in the AOI is described below. The borehole database, from which this is largely derived, began with the discovery of potash in North Yorkshire in 1939. A corpus of academic studies (mostly published) and commercial reports (mostly unpublished) builds upon the borehole data and on CPL's last 40 years' mining experience in the Boulby Potash seam.

4.2 In 1939 a wildcat borehole known as Eskdale 2 (E2) – E1 having been abandoned at shallow depth – was drilled by D'Arcy Exploration Company for oil at Aislaby, on the closure of the Eskdale Anticline. It proved the existence of potash minerals in three cycles of the Zechstein evaporites (Z2, 3 and 4). The cores were examined by ICI, with whom D'Arcy had good relations. Although core recovery was poor in the two upper cycles (of sylvite mineral), the lower Z2 evaporites were cored and found to include 45 feet of "almost entirely polyhalite" (Fleck, 1950). Core samples (not the whole bed – which was never fully assayed) contained 15.0% K_2O (compared with 15.6% K_2O in pure polyhalite) – (Napier, 1948). In addition, the formation water in the Lower Magnesian Limestone was found to contain 24% NaCl and 1.6% KCl. A gas-bearing limestone was encountered at 1,280 m, yielding 3 million ft^3 per day.

It was considered that the brine might be exploitable for its potassium content and after the war ICI commenced a series of exploratory boreholes for brine and mineral. Borehole Eskdale 3 (E3) was drilled in 1948/9, and partly cored through all three potash horizons. The polyhalite-bearing zone was an extraordinary 137 m thick, albeit banded so that the polyhalite varied content from "pure to traces" (Fleck, 1950). ICI subsequently drilled E4 to E7 principally to explore the two upper seams, with E5 continued down through the polyhalite (Raymond, 1951). The Eskdale ('E') series of borings was later continued up to E12 (sunk in 1963) by BP for hydrocarbon exploration. The Eskdale Gasfield is currently licensed to Egdon and Star but, we understand, is not currently in production, due to brine incursion.

4.3 Fisons also drilled four deep boreholes for potash exploration between 1949 and the early 50s, to prove the Sneaton and Boulby seams. Core logs are available, but none of the original Fisons assay reports appears to have survived. The only figures available are grades and thicknesses of the Sneaton and Boulby seams quoted in published papers, or in unpublished manuscripts from DBS files.

4.4 Fisons BH 1, near Robin Hood's Bay, was reopened by BP in 1957 and deepened through the Z2 evaporites in search of hydrocarbons. No cores were taken of the polyhalite – but a gamma ray log is available (as well as a composite log, based on drill cuttings, that erroneously described polyhalite as "anhydrite").

4.5 After further geological evaluation by ICI (Phillips, 1962), exploration restarted in the mid 1960s near Staithes, just off the area of underground ironstone mine workings (in the Jurassic Liassic bedded iron-ore). Staithes 1 (1965) was sunk to a depth of 1,518 m, by Home Oil of Canada in association with ICI, and proved the Z2 and Z3 potash seams (the Upper, or Sneaton, Potash being absent so far north). ICI's subsequent drilling programme ('S' series holes) went on to establish the presence of workable potash in the Z3 Boulby Potash seam around Staithes, west of Whitby, and a joint venture was formed with Charter Consolidated Ltd to create Cleveland Potash Ltd. Planning consent was obtained and work began on site in 1969. Following a pilot borehole to prove the strata (Woods, 1973), two circular shafts, 5.5 m in finished diameter, were sunk to 1,150 m. One was pre-grouted through the Sherwood Sandstone aquifer; the other was sunk using freezing techniques (Cleasby et al., 1975). Potash was intersected in the first shaft in 1973. Full scale production commenced in about 1975.

4.6 The 1960s also saw exploratory drilling by Yorkshire Potash Ltd (a subsidiary of Rio Tinto Zinc) – the "YP" Series holes; and by Whitby Potash Ltd (originally owned by Armour Chemicals, then later by Shell and Consolidated Goldfields) – the "A" and "WP" Series holes. None of the A, WP or YP holes was drilled down into the polyhalite deposits.

4.7 In 1956 the D'Arcy Exploration Company (now BP) sank on behalf of The Gas Council (now British Gas) an exploratory well near Fordon, eight miles south of Scarborough. The evaporite section was cored "in the national interest" and the results relating to the Lower or Fordon Z2 Evaporites were described by Stewart in 1963.

4.8 In the early 1970s The Gas Council investigated the feasibility of establishing a coastal natural gas storage facility in leached salt caverns. Attention focused on the great thickness of halite in the Fordon Evaporite Formation. They deepened YPL's potash exploratory BH YP14, and ran a comprehensive suite of wireline logs supported by sidewall cores. Activity then shifted southwards to Atwick, where the salt sequence was even thicker, and eventually a storage field was developed there.

Atwick No. 1 was cored through the Fordon Evaporites; and gamma, sonic, density and neutron logs were run. The intention was to correlate the mineralogy with the wireline logs to reduce the need for coring in future wells. Some results of the work were written up by Ford et al. (1974) and Colter & Reed (1980). The full results of The Gas Council's (now British Gas) research were never published and, in particular, there is no complete core assay for potassium. Ford et al. provided a table of mineralogical observations and spot analyses.

4.9 A broadly anticlinal structure at Lockton was tested by BP in the 1940s, initially terminating in the Lias, but later in the Carboniferous. Gas was discovered in modest amounts, and to date there have been nine wells drilled at Lockton, and Lockton East. The Wykeham BH (1971) is nearby. Logs are available (in varying degrees of completeness) for several of those that penetrated all three potash cycles. The Lockton Gas Field is currently licensed to Viking for hydrocarbon production – but we understand is currently not producing. The detailed geology of the Lockton Gas Field, and boreholes, has never been published.

4.10 Offshore exploration of the North Sea Oil and Gas Fields began in the 1960s and proved the continuity of the Zechstein sequence between the NE Yorkshire province, and Central Europe. Total Oil Marine drilled a wildcat well (A339/1) into the Robin Hoods Bay Dome in 1966 (actually two holes were drilled; the first being abandoned at shallow depth). Three more holes were drilled in Offshore Blocks 41/24 and 41/25, east of Scarborough within York's AOI; and some NE of Whitby in Block 41/14 just beyond the fringe of York's Offshore Contract Area.

4.11 Interpretation of the evaporite sequence from borehole logs (unless cored, assayed and examined by microscope) needs a comprehensive suite of wireline geological logs – principally gamma ray, supported by density, sonic and neutron. Use of these can, by well established methods (e.g. Crain, no date; Ford et al., 1974; Nelson, 2007; and unpublished FWSC reports), interpret extremely well the mineralogy (Table 3). A correlation of % KCl against gamma ray response measured by FWSC from logs of North Yorkshire exploration holes sunk by Armour and Whitby Potash is shown in Figure 6. Correlation is generally good with expected theoretical values. For example, the equivalent of pure polyhalite, which is theoretically 180 API units, gives a graph reading of 173 API units. The spread of data points, however, reflects the spiky nature of the original gamma plots in relation to the assayed intervals, and indicates an obvious limitation of this type of work. A report by WPL on the correlation of 95 KCl assays against γ readings (Stagg, R.N., 1979) found remarkable correspondence of "calculated" and "actual" results (Figure 24).

4.12 A borehole database relevant to the AOI is given in summary form in Appendix 1, and paper copies of the well logs (or reports) are held by FWSC. References and a bibliography are provided at the end of this report.

4.13 The Zechstein evaporite cycles, and principal evaporite deposits that comprise York's exploration target horizons, will now be described.

5 Z1 CYCLE (DON GROUP)

5.1 Details of Z1, as interpreted from borehole logs are recorded in Appendix 2. This cycle has no known potash resources.

5.2 In essence, the Z1 cycle shows very strong palaeotopographical control. The carbonates and the succeeding anhydrite are mostly contained in thick lenses encircling the basin. The shelf carbonates (Cadeby Formation), ranging up to around 130 m (and including oolites, carbonate sand, and reef limestones), can be traced eastwards into dark, pyritic, argillaceous basinal limestones (Zechsteinkalk) of only a few metres thickness (often unrecognizable on offshore logs). The shelf anhydrite (Hayton, or Werra, Anhydrite), deposited under sabkha-like conditions, passes basinwards into thin, laminated anhydrite. The lens-like geometry of A1 is very striking where proved by borings (Figure 7).

5.3 Halite occurs in the Z1 cycle in the deeper parts of the basin, but nowhere onshore.

6 Z2 CYCLE (AISLABY GROUP) INCLUDING THE FORDON EVAPORITES AND THE POLYHALITE DEPOSITS

6.1 The second cycle was initiated by renewed flooding of the basin and reversion to carbonate deposition in a marginal wedge (the Kirkham Abbey Formation in Yorkshire – Figures 3 and 8) up to about 50 km wide. The landward edge of significant deposition was formed by the Z1 shelf edge. Semi-continental deposits of lagoonal muds, salt pans, sabkhas and alluvial plains spread further west. The Kirkham Abbey carbonates reach over 150 m of shallow-water, or even intertidal, dolomite sands. No reefs, such as occurred in Durham at the platform edge during Z1, are known. The basin slope is known, therefore, by the pronounced eastwards thinning of the deposit and the occurrence of sedimentary structures indicative of debris flows, for example. The ramp could have been locally as steep as 1 in 20. Basinal facies comprise thin, dark, millimetre-bedded, bituminous and dolomitic mudstones known as the Stinkdolomit (or Stink-kalk) member in the North German succession.

The marginal carbonates sometimes include primary anhydrite (occasionally referred to as the Upper Werra Anhydrite) resembling A1 (Taylor & Colter, 1975), or replacive anhydrite (e.g. offshore Durham). The boundary of A1-Ca2 is not easily identified from geophysical logs.

6.2 The Z2, or Fordon, Evaporites are the thickest of all the Zechstein evaporite units, originally infilling the basin and possibly exceeding 500 m in thickness (though now grossly affected by halokinesis and localized dissolution). The general sequence has been summarized by Dr D B Smith as follows.

"Towards the periphery of the basin, thickness decreases to fewer than 100 metres as the evaporites progressively wedge out against the east (seaward) slopes of the Kirkham Abbey Carbonate Formation (= Hauptdolomit) (Figures 3, 8 and 9). Only the youngest of the Fordon Evaporites surmount the shelf-edge carbonate shoals of that unit and these appear to merge westwards with the upper part of the Edlington Formation. Similar relationships obtain against the flanks of the Mid North Sea High (MNSH), but Taylor & Colter (1975) favoured an alternative view that Z2 salt may once have covered the MNSH and later partly been dissolved so as to leave the Deckanhydrit as a residue.

The most fully documented boreholes through the Fordon Evaporites are Eskdale E2 (Stewart, 1949), Eskdale E3 (Armstrong et al., 1951; Raymond, 1953), Fordon 1, the

Type-Section (Stewart, 1963), and Atwick 1 (Colter & Reed, 1980), with brief documentation and/or generalized drawn sections of Eskdale E4, Fordon F2, Hunmanby 1, Robin Hood's Bay, YP14, Barmston 1, and Atwick 2. Information from these sources, together with that from several hundred offshore boreholes, shows that halite is by far the most abundant mineral in the Fordon Evaporites, but that anhydrite and polyhalite predominate in the lower half of the formation in a marginal slope belt. Kieserite is unusually abundant high in the formation in a few places (including Fordon 1 and 2) and sylvite or carnallite (not differentiated) was recorded by Taylor & Colter, (1975) in a widespread 10 m unit ca. 10 m below the top of the Fordon Evaporites.

Stewart's (1963) exhaustive study of the 335 m thick Fordon Evaporites of the Type Borehole remains the standard work on the succession at Fordon (south of Scarborough) and is thought to be reasonably representative of basin-marginal areas along the depositional strike. Stewart found that the Evaporites could be divided into three main sub-cycles that could each be further subdivided to make a total of ten sub-units (2:6:2) (his 'sub-zones') on the basis of their mineral content shown in Table 4. He was able tentatively to identify the three main subcycles in the thinner Fordon Evaporites of boreholes E2, E3 and E5, but it awaited the advent of additional boreholes and good quality wireline logs before it could be shown (Colter & Reed, 1980) that the mineral sub-zones recognized by Stewart (1963) in Fordon 1 could be traced with confidence for 12 km southwards to Atwick 1 Borehole (Figure 10) and for considerably greater distances along the strike. Colter & Reed lumped the sub-zones into 8 “units” in their descriptions. Elsewhere, across the strike, Colter & Reed (op. cit.) were able to demonstrate 'foresetting' of the various evaporite units (Figure 8), confirming an earlier suggestion to this effect (Taylor & Colter, 1975) and throwing some light on the contemporary environment. Cameron et al. (1992) noted that a 3-fold subdivision is widespread in the Southern North Sea Basin.

The main potash interest in the Fordon Evaporites is a roughly stratiform body of polyhalite associated with anhydrite and halite in Stewart’s Middle Cycle. This polyhalite is widely 30 to 80 m thick in most marginal areas of the English sub-basin”.

The Lower Anhydrite (part of Colter and Reed's Unit 1), or Basalanhydrit, shows the same lenticular geometry as the earlier beds, thickening from the shelf over its submarine slope, then thinning on the basin floor.

6.3 Recognizable Mineral Cycles, Units and Mineral Sub-zones (Figure 10) are as follows:-

The Lower Cycle (Unit 1) consists of the Lower Anhydrite (the dominant sub-zone at Lockton, Eskdale 2 and Staithes 1) and, thickening basinwards, the Lower Halite-Anhydrite sub-zone. No significant potash mineralization has been recognized.

The Middle Cycle consists of six mineral sub-zones – equating with Colter & Reed’s Units 2 to 7 inclusive – including abundant polyhalite. Careful examination of wireline logs shows consistent mineral patterns that allows us to further subdivide the polyhalite sections even further. The gamma ray signature of the polyhalite zone is shown in Figures contained in Appendix 3.

Unit 2 (Anhydrite-polyhalite sub-zone) consists of mixed polyhalite and anhydrite, with minor halite. At Fordon the polyhalite content overall was estimated at about 30% by volume and this is probably reasonably typical, judging from the wireline logs, wherever this sub-zone is recognized in the AOI. The polyhalite appears to be secondary, and has replaced anhydrite at Fordon (Stewart, 1963); and anhydrite, or gypsum, and locally halite at Eskdale 2 (Stewart, 1949).

Unit 3 (Polyhalite-anhydrite-halite sub-zone) can often be subdivided further on the basis of gamma log traces into a lower, 3a, unit that is high grade polyhalite (with some anhydrite and halite) as shown by the gamma logs; and an upper, 3b, unit that is mostly halite (with some polyhalite). Stewart (1963) estimated that about 90% of the polyhalite in this sub-zone is secondary, but that towards the top of the sub-zone some layers may be primary. Stewart (see Table 4) estimates this sub-zone as a whole to contain ca. 45% polyhalite – most of which lies in the basal 3a section.

Unit 4 (Halite-polyhalite sub-zone) is relatively high grade bedded polyhalite with halite bands. The petrographic evidence suggests that the polyhalite is primary (Stewart, 1963; Colter & Reed, 1980). The highest grade often appears to be at the very top of the unit.

Unit 5 (Halite-polyhalite-kieserite sub-zone) contains lower amounts of polyhalite, decreasing upwards, that again appears to be primary in origin.

Unit 6 (Halite-polyhalite-anhydrite sub-zone) is mainly halite – and it is in this unit (and Unit 7) that the Atwick gas storage caverns are formed. A sylvite horizon (K2.2) is often found close to the top of the unit. It is thin and low grade in the onshore boreholes. Although apparently thickening offshore, no exploration target is presented – even though it is believed this horizon probably correlates with the famous Stassfurt Sylvite seam mined in Germany. Polyhalite is rare in Unit 6.

Unit 7 (Halite-kieserite-anhydrite sub-zone) is again mainly halite, but with accumulations of kieserite in the upper part (up to 20% in places, by volume). Traces of secondary polyhalite are occasionally present at Fordon 1. Some traces of highly soluble potash salts are locally present outside the AOI, e.g. Hunmanby BH 1.

The Upper Cycle (Unit 8) consists of two recognized sub-zones, the Upper Anhydrite and the Upper Halite-Anhydrite sub-zones – and in our view the UH-A sub-zone is probably capable of further subdivision given the complexity of the wireline responses. Another horizon of potassium minerals (Z2.3) is commonly present near the top – possibly sylvite or carnallite – but, again, insufficient to constitute a target. At the top of the unit there are local segregations of calcium and strontium borates, "reaching up to 20% in some samples" (Colter and Reed, 1980). Borates are found elsewhere in the Zechstein sequence and, to date, no assessment of economic value (if any) has been made.

6.4 In considering the origins of the secondary polyhalite, Stewart (1960) argued as follows:- "It seems likely that after polyhalite became the stable primary sulphate at the top of the polyhalite-anhydrite-halite sub-zone (= Unit 3), brines enriched in potassium and magnesium were able to penetrate the crystal mush below to a degree which is abnormal in evaporites and effect the transformation of very large quantities of primary anhydrite to polyhalite. If it is true that this replacement was penecontemporaneous, we have a reasonable explanation for the abnormally large quantities of primary polyhalite. During the replacement, large amounts of potassium and magnesium were added to the sediments below, and these displaced calcium which may have been transferred to the residual liquid where it may have appropriated more potassium and magnesium to form primary polyhalite far in excess of the normal amount. The quantity of primary polyhalite produced in this way should approximately equal the amount of secondary polyhalite." This is broadly supported by his observations at Fordon where the ratio of primary to secondary polyhalite was judged to be 0.9 (Stewart, 1960). Colter and Reed (1980) reviewed Stewart's argument in the light of additional North Sea data, and concurred with his conclusion. They state "it seems unlikely that if the polyhalite layers were entirely secondary that they could maintain the regional continuity shown by gamma ray correlations, in which they can be seen to extend from the deep basin on the presumably shallower shelf".

This theory of "backreaction" in the Zechstein Basin was modelled by Harvie et al. (1980) who established that as seawater concentrates to slightly below halite saturation anhydrite replaces gypsum. As evaporation continues, existing anhydrite is replaced by glauberite that in turn is replaced by polyhalite.

Studies in Poland (quoted by Warren, 2006) show that polyhalite deposits on the Zdrada platform, in a similar position with respect to the Zechstein margin (but in the Z1 cycle), formed in exactly the same manner as the Fordon polyhalite – by backreaction of anhydrite to create secondary polyhalite.

6.5 Gamma logs for some of the deep boreholes within and around York's AOI are given in Appendix 3 (Figures A3.1 and A3.2). Arranged in sections west to east (shelf to basin) and north to south (roughly along strike of the basin margin) they demonstrate (a) the remarkable continuity of the polyhalite deposits; and (b) the lateral persistence of the relatively high grade section in Unit 3a. Table 7 gives a breakdown of thicknesses, and wireline log responses (γ API), for the high grade sections.

6.6 The most consistent high grade section appears to be Unit 3a (the lower part of Unit 3), where gamma ray logs commonly show a plateau, surmounted by six to nine spikes. This is the current focus of York's attentions as an Exploration Target. The gangue or associated minerals with this polyhalite are chiefly halite, with minor anhydrite. Halite occurs as bands or coarse inclusions that might be readily separated from the polyhalitic mineral. Anhydrite occurs as a single band in boreholes Cloughton 'A' and YP 14 - indicated by wireline logs as a bed up to 1 m thick – but this seems relatively unusual. It occurs more commonly, as described from microscope work by Stewart and others, finely intergrown with the polyhalite rock and therefore not readily separable (if at all, except by chemical processing).

6.7 No comprehensive chemical analyses through the polyhalite zone have been published, but there are other indications of polyhalite purity to support the wireline log interpretation.

Three core specimens from E2 were analysed and reported by Stewart (1949). They contained 15.64, 15.42 and 15.53% K_2O – which is virtually pure polyhalite (15.62% K_2O). Insoluble matter ranged 0.18 to 0.27%. The depths at which these cores were collected were not recorded.

A short core taken at 5,033.5 feet depth in E3 was analysed and reported by Armstrong et al. (1951). They quoted 11% K – which equates to 85.2% polyhalite in the rock (along with NaCl 1.3% and 5.3% insolubles). It was reported at the time that ICI had collected and analysed the drill cuttings from this borehole, thereby confirming the presence of polyhalite from 4,722 to 5,171 feet – but the results are not available to us (if, indeed, they survive).

Stewart (1963) estimated the proportions of constituent minerals in the Fordon 1 core – see Table 4 and Figure 10 (this report) - quoted 40% polyhalite for the whole of Unit 3. Since, from our interpretation of the logs, Unit 3 can be divided further into a lower section of mostly polyhalite and an upper section of mostly halite, each of similar thickness, we can conclude that the lower, or 3a, section contained considerably in excess of 40% polyhalite.

Colter & Reed (1980) and Ford et al. (1971) researched the substitution of wireline logs for coring to reduce exploration costs at the Atwick Gas Storage site. The core of Atwick 1 was analysed chemically and mineralogically. Mineralogical assessments published by Colter & Reed (see Figure 10, this report) indicated 80% polyhalite in Unit 4, and 60 to 80% "mixed sulphates" in the lower part (i.e. 3a) of Unit 3. Mineralogical estimates (by microscopy) of % polyhalite made at intervals through Unit 4 were published by Ford et al. and provide a weighted average of 72.64% polyhalite (over 11.45 m). The gamma ray response from Unit 3a is appreciably higher than that of Unit 4 (see Figure 10) and so a higher average polyhalite content can reasonably be expected. The core of Atwick 1 is believed to have been conserved on site, and York hopes to inspect and sample it. Despite the Atwick location being over 20 km south of York's AOI, the core will provide useful data on the deposit.

6.8 Unit 4 may locally present a target. Logs suggest it consists of interbanded halite and pure, primary, polyhalite. Overall, the grade may be lower, and total thickness less, than Unit 3a, but beneficiation may be simple since the anhydrite content is less.

6.9 Unit 2 varies considerable in thickness. Polyhalite occurs throughout, but the associated gangue is generally anhydrite and so (given the similarity of their physical attributes, and likely intergrown texture) there is no simple method of upgrading potassium values.

6.10 Polyhalite forms essentially a tough, brittle rock broadly similar to anhydrite in quality. It does not flow and is expected to fracture cleanly in the vicinity of faults – though any interbedded halite (where present) might be prone to disturbance.

7 Z3 CYCLE (TEESSIDE GROUP)

7.1 The cycle begins with the Grauer Salzton (GS), or Grey Salt Clay, a thin marine shale with prominent gamma-ray peak indicating the early stages of the marine transgression at the onset of Z3. Although probably very extensive, and overtopping red beds around the margins, it is not always recognisable in boreholes. Gaps in the database are probably mostly due to non-recognition rather than non-deposition.

7.2 The Brotherton Formation or Plattendolomit (Ca3) was deposited in a shallow basin of much lower relief than previous cycles, but still shows its maximum development (up to about 75 m) in a concentric lens-like rim around the shelf-edge.

7.3 The Boulby Halite (Na3), or Leine Halite, was deposited in a basin of extremely low relief, under very shallow water or emergent, salt flat conditions (cf. the desiccation polygons recognizable at Boulby Mine – Woods, 1979). Smith (1973) subdivided the formation into four main lithological units (A to D), based on observations in Yorkshire (Table 5). Unit A contains bands and beds of anhydrite, and can grade down into the Billingham Main Anhydrite. Unit B is clean halite (occasionally with traces of potassium salts). Unit C, which is the Boulby Potash, first appears patchily by lateral passage from halite near the top of the formation, 20 to 30 km basinward of the margin, and thickens to more than 100 m in the Basin deep by incorporating successively lower beds of Unit B (Smith, 1980). It consists of halite with potassium minerals and fine clastic sediment (red clay). Unit D is only recognizable where Boulby Potash is present and is generally less than 3 m thick. It comprises halite with minor red and grey mudstone and some anhydrite; and is sometimes called the Boulby Shale (Talbot et. al., 1982) or Transition Zone (see Figure 11). Although generally drawn as the lowermost unit of cycle Z4, the Carnallitic Marl is effectively the ultimate stage of cycle Z3 and represents the final desiccation of the basin, and encroachment of semi-continental conditions with playa lakes. The Marl is commonly veined with remobilized halite, carnallite and sylvite.

Overall Na3 thickness ranges from a few metres in southeast Yorkshire, where halite is interbedded with red marl, to around 50 m in the Boulby Mine area, and around 200 m in the main North Sea basin (disregarding halokinesis).

7.4 The Boulby Potash (K3) data have been plotted to show base and total thickness of K3. The conjectured landward limit of K3 has been shown on the appropriate drawings.

The base level falls from around 880 m BOD (1,183 m bgl) at Egton High Moor 1 (the shallowest borehole intersection in terms of OD) on the Cleveland High, through around 1,050 m BOD at borehole S1, dropping to >1,200 m BOD in part of the WPL area, rising again in a dome at Robin Hoods Bay. At Cloughton, just north of Scarborough, it is similar in depth (below O.D.) to Boulby (see Figures in Appendix 2). The K3 horizon then becomes progressively deeper as one goes further south along the Yorkshire coast-line.

Total thickness of K3 is highly variable on a small scale, as seen in Boulby Mine, and so the variation displayed within the database needs to be interpreted with caution to differentiate true variation from chance. Thickness varies from typically 2 to 10 m in the Whitby area to over 100 m in the deeper basin, where halokinetic thickening is an additional complication. K3 is only present onshore from the Cleveland area, south through the Lockton-Cloughton area, to about Great Hatfield (south of Flamborough Head). The most consistent, thickest, and shallowest K3 lies between Boulby and Scarborough.

The northwestern limit of K3 onshore has been proved by Boulby Mine exploration (Holmes, 1991). It is present, but low grade, in Egton High Moor 1; then follows a gap of poorly explored ground, until proof is again given by positive (though thin) intersections in the Lockton area.

An hitherto unexplained feature is the absence or impoverishment of K3 in a NE-SW trending zone running offshore from Scarborough, Fordon and Hunmanby towards Well 42/13-1. This well is not a particularly good data point, being located in a diapir, but the general trend is backed up by a belt of intersections (e.g. 42/25A-1) where the K3 horizon is thinner and the Carnallitic Marl is generally thicker than usual. It may be, therefore, that the impoverished area indicates a zone of leaching or subaerial erosion prior to Carnallitic Marl deposition, which then infilled the resultant slight topographic depression. Another feature shown by some offshore wells near this zone is that the potash horizon logged as K3 is sometimes much lower down in Na3 than normal and may not be exactly contemporaneous with K3 logged elsewhere (or may even be a secondary mobilization).

A plan in Appendix 2 shows the change-over in dominant mineralogy from sylvite onshore to carnallite offshore. The K3 database shows reliable sylvite observations onshore from Boulby-Whitby to Lockton-Cloughton. There are very few reliable observations close offshore, but sylvite is usually not present in any hydrocarbon well beyond ca. 10 km offshore in this part of the basin. Carnallite becomes the principal component of the seam in the basin and thickens steadily eastwards into the basin deep. In a transition zone around the basin margins it overlaps with the sylvite field (where, usually, sylvinite lies on carnallite).

This eastward limit of sylvite, giving way to predominantly carnallite, is critical in determining the seaward extent of any new mining prospect; and limits the seaward extent of Boulby Mine's current workings (Holmes, 1991). A drawing in Holmes (1991) shows the westwards limit of K3 carnallite within the Boulby Mine concession (Figure 12). We tentatively estimate the transition to predominantly carnallite about 6 km offshore – but it will need to be proved. Carnallite is plastic and unstable at these mining depths. It is a potash ore, commonly mined in other regions, but no safe method has yet been devised to extract it in this orefield.

Small nodules of very hard boracite occur in K3, often associated with shaly partings. Larger nodules, up to 1 m diameter, occur in the sylvinite directly above carnallite pods in the Transition Zone (a similar situation to the boracite nodules in the Z2 cycle) and have been described by Milne et al. (1977).

7.5 Detailed accounts of the mineralogy, mining geology, and structural geology of K3 are given by Holmes (1991), Talbot et al. (1982) and Woods (1979).

8 CARNALLITIC MARL

8.1 The Carnallitic Marl (or Röter Salzton) is a red saliferous mudstone with varying amounts of displacive, interstitial and vein anhydrite, halite, carnallite and sylvite. Smith (1980) interprets it as the coalesced distal extremities of alluvial fans that spread into the basin during a lengthy pause in evaporite deposition, and perhaps merged into an extensive central saline playa. Much of the silt grade quartz may have been aeolian dust. It extends throughout the basin (merging with marls around the basin margin), though it is not always recognizable in the basin deeps. This may be due to halokinetic disturbance.

8.2 Data on the base of the Carnallitic Marl (CM) show a regular and consistent basinal pattern beyond the Cleveland High. On a small scale, the base of the CM is quite irregular, displaying features known as 'marl rolls' that belly down into the underlying evaporites.

8.3 The Carnallitic Marl is extremely weak. No cement binds the clay minerals, and the rock is not self-supporting in Boulby Mine. Any accidental exposure in the roof of the workings, if left untreated, collapses within days to expose the floor of the Sherburn Anhydrite. A second feature is that when underground probe/exploration drilling meets the base of the marl it forms a thixotropic mud (marl plus saturated drilling brine) and immediately jams the drill-string. More importantly, though, is the problem caused by the marl squeezing the shaft linings, leading to two shaft failures and relining exercises (1983 to 86, and 1997 to 2002) at Boulby (Williams & Auld, 2002). Contractors are reportedly being recruited for a third relining exercise – presumably for the same reason.

8.4 Given the extremely weak nature of the Carnallitic Marl, Boulby Mine generally leaves a roof beam of 2 m of halite (or potash) for protection. As described earlier, there is usually, within the Whitby-Boulby area a band of halite (Smith's Unit 'D', shown as Na3tm by Kali and Salz, Z4D/E in some of the old WPL reports, or the Transition Zone of CPL) in this interval, measuring a couple of metres – so that little potash is lost. But that is not always the case, and given the need for this 2 m roof beam, and a minimum stope height of about 3 m, the thickness of the high grade Boulby Potash horizon, and its disposition relative to the base of Marl are key criteria in determining mineability and calculating reserves.

9 Z4 CYCLE (STAINTONDALE GROUP)

9.1 Rocks of this group are generally similar to, but somewhat thinner than, those of cycle Z3 and were deposited in a gently subsiding basin of very low relief. The overall thickness of A4 and Na4 (including K4) ranges up to around 100 m to 120 m in the basin deeps.

9.2 The Upgang Formation, a thin carbonate forming the basal unit of cycle Z4, is very thin and cannot usually be recognized on geophysical logs, but is often recorded as ca. 0.3 to 0.5 m thick in core descriptions.

9.3 The Sherburn Anhydrite (A4), or Pegmatitanhydrit, can be traced off the shelf, where it is widespread and well developed (giving a very characteristic geophysical signature), throughout the basin. In general the formation thins towards the basin centre where it is locally absent.

9.4 The Sneaton Halite Formation (Na4), or Aller Halite, has been subdivided by Smith (1973) into five lithological units (Table 5) onshore, that are generally traceable throughout the study area. Units A to C were probably deposited under conditions similar to the later parts of the Z3 cycle, show upward-diminishing amounts of anhydrite, and culminate in the potash beds interleaved with red mudstone. The anomalous position of the Sneaton Potash in the centre of the Formation can be most readily explained if Unit C is regarded as the youngest member of an evaporative subcycle; Unit D being then regarded as the facies equivalent of the Carnallitic Marl; and Unit E (relatively pure halite) as the product of a short-lived expansion of the basin centre playa before cycle Z4 was brought to an end (Smith, 1980).

Petrographical studies have been published by Armstrong et al. (1951), Raymond (1953), and Stewart (1951 and 1956). These show that the mineralogy (especially of unit C) has undergone complex diagenesis on a massive scale. Nevertheless, the mineralogy overall is less variable than that of the Boulby Halite Formation.

9.5 The Sneaton Potash horizon is readily distinguishable on most wireline logs, but since the interbedded marls continue and thicken westwards onto the shelf areas, it is difficult to differentiate precisely the feather edge of the potash seam.

Although superficially similar to the Boulby Potash, the Sneaton Potash is (on land at least) much less variable in mineralogy and thickness. There is no petrographic evidence, for example, that carnallite was a precursor to sylvite. Most importantly, though, the potash seam is generally a cleanly layered body within mudstone bands that can be traced locally by borehole for moderate distances (Smith & Crosby, 1979). Although the potash is cut by abundant minor movement planes and veins of carnallite, halite, rinneite and sylvite, it is overall less deformed than K3 and the mudstone bands appear, therefore, to have prevented mobilization and flow on the scale observed in K3 at Boulby Mine (e.g. Talbot et al., 1982).

The overall thickness variation of the Sneaton Potash has been plotted, from the database, and the westernmost limit of the seam identified approximately. The seam shows rather more internal complexity than the Boulby Potash insofar as it splits into two or more thin beds (Appendix 4). The impoverished zone noticed in K3, running northeast from Hunmanby, is not present in K4.

Sylvinite is chiefly present in a 50 to 80 km wide marginal zone - occurring on its own within the current AOI, or with carnallite (usually as a sylvinite seam overlying carnallite) south of Hornsea. It is virtually absent from the deeper parts of the basin. Carnallite shows the converse, being mostly restricted to the deeper areas and being virtually absent near-shore, except where associated with sylvinite.

Grade variation shows no obvious pattern. This is, again, unsurprising in light of the widely spaced data points. The grade of the Sneaton Potash is almost always much lower than that of the Boulby Potash.

10 HALOKINESIS

10.1 Halokinesis, or viscous salt flow, is evident at almost every scale (down to the gneissose texture of the K3 potash ore itself – Woods, 1979) and is the commonest cause of localized thickness variation in the evaporite sequence. In the deeper parts of the basin there are probably few, if any, areas of unaffected salt (Figure 13). Depth of burial in the area of current interest is likely to have been as much as 6 km.

10.2 On a small scale, salt deformation above and around faults is well documented (Rommelts, 1995; Smith, 1996, Woods, 1979). It is clear that halite, and K-Mg salts in particular, readily deformed and flowed in such a way as to 'take up' the displacements of minor faults (normally only up to the overall thickness of the individual salt formation, but sometimes more) – e.g. Figure 14.

10.3 Salt may also flow in response to thermal convection influenced by primary gravitational instability on a grand scale. Potash salts, especially carnallite, are even more mobile than halite and a wide range of extraordinary flow structures, and modes of thickness variation (e.g. multiple recumbent folds), has been described from Boulby Mine (see Figure 15, and Talbot et al., 1982). Of significance to the present study, with respect to reliance that can be placed on any borehole record, is the observation that overall potash seam thickness may vary from "less than a metre to as much as 20 m over horizontal distances of 20 to 30 m" (Woods, 1979). For example, the K3 seam varied in thickness from ca. 1.5 to ca. 5 m across the diameter of Boulby No. 2 shaft. Similarly, the K3 seam in YP10 consisted of 1.5 m of high grade sylvite (1,581 γ CPS – see Appendix 4) and 2.1 m of low grade sylvite (314 γ CPS) in YP10 Diversion – only a few metres away.

10.4 The enhanced mobility of sylvite and carnallite relative to halite, means that as the K3 evaporites have flowed into the marginally lower pressure zones on the downthrown sides of growing faults, the potash salts have flowed preferentially – so that these zones have become not only thicker, but richer in potash minerals. One of the major achievements in the early years of mining at Boulby was the recognition of this and the development of techniques to predict the thick, high grade potash oreshoots and to probe them with longhole drilling to establish the location of the best reserves.

10.5 Major halite flow in the North Sea Basin appears to become commonplace about 40 to 50 km offshore (Figure 13), far beyond the limits of mining. Flow wavelengths are typically in the order of 20 to 30 km (Davison et al., 1996). A systematic pattern in the location and orientation of the salt pillows, domes and walls is evident throughout the North Sea Basin, and bears such a remarkable resemblance to the structural grain of the basin that it seems likely that the triggering mechanism for large scale flow was usually related to basement faults.

11 SOLUTION EDGES

11.1 Solution edge effects are evident in Cleveland, Durham and Northumberland as Z1, Z2 and Z3 evaporites approach the modern land surface, or sea bed. They lead to local difficulties in recognizing the sequence but, insofar as they do not affect any potash deposits, are of no significance to the present study. The limit of the Sneaton Halite in Yorkshire has sometimes been described as a solution edge, but without any firm evidence. Two edge dissolution slopes in Z2 halite have also been described along the flank of the mid North Sea High (Jenyon, 1987).

11.2 The widespread Deckanhydrit member of the Fordon Evaporites is considered by Taylor and Colter (1975) to be an intraformational palaeosolution residue resulting from leaching of salt deposits during an episode of basin flooding. There is no indication that it affects the polyhalite deposit.

12 FAULT PATTERN

12.1 Regional contours drawn on key horizons in Appendix 2 illustrate the generally simple lie of the principal horizons of interest, but superimposed on this (and not shown on the drawings) is a pattern of significant faulting. A few faults break surface and have been mapped displacing Jurassic sediments (Figure 16). There is, however, substantially more faulting beneath the evaporite sequence, and these deep-seated structures diminish – or sometimes disappear – upwards into the evaporites (e.g. Figures 14 and 15, and Talbot et al., 1982). As described earlier, the more mobile salts – potash in particular – have flowed and tend to form swells and high grade ore-runs on the downthrow side of some of these structures. Seismic surveying can detect and map the deeper fault pattern, thereby presenting an opportunity to predict the location of ore-runs.

12.2 Onshore seismic work was carried out by WPL (building on 1973 Gas Council Seismic Surveys – see Riddler, 1980) and by YPL. Offshore seismic surveys were also carried out for YPL and Total Oil Marine in the 1960s. Summaries of some of these results are currently available to us (e.g. Figure 17). CPL has also carried out seismic studies, but their results are not publicly available. FWSC has identified some 3,100 km of relevant legacy 2D seismic lines (onshore and offshore) in UK archives, and a project has been designed to reprocess and remodel them to identify fault locations at various levels in the evaporite sequence, and to contour key horizons throughout the AOI.

12.3 The basic underlying fault pattern appears to comprise an early, largely east-west trending, fault system (e.g. the Lealholm Fault) perhaps reflecting major basement features (and rarely extending to surface), displaced and possibly offset by later north-south trending faults that continue strongly to surface (Figure 17).

12.4 The principal known north-south faults affecting the potash area as a whole are:-

- the Runswick Bay Fault, traceable through Boulby (where it has a very strong influence on ore distribution – see Figure 12 and Para. 15.4), the WPL area (again strongly influencing ore distribution), and indicated by YPL's seismic work to die out a few kilometres south of Goathland. YPL's seismic map (Figure 17) shows the throw changing from east down (south of Grosmont) to west down (north of Grosmont, and through Boulby);

- the Whitby Fault, shown on YPL's seismic map (Figure 17) as throwing east down at Whitby, then veering off and dying away at Robin Hoods Bay – but a similar fault beginning *en echelon* at Stainsacre, follows a sinuous course and eventually dies out southwards. There are insufficient borehole data, backed up with assays, to determine its effect on the potash horizons;

- the Ravenscar (or Peak) Fault, shown on YPL's seismic map (Figure 17) as running north-south through the Peak at Ravenscar and increasing in throw offshore to ca. 245 m in a complex fault and monocline structure – dying out onshore to the SSE. The offshore trace is shown in a different location and trend on the YPL map (drawn 1969) from that on the BGS Tyne-Tees map (Figure 16, based on earlier work carried out between 1964 and 1966). The YPL interpretation is probably better informed and more reliable. It provides the line that we currently use in York documentation. There are differences in the Jurassic sequence across the fault, and these have been interpreted (Hemingway in Rayner & Hemingway, 1974) as indicative of growth during the Jurassic, or of major wrench movement.

12.5 YPL's seismic structure map (Figure 17) shows a monoclinal structure offshore on the footwall of the Ravenscar Fault, with the annotation "Collapse Zone?". As the structure approaches the coast it becomes confused and a separate zone is labelled "Zone of faulted and confused reflections". The graben-like structure is now known in far better detail as the Peak Trough (Milsom & Rawson, 1989; and Figure 18), rather than as a fault with complementary monocline. The condition of the mobile evaporites within the Trough remains unknown. So too are the potential problems associated with tunnelling through it to access offshore potash resources further east. An objective of York's seismic reprocessing, and any future follow-up, will be to define in detail the geology of the Peak Trough, its effect on the evaporites, and the safest location to traverse it.

12.6 Landsat imagery was used by WPL to identify lineaments, summarized by Riddler (1979) and considered to provide an idea of fault trends in the underlying Permian.

12.7 The regional dip of strata is relatively low and regular (typically 1 in 30), and the polyhalite bed is expected to be similar. The dip can be locally highly variable within the Boulby Potash seam, as a result of salt flow (especially in the vicinity of faults).

13 CLEVELAND DYKE

13.1 The NW-SE trending Tertiary Cleveland Dyke has been mapped at surface for more than 50 km northwestwards from Blea Hill Rigg (N2903005) - see Figure 16. It is absent, or is undiscovered, in the AOI SE of Blea Hill. It ranges from 25 m width at Great Ayton on the western edge of the North York Moors, to about 2 m where last seen in the SE at Blea Hill. Emeleus (in Rayner & Hemingway, 1974) says the dyke is "in a series of *en echelon* segments, which are locally headed in a manner suggesting that the intrusion is near its upper limits". Alteration of wall rocks is slight, being limited to discolouration and induration up to 2 m from the dyke, sometimes with some disturbance of dip in a zone a few metres wide.

13.2 Experience in the Durham and Northumberland Coalfields shows that the Tertiary dykes can be water-bearing – being often well-jointed. The dyke may, therefore, present a hazard to underground mining – where water ingress cannot be allowed. Its condition and metamorphic aureole in the evaporites is totally unknown.

13.3 The presence or otherwise of the dyke SE of Blea Hill Rigg is clearly something that needs to be proved if likely to impact on a future mining area, and a surface magnetometer survey would appear a reasonable first step – bearing in mind always that the dyke may be present at depth in the evaporites, but have no surface expression.

14 GAS

14.1 Potash discovery was made in the course of exploration for gas, and a number of gas showings are known from the magnesian limestones. Small gasfields were discovered at these levels at Eskdale (produced 1960 to 1966, chiefly from E2, 11 and 12), and Lockton (produced in 1971 and intermittently until recently). Hydrocarbon licences are still held by Egdon (Ralph Cross – PEDL 068), Star (Eskdale – PEDL 002) and Viking (Lockton – PL077). Some old data on gas production from Permian Limestones at Eskdale and Lockton are provided in Riddler (1979).

14.2 No offshore blocks are currently licensed within Project Forty's area of interest. Several offshore exploration wells have been drilled in the past. Wildcat Well 41/18/1-2 (also known as A339/1-2), was sited by Total Oil and Marine in 1966 off Robin Hood's Bay. Wells were also drilled NE of Whitby (just outside York's offshore Contract Area) and three wells inside the Area, east of Scarborough (Conoco). Data are summarized in Appendix 1. All were considered dry and were abandoned; as were the onshore wildcats outside of Eskdale and Lockton. Most hydrocarbon wildcats penetrated the entire Zechstein sequence and Basal Permian Sands (Rötliegendes), and terminated in the underlying Carboniferous.

14.3 Gas is also present throughout the Boulby Potash seam (Woods, 1979 and Holmes, 1991) at Boulby Mine and in certain areas can outburst with explosive force as the seam is mined. Such outbursts displace from less than 1 tonne to greater than 1,000 tonnes of potash. The gas is 60 to 80% nitrogen with 20% methane, and traces of ethane, propane etc. It is believed to be adsorbed onto clay minerals and so tends to be associated with accumulations of shaly ore. Mining methods and safety rules at Boulby had to be changed to minimise the risk from this phenomenon.

15 CONTROLS ON POTASH GRADE AND THICKNESS

15.1 Controls on polyhalite grade and thickness appear to be depositional or early diagenetic and, whilst recognising the sparseness of data, Unit 3a of relatively pure polyhalite appears to maintain a remarkably constant thickness from Whitby to Scarborough, inland to Lockton, and offshore to the eastern limit of the AOI (Figures in Appendix 2). It seems very unlikely that any halokinetic effects are present.

15.2 K3 and K4 sylvite seams have been shown to die out to the north and west as a result of primary depositional edges – rather than solution edges (or faults). A zone of impoverishment cuts off the K3 seam at Scarborough, but K4 appears to continue unaffected. Both sylvite/sylvinite seams change offshore to carnallite, which is currently deemed to be unmineable (unless by an innovative underground-based, solution mining technique utilizing horizontal drillholes in the footwall – yet to be assessed). The transition – or Carnallite Line – has been estimated to be ca. 6 km offshore in the K3 seam (very sparse evidence), and to be beyond the eastern edge of the AOI in the K4 seam.

15.3 The thickness of K4 does appear to thicken progressively from west to east (see plot in Appendix 2), but this may be by chance – resulting from the small number of data. It is safer to assume that some localized variation in thickness is present, resembling that in K3. Riddler (1979) described "a small basin of thick (>7 m) K4 potash occurs centred on Whitby (intersected at E6, F4 and E3)" and again in the Scarborough area – that agrees with our isopach drawing (Figure A 2.5).

15.4 The variability of thickness and grade of K3 is now well understood from Boulby – where flow associated with the underlying fault pattern is superimposed on an already complex smaller scale pattern of convection cells. The pattern of variation is shown by Annels and Ingram (1992) and more clearly on Figure 12, from Holmes (1991). The very strong N-S influence of the Runswick Bay Fault (downthrowing to the west) is clear, as is the influence of smaller N-S and E-W structures in the underlying strata. The major ore-run on the downthrow of the Runswick Fault continues southwards into the WPL lease, where it was proved by drilling and is clearly shown on Figure 19 (running NW-SE through BH A17). This same figure shows a second ore-run (running through BH E3) in the footwall of the E-W Lealholm Fault. There are insufficient assay data (we do not yet have access to YPL's reports) to continue these outlines through the YPL area and southwards, but it is reasonable to assume that similar swells in thickness (usually accompanied by high KCl content) follow the faults identified by YPL's seismic surveying and shown on Figure 17, and further south throughout York's AOI.

There is nothing to suggest a fundamental, depositional reason for K3 thickness and grade to be any different in the unexplored part of York's AOI, south of WPL/YPL, from the better-known northern part. The fact that the few existing boreholes in the south (e.g. 41/18-1, YP 12 and 14, and Cloughton) show only modest accumulations may readily be explained as chance intersections.

16 MINING DEPTH AND VIRGIN ROCK TEMPERATURES

16.1 The base of the main Polyhalite seam dips southwards and eastwards, at a shallow gradient, so that at Scarborough it is expected to be in the order of 1,600 to 1,650 m BOD, and at the furthest offshore limit of the TCE Area ca. 1,650 to 1,700 m BOD (or 1,500 to 1,600 m below the sea bed).

Surface levels vary onshore across the AOI, so that in places there could be a maximum of 1,900 m of cover on the polyhalite.

16.2 The geothermal gradient is known in the Staithes area, and some temperature measurements were made in the Eskdale boreholes. Virgin rock temperatures within the deepest K3 seam workings at Boulby Mine, in the onshore mining districts, are said to be typically 44 degrees Centigrade (P. Woods, pers. comm.).

16.3 Virgin rock temperature will be relatively high for mining in any new operation by York, and appropriate ventilation and refrigeration systems will be designed. The elevated rock temperature may present opportunities, however, and a considerable geothermal resource may be exploitable – from ever increasing areas as mining expands. This opportunity will be studied as part of the planned exploration programme.

As far as we are aware, there is no recovery of geothermal energy currently at Boulby.

16.4 The regional geothermal gradient is approximately 30°C/km, slightly above the UK average for low conductivity sedimentary rocks of 26°C/km (Downing & Gray, 1985).

16.5 Heat flow at Boulby (NGR N24761 5184) is 47 M W/m^2, measured between 799 and 1,087 m below ground level. Similar heat flows of 49 and 48 M W/m^2 have been recorded at Tocketts (NGR N24631 5180) and Kirkleatham (NGR N2458 5213) respectively (Downing & Gray, 1985). These values suggest relatively low levels of heat flow through the rocks in this region.

17 MINING ACTIVITY AND PREVIOUSLY REPORTED RESOURCE ESTIMATES

17.1 The history of planning permissions is recorded by Statham (1979) – see Table 6 and Figure 25. In summary, three companies explored for potash in the 1960s:-

- Cleveland Potash Ltd, owned initially by ICI and Charter Consolidated Ltd (later with ICI's shares bought by Minorco/Anglo-American Corporation).
- Whitby Potash Ltd, owned by Armour Chemical Industries (later by Shell and then Consolidated Goldfields).
- Yorkshire Potash Ltd, owned by Rio-Tinto Zinc Corporation.

17.2 WPL applied for planning consent for solution mining in 1962, but later withdrew the application. They did, however, establish a pilot solution mining plant on Egton High Moor in 1966, which closed down during 1970.

17.3 All three companies submitted planning applications in the late 1960s and Public Inquiries were held. Consents were granted for all three. CPL received its permission ahead of the others and commenced construction at Boulby Mine in 1969. The other two projects lapsed.

Reserves at Boulby Mine were reportedly sufficient for 20 to 30 years in their original mining area (Mineral Resources Cons. Committee, 1974). In 1997 CPL was granted planning consent to expand southeastwards under an additional 55 km^2 of land (Pettit, 1999) – which includes some of the former WPL project. Mining depths increase into the new area, and virgin rock temperatures reportedly approach 50ºC. CPL is, therefore, having to cope with steadily increasing demands for refrigeration, underground haulage distances, and pumping – as well as proposing now to hoist a third mineral product (polyhalite) – from shafts designed 50 years ago. The shafts require regular attention (e.g. Williams Auld, 2002). The ability to extend the mine significantly in the Boulby Seam beyond the current boundary must be very limited. The recent move to sink drifts to exploit the Fordon polyhalite close to the mine shafts may have been a result of that. York's strategy, therefore, is to assess the entire area, south from the current CPL Boulby Mine boundary, as prospective for a new mining operation (or operations) to modern standards building upon lessons learnt at Boulby.

17.4 Boulby lies within the North York Moors National Park, but potash mining is a broadly accepted activity. In 2003 the Park Authority adopted a supportive Local Plan Policy which is "Proposals for the extraction of potash at Boulby will be permitted provided that any detrimental effect on the environment or landscape, or residential or visitor amenity, can be moderated to a level considered acceptable in a National Park in the context of and overriding need for the development" (BGS, 2006). As mentioned earlier, York has met senior officers of NYMNPA and opened channels of communication.

17.5 The York onshore AOI (484 km^2) encompasses part of the former WPL lease, the whole of the former YPL onshore planning consent area, and a very considerable area southwards – amounting in total to several times the area of the WPL and YPL blocks combined (Figure 25). The northern part of York's AOI has the benefit, therefore, of exploration data from WPL and YPL's activity (excluding, at the moment, YPL assay data and interpretative reports still held as confidential by Rio Tinto). The southern part of the AOI is virtually unexplored, except by hydrocarbon drilling.

17.6 Riddler's 1980 report stated that the WPL "lease area as a whole is estimated to contain 494.65 million tonnes (of K3 Boulby Potash) at 35.38% KCl. Taking structural and technical limitations into account, the total potential reserve available for recovery (FWS – by solution mining) within the lease area is 63.10 million tonnes at 45% KCl (I.F.) probable and inferred"; and "The minefields area (FWS – i.e. the area with planning consent for solution mining) is estimated to contain 135.10 million tonnes of 40.45% KCl and potash reserves available for recovery of 34 million tonnes of 44.56% KCl (I.F.) probable. Allowances are made for ore body dip, accumulation, preferential solubility, areal extraction, grade and refinery recovery". "This leads to a final estimate based on current available data and the present understanding of the geology of total recoverable KCl, available from the refinery, of 4.54 million tonnes probable, which is equivalent to an approximate mine life of 10 years at an output of 455,000 tpa from the initial minefield area". The reason that solution mining had such a low overall recovery from the mineral bank in the ground is that the dip of the seam, relative to its thickness, meant that few parts of the lease were geometrically ideal for cavern formation.

In summary, the entire WPL lease area (ca. 48 km^2) was estimated in 1980 to contain an in situ resource (Non-JORC compliant) of 494.64 Mt at 35.38% KCl (≡ 22.36% K_2O), of which some 34 Mt (at 44.56% KCl) were considered recoverable (classed as "probable") by solution mining from the smaller minefield acreage granted planning consent.

17.7 No YPL reports are currently available to us, but the Mineral Resources Consultative Committee reported in 1976 that Rio Tinto's YPL "anticipated reserves in the K3 Boulby Potash, both on land and offshore, have been calculated at 380 million tonnes, assuming an average mineable thickness of 3.7 m grading 23% equivalent K_2O". Note that the basis of this figure is not known and it cannot be relied upon as complying in any way with JORC protocols.

18 THE YORK ASSET AND POTASH PROSPECTS

18.1 York has identified, on geological grounds, an AOI extending approximately from the River Esk in the North, locally bordering CPL's planning consent, to the outskirts of Scarborough in the South – and inland as far as a notional line indicative of the depositional limit of potash. The AOI includes an offshore block, extending up to about 16 km from the coastline, broadly east of the Peak Fault Trough. York has expressed interest in a second offshore block – between the Whitby and Peak Faults – but the mineral rights are not currently available. The whole AOI, as presently constituted (Figure 20), amounts to around 1000 km^2 (484 km^2 onshore, and 530 km^2 offshore).

The southern boundary takes account of the fact that there appears to be a zone of impoverishment in the Z3 cycle potash seam running more or less through the Scarborough area; that the polyhalite seam becomes too deep to mine south of Scarborough; and that a major east-west fault system lies just south of the boundary.

18.2 York has identified rural land and mineral owners in roughly 80% of the onshore AOI.

18.3 Three of the largest mineral owners have signed contracts with York granting various rights to their potash and associated minerals. As at January 2011 these include:-

- Option (and Exploration) Agreements with Strickland Constable Estate (onshore) 29.72 km^2;
- Option (and Exploration) Agreements with Duchy of Lancaster (onshore) 48.64 km^2;
- Exclusivity and Heads of Terms with The Crown Estate (offshore) 530 km^2.

Both the onshore agreements have granted blanket option and exploration rights over all their minerals in and around the AOI now and into the future. Some of the minerals associated with the Duchy of Lancaster lie outside York's AOI and have been excluded from the discussion, and the reader can assume that all areas referred to herein are inside the York AOI.

Use of the term "Contract Area" in this report relates to the areas and agreements described above.

18.4 Other medium-sized land and mineral owners have been approached and negotiations commenced. York's strategy has been to build up a very strong position with the largest owners, before approaching the medium and smaller mineral owners (mostly smallholder farmers).

18.5 All three potash seams occur within the AOI and each presents an Exploration Target. An Exploration Target can be defined as a mineral deposit that appears to have the potential - pending results of appropriate and diligent exploration, subsequent feasibility studies, and permitting – to be mineable and therefore, worth in vesting in exploration. Clearly, in order to be considered a Target, the deposits must have certain merits such as existing indications of the presence of minerals, or proximity to deposits already in production (and showing similar geological characteristics). But it is conceptual. Any discussion of the potential size or grade of the Exploration Target must not be misconstrued as indicating a Mineral Resource, or Mineral Resource as defined by JORC and similar protocols. In particular it must be understood that it is uncertain whether further exploration will result in the determination of a Mineral Resource at all.

18.6 As described earlier the Z2 polyhalite appears likely to be present at relatively consistent thickness and quality throughout and, so far as exploration is concerned, the primary objective must be to improve confidence that this is the case.

18.7 The maximum amount of geological data in the Z3 and Z4 seams exists for the northern part of the AOI, as a result of historical exploration. As noted earlier WPL and YPL were both sufficiently confident, on the basis of a relatively small number of boreholes to Z3 to proceed to planning applications. Non-JORC resources in round numbers of 495 million tonnes at 35% KCl (WPL) and 380 million tonnes at 23% equivalent K_2O (YPL) were published at the time – entirely in the Boulby Potash seam. Despite the now manifest inadequacy of the borehole programme (in the light of subsequent discoveries of lateral variability of the seam at Boulby Mine), it remains clear that potash intersections of workable thickness and grade have been made, that warrant serious follow-up.

18.8 In contrast, the southern part of the AOI is poorly explored. The onshore limit of the Boulby Potash is conjectural between Egton High Moor (in the north) where it is very thin and the Lockton Gasfield (in the south) where it is again at about its feather edge. A small number of other boreholes on and offshore prove Boulby seam continuity – but the results (generally based on geophysical logs only) suggest either thin seam or low grade. They are so few and so widely spaced that this is not regarded as conclusive (compared with the genuine zone of impoverishment south of Scarborough, where significant thickness changes are also present in the Carnallitic Marl, suggestive of a fundamental geological feature).

18.9 There are two schools of thought with respect to the need for further boreholes in the southern area. One view is that many more boreholes are needed, targeted on the downthrow of any faults identified by seismics (to test for ore-runs), in order to improve confidence (but accepting that it may never be possible to drill enough boreholes to meet high level JORC requirements – see Para. 20.4). The second is that – in the absence of any fundamental geological reason to explain why the Boulby Potash should be thinner to the south – to proceed on the basis of a small number of new holes (and a seismic structural survey), and to explore for ore-runs when underground, in order to avoid the inevitable sterilization of reserves that results from surface drilling.

Current local practice is to allow 100 m radius pillar of unworked ore around each surface borehole intersection, regardless of the reliability of surveying and cementing records, in order to eliminate any risks of water ingress from the overlying, pressurized, Sherwood Sandstone aquifer. Therefore, the more surface boreholes that intersect an ore-zone, the more ore is sterilized.

18.10 Given the perceived difficulty in exploring and satisfactorily proving JORC-compliant resources in the laterally variable K3 (and K4) seams, York's strategy will be to focus on the deeper Fordon polyhalite seam that appears – on current evidence – to be more consistent and less prone to variation over short distances. This, of course, still needs to be demonstrated for certain. But the benefit of proving a viable mining project in the polyhalite is that developments can be made, from the same shafts, in the K3 and K4 seams and underground drilling safely carried out to prove the existence or otherwise of workable resources.

18.11 Consideration has been given to the availability of potential minehead locations, and a number of possible alternatives are under study. There is sufficient borehole coverage within the AOI to allow outline mine costings.

18.12 Whilst the discussion above summarizes the strategy currently under consideration by York, it is not the only option, and others may come to the front as specialist studies are completed.

18.13 The next sections of this report discuss our current understanding, or conceptual models, of the targets presented by each potash seam within the AOI.

19 CONCEPTUAL MODEL AND EXPLORATION TARGET – POLYHALITE SEAM

19.1 This review suggests remarkable lateral persistence of a relatively pure polyhalite section within the middle (polyhalitic) subcycle of the Z2 Fordon Evaporites.

Within the central and eastern parts of the AOI, this section (described herein as Unit 3a) can be correlated with ease from well to well, using wireline logs. A high grade section of very similar appearance is identifiable at the shelfward extremities of the Basin – in boreholes such as the Lockton series, and Staithes 1 – and is likely to be the same horizon. Whether it is, or is a different horizon, its thickness and purity are closely comparable. Our conceptual model of the polyhalite zone is of a bedded deposit, traceable over at least 350 km around the NW edge of the Zechstein Basin, and at least 50 km in width (shelf to basin). The mineral is in part primary, and in part (probably predominantly so in the Target Section) secondary produced by backreaction of highly evolved bittern brines on anhydrite crystal mush. The secondary replacement process was syndepositional with primary polyhalite (there being no polyhalite in the upper Fordon subcycle). The Target Section, where this backreaction was significant, may be transgressive, but remains consistent; whereas the preceding and succeeding mineral sub-zones show a higher degree of foresetting (and, therefore, localized thickening and thinning).

19.2 The grade is not known for certain, insofar as no reliably assayed cores exist in the AOI (see Section 6.7). Purity is inferred from wireline logs. These show average gamma readings, for the high purity sections in 10 wells in and adjacent to the AOI, of 145 API units (Table 7). Since the relationship between γ API and K content appears linear at the concentrations that concern us (Figure 6), the purity of the target section can be estimated as between 67 and 94% polyhalite (arithmetic mean is 82%). The gangue mineral is predominantly halite. Ore grade expected by CPL in its new workings at Boulby is not known, but wireline log of S1, which is central to the Boulby Mine take, shows an average of ca. 128 γ API units – equivalent to 71% polyhalite.

Consideration has been given to the use of geostatistics to refine the process of estimating purity. In our view, though, the wide and irregular distribution of the data points is such that no improvement in reliability could be expected.

The purity range is supported, however, by the other observations quoted earlier, that spot samples of core from the E2, E3 and Atwick 1 boreholes assayed 85 to 95% polyhalite; and mineralogical analysis of the Atwick 1 core indicated 72.6% polyhalite (by volume).

19.3 Polyhalite is not subject to flow. Halokinetic effects do not appear to significantly alter the thickness of polyhalite beds in the AOI – or broader study area (though flow of the interbedded halite causes some physical disruption of polyhalite layering). Thickness appears to relate to primary bedding – either by deposition of the mineral as primary polyhalite, or by basin-wide replacement of primary, bedded, anhydrite parent beds. A line drawn on Figure 20 connects the westernmost boreholes where this "high purity" section exceeds 10 m in thickness. Base contours are shown on Appendix Figure A 2.1 and all those boreholes deep enough to intersect the polyhalite are shown on Figure A 2.2.

19.4 Polyhalite of less than ca. 10 m thickness extends further westwards in the AOI, but is excluded from the current Target calculation.

Although the area of potential polyhalite target is being defined on the basis of thickness >10 m, it is unreasonable to think that the full 10 m (plus) could be mined.

A potential mining height of 5 m is assumed as reasonable given the depth below surface. Stope height at Boulby Mine, in the far less stable sylvinite seam, is limited to 4.5 m – so 5 m in the massive bedded, relatively strong, polyhalite seam is considered a conservative figure for a first pass assessment.

Given a 5 m mining cut within a seam of minimum 10 m thickness, the stope roof and floor is likely to be polyhalite. Otherwise the overlying bed to the Unit 3a polyhalite seam is halite of Unit 3b, and the underlying bed is anhydritic polyhalite of Unit 2. Neither presents unusual mining problems.

Processing of polyhalite generates a significant volume of calcium sulphate waste (roughly 0.3t of waste solids per tonne of pure polyhalite – or more if anhydrite occurs as a gangue mineral). This would be stowed underground as backfill in disused workings. Since the polyhalite excavations themselves are likely to be very stable, by the nature of the mineral, it may be more beneficial to dispose of the waste within sylvinite workings – thereby facilitating an increased percentage extraction of that material.

19.5 Specific gravity (SG) of 70% polyhalite, 30% halite, can be estimated from theoretical values to be 2.6 tonnes per m^3. Polyhalite rock of higher purity (halite gangue) would have a higher SG.

19.6 Target tonnages of polyhalite (cut at 5 m) that might occur within the Target area can be estimated as in Table 8. Certain deductions have been allowed. Their estimation is based on pragmatic factors (given that these are Exploration Targets only), as follows:-

- **Fault Losses** – assume 100 m width loss either side of known simple fault structures, and no recovery from the Peak Fault Trough.

- **Cleveland Dyke** – assume 100 m loss either side of the known section of Cleveland Dyke and its possible extension to the coast (i.e. worst case).

- **Urban Areas** – assume initially no exploration/mining beneath centres of population.

- **Coastal Protection** – it will be necessary to demonstrate that polyhalite mining beneath the coastal zone will not generate harmful subsidence, but since much of the coastal section lies within fault influence, or urban areas, no particular allowance has been made at this stage.

19.7 Further consideration of the offshore Contract Area, its shape, and its extent offshore, suggests it may be unrealistic to include it all as a target. A further calculation has, therefore, been carried out, that cuts off the Target Area at 11 km offshore. Undersea coal workings in Durham and Northumberland extended this far (albeit at shallower depths) from coastal shafts sunk in the early part of the 20th Century. This results in a deduction from both Targets of ca. 2,700 million tonnes. Advances in mining technology may well be such that offshore mining to greater distances can be contemplated in future – but this deduction sets a lower limit based on current precedent in the region. Undersea mining in other parts of the world is facilitated by construction of artificial offshore islands (e.g. Hannon & Le Blanc, 1987), and such constructions could be of considerable assistance in exploiting the offshore potash resources, by providing additional ventilation to distant workings. That is, however, beyond the scope of the present study.

19.8 We conclude therefore that the polyhalite Exploration Target Tonnages are in the following broad ranges, depending largely on the ability to explore and access the furthest offshore areas:-

Whole York AOI 6,800 to 9,500 million tonnes of polyhalite (67 to 94% purity ≡ 19 to 27% K_2SO_4)

York Contract Area 3,300 to 6,000 million tonnes of polyhalite (67 to 94% purity ≡ 19 to 27% K_2SO_4)

19.9 The principal geological risks associated with these estimates are:-

i) that the clean polyhalite section (Unit 3a) is neither as consistent in purity and thickness as predicted, or that an unacceptable degree of small scale variation is present;

ii) that the degree of fault disturbance, or some other currently unforeseen structural issue, reduces the workable area or access to areas;

iii) localized presence of hydrocarbons;

iv) rock temperature or other problems of mining at these depths and distance offshore.

19.10 Whilst it is almost certain that mining will be by room and pillar, no mining design, preliminary layouts, or estimates of possible extraction percentage from the Target Areas have been carried out at this stage. Clearly, however, this is a further highly significant factor, plus plant efficiency, that will influence the proportion of future resources, if any, that is ultimately recoverable.

20 CONCEPTUAL MODEL AND EXPLORATION TARGET – BOULBY POTASH SEAM (Z3)

20.1 The Boulby Potash is the best known, and best explored potash ore seam within the British Zechstein. Until recent months it was the only ore that had been mined. It corresponds with the Riedel Seam mined in Germany.

20.2 Its depositional limits are shown approximately on Figure 21 and illustrative contours on the base of the seam are shown in Appendix Figure A 2.3. Exploration drilling by ICI, Fisons, CPL, WPL and YPL, and subsequent mining at Boulby, has proved continuity in reasonable detail in an area from around Skinningrove in the north, to Robin Hood's Bay in the south. Southwards beyond Robin Hood's Bay there are sporadic boreholes (mostly for hydrocarbon exploration) that demonstrate seam continuity within an evaporite sequence that appears broadly similar to the northern, explored/exploited, area. A zone of possible impoverishment runs very roughly NE-SW through Scarborough and offshore boreholes 41/24A-1/2 and 41/25A-1, forming the southern limit of the Exploration Target Area, and this is reflected not only in the absence of the Boulby Potash Seam, but also in changes in the associated strata (i.e. there is a fundamental geological difference).

Approximately 10 m of K3, suspected to be low grade carnallite, occur offshore to the NE of the AOI in Conoco Well 41/14-1. The offshore transition from sylvite to carnallite is shown as a tentative line on Figure 21 (drawn in a similar position to that inferred at Boulby).

20.3 The original resource, or reserve, concept on which CPL took the decision to open Boulby Mine was subsequently shown to be unfounded. It had been assumed, from a number of ‘good’ borehole intersections, that the seam was persistent over wide areas, at consistent thickness and grade. The early years of mining showed this was not the case and that the degree of lateral variation in thickness and grade was far greater than had been thought earlier. Another borehole pattern might have led to very different conclusions. Nonetheless, Boulby has been a successful mine, producing in the order of 25 million tonnes of refined MOP and, as a result, the controls on the geometry of the K3 sylvinite oreshoots are much better understood.

It is also clear now that the 20 ‘A’ and four ‘W’ series holes, and the 10 or so YPL boreholes, were inadequate and that such resource figures that were produced from them in the past would not be JORC compliant. The borehole results would need significant additional geological modelling to refine tonnages, and are no more than indicative of the potential.

20.4 The mining layout at Boulby is now guided by geological modelling of oreshoot trends (and underlying structures), tested and proved by horizontal longhole drilling. Figure 22 shows a typical arrangement, the frequency of seam intersections within the mine, and the detailed variation of seam thickness. Annels & Ingram (1992) found that the optimum search radius for the calculation of reserves at Boulby by statistical means (using elliptical weighting techniques) is between 500 and 600 m. It is clearly impossible to replicate such detailed drilling from surface, partly because of the sheer cost, but more importantly because each surface exploration borehole requires a 200 m diameter safety pillar, of sterilized mineral, around each borehole intersection (see para. 18.9). So that, the more boreholes are drilled into an oreshoot, the more of the good ore is sterilized. We need, therefore, to devise a means of evaluating the potash potential that does not require close spaced surface drilling. The advantage of underground longhole drilling, as designed by Peter Woods (Woods & Hopley, 1980) is that the boreholes are entirely in halite below the potash and so do not create water hazards, and can probe up to 2 km ahead of developments.

20.5 York’s proposed strategy for the K3 Boulby Potash is currently, therefore:-

- to found the feasibility study initially upon mining the polyhalite seam – which, being a bedded deposit and apparently consistent, is not expected to require such close drilling;

- Use seismic methods (interpretation of legacy data and new infill 3D data), and the borehole database (including results from the polyhalite exploratory holes) to produce a structural model, define fault locations, and predict oreshoots in the Boulby Potash;

- Assess the new borehole data for continuity of the Boulby Potash seam;

- Plan a basic development layout in the Boulby Potash that will enable exploration of the predicted favourable areas by underground drilling.

20.6 The mining potential of the Boulby Potash is very considerable, despite the problems of "proving" a JORC compliant resource/reserve in such a variable seam. We can assess that potential (defined herein as an "Exploration Target") by using Boulby Mine and the previously explored WPL and YPL areas as analogues. This assumes that York's AOI is geologically comparable with those areas, and that the Boulby seam exhibits broadly the same characteristics, average grade and thickness, south as far as the conjectured Zone of Impoverishment.

20.7 We have no reason on geological grounds to doubt this is the case. There is no reason to suspect that the Staithes section of the Zechstein margin was any more or less conducive to sylvite deposition than any other. A paper by Smith & Crosby in 1979 did postulate an area of thin Boulby Potash in a "narrow belt – only a few kilometres" south of Whitby, presumably on the strength of the few widely spaced YPL boreholes in that area. They regarded this observation as "puzzling" and could not suggest a plausible cause. The boreholes in the area in question (e.g. YP 10, 11, 12, 13) record some thin high grade sylvite (YP 10) or thick low grade (YP 11) and in our view represent chance variations that we now know are commonplace within this deposit.

20.8 That being the case, we can define on Figure 21 an Exploration Target area between the conjectured western limit of K3, a tentative carnallite line to the east, and the conjectured impoverishment, and can estimate an Exploration Target tonnage by analogy with CPL, WPL and YPL's various statements.

20.9 WPL's lease area was ca. 48 km^2. The Non-JORC compliant total <u>in situ</u> mineral resource quoted by Riddler in 1980 was 494.65 million tonnes at 35% KCl ($\equiv$ 22.1% K_2O), which equates to:-

10.31 million tonnes ore/km^2 <u>in situ</u>

$\equiv$ 3.61 million tonnes KCl/km^2 <u>in situ</u>

20.10 YPL's lease area is quoted by BGS (1974) as ca. 30 km^2 containing "anticipated reserves" [NB: These are, again, Non-JORC compliant] of 380 million tonnes assuming an average mineable thickness of 3.7 m grading 23% equivalent K_2O. This equates to:-

12.67 million tonnes ore/km^2 <u>in situ</u>

$\equiv$ 4.60 million tonnes KCl/km^2 <u>in situ</u>

20.11 An historical ore reserve (1970s and Non-JORC compliant) for Boulby Mine quoted ca. 1,000 million tonnes in all categories, at ca. 40% KCl (≡ 25.3% K_2O), in situ within ca. 145 km^2 under lease. We can estimate a past production of say 10 Mt from the same area. Thus we can estimate:-

6.9 million tonnes ore/km^2 in situ

≡ 2.76 million tonnes KCl/km^2 in situ

20.12 So, despite the limitations of the WPL and YPL drilling programmes, there was reasonable agreement between all three companies in the 1970s that they considered the K3 Boulby Potash was present at say 7 to 12 million tonnes of ore in situ per km^2, and at in situ grades of 30-40% KCl (≡ 19 to 25% K_2O).

These figures imply, however, that average seam thicknesses of between 3.45 and 6.3 m had been applied across the entire leases – i.e. continuously mineralized.

It is now apparent that this is not the case. The drilling results at Boulby indicate (Figure 12) around 40% of the seam area to be fully payable (and therefore mined at say 30% recovery), and another 30% of the seam to be medium pay (200 to 300 m % and mined at say 10% recovery); equivalent to CPL extracting maybe only around 15% of the licensed seam area. Furthermore, there are limitations to the maximum height of mining (say 4.5 m), and a typical working height of 3.5 m should now be assumed. On this model, the K3 seam is typically more likely to contain in the order of 1 Mt/km^2 of recoverable ore.

20.13 We can now attempt to double check this against Boulby Mine's recorded output. We estimate the area of workings to date to be in the order of 122 km^2 (from the planning consent area, less areas known to be beyond the depositional limit, and a major fault). Cumulative production of refined MOP (@ 95% KCl) to 2010 has been say 25 million tonnes. Average ore grade has been in the order of 38% KCl (≡ 24% K_2O) and typical plant recovery 86% (McConnell & Gilchrist, 2001) – so we can estimate that the cumulative ore production has probably been in the order of 76 million tonnes since the mine opened. Mine recovery to date equates very roughly, therefore, to:-

0.62 million tonnes ore/km^2

0.23 million tonnes KCl/km^2

The discrepancy between this and our estimate in para. 20.12 – which cannot be confirmed without access to CPL data – may readily be accounted for by:-

- the very approximate nature of the estimates, in absence of proprietary data;
- self-evidently, mining is ongoing, has not reached the limits of the lease and viable resources remain to be mined;
- the presence of carnallite limits seaward expansion and may have significantly reduced the actual area of mineable ore;
- mine layout losses;

- unforeseen geological conditions such as loss of the protective beam below the Carnallitic Marl, gas blows, etc.

20.14 We can firstly conclude that the characteristics of the seam are broadly similar through the CPL, WPL and YPL areas, since all three companies came up with a range of 7 to 12 million tonnes of in situ ore per km^2, having carried out their evaluations and calculations at about the same period of time.

Secondly, we can discredit those early estimates of 7 to 12 million tonnes/km^2, as significantly over optimistic with respect to the percentage of payable ground. A more reasonable figure based upon roughly 40:60 split of pay:unpay ground, and typical 3.5 m thickness, would be around 2.5 to 3 million tonnes/km^2 in situ potash at workable grade and height. Given the crude nature of this estimate – based on averaging over an area >100 km^2 – the figure can probably be applied without further discounting for the normal fault pattern to the rural part of the York's AOI, and to York's Contract Area.

20.15 In situ grades reported for the CPL, WPL and YPL projects ranged from 35 to 40% KCl (≡ 19 to 25% K_2O), and judging from the borehole assay reports we have examined for the "A" and "WP" series holes this is reasonably indicative of the Boulby Potash in the region. As a further comparison Warren (2006) states that the average grade of Zechstein potash mined in Germany is in the range of 17 to 18% K_2O (it is not clear if this is run of mine, or in situ grade). The lower grade in Germany results from the highly disturbed nature of many of the deposits there.

20.16 Considering now the potential scale of Exploration Target in York's AOI, and (in the absence of any more reliable data) assuming that the geological characteristics remain generally similar on a macro scale to those of the areas previously drilled or mined around Staithes and Whitby, then we can make the following estimates;-

1 Area of K3 seam within York's whole AOI (less deductions for urban areas) – as shown on Figure 21 – 450 km^2.

Make special discount for Peak Trough Fault Zone (where geological conditions are uncertain) – 60 km^2.

Apply estimate from 20.14 giving an AOI Exploration Target of:-

900 to 1,200 million tonnes @ 35 to 40% KCl in situ

2 Area of K3 seam within York's Contract Area as shown on Figure 21 (less deductions, as above, for urban areas and Peak Fault Trough) - 133.8 km^2.

Giving an Exploration Target within the Contract Area acreage of:-

330 to 400 million tonnes @ 35 to 40% KCl in situ

20.17 It must be clear that these figures are conjectural – but also that, in the absence of closely spaced drilling, the use of such analogies with adjacent, apparently similar, properties is the only means of assessing the magnitude of an Exploration Target at this preliminary stage in a deposit of this nature. There is no suggestion that such tonnages and grades definitely exist, or can be mined. York's exploration strategy and future work programme will test and refine the model. No allowances have been made for mining layouts and recoveries – but it is worth noting in this respect that a number of potash mines, worldwide, have been converted to solution mines for recovery of unmined resources, following closure. Whilst this is a distant prospect, it is worth further consideration.

21 CONCEPTUAL MODEL AND EXPLORATION TARGET – SNEATON POTASH SEAM

21.1 The Z4 Sneaton Potash is not currently mined in the UK, being absent at Boulby Shafts, and much of the CPL concession. Figure 23 shows our best estimate of the landward limit of recognizable potash from wireline logging.

21.2 The seam lies mostly within Unit C and sometimes Unit D of the Sneaton Halite (Table 5). It is characteristically interlayered with halite and with marl. There are fewer anomalies in thickness and inferred grade than in the Boulby Potash seam. Smith & Crosby (1979) infer "a greater primary consistency, or less complex diagenesis, than in the K3 Boulby Potash. It seems less likely in the Sneaton Potash than in the Boulby Potash that the marginal sylvinite grades basinwards into carnallitic ore". However, "both carnallite and sylvite are present in Unit D onshore and, on the evidence, either could predominate offshore in that unit". We have not identified significant carnallite on any wireline log signatures within the AOI.

21.3 Although high grade sylvinite occurs locally in the seam, the highly banded nature of the deposit means that overall the potash grades are lower than in the Boulby Potash. As a result of this it was not considered by WPL and YPL to be a mineable proposition, and did not figure in their projects in the 1960s/70s.

Its location towards the top of the evaporite sequence, closer to the high pressure Sherwood Sandstone aquifer, also means that any proposal to work this seam must incorporate stringent precautions to safeguard the integrity of the mine and preclude upward collapse and water ingress. Since the roof of the seam is halite, the particular stability issues posed by the Carnallitic Marl to mining in the Boulby seam are absent from Sneaton seam. The opportunity to backfill workings with waste from polyhalite processing might further increase confidence. Nonetheless, it is clear that, whilst probably easier to characterize (being apparently more consistent) than the Boulby Potash, and extending as sylvinite further offshore, the Sneaton seam is (a) significantly lower grade overall; and (b) could only ever be mined at a relatively low extraction percentage, if at all.

21.4 The British Geological Survey (Mineral Resources Committee, 1974) reported "investigations by ICI Ltd, and Fisons Ltd. shortly after the Second World War within a roughly circular area of about 31 km^2 SW of Whitby bounded by Aislaby, Eskdalegate, Sneaton and Upgang [FWS – this area is mostly within York's AOI – at the northern end] indicated reserves totalling 64.5 million tonnes KCl in the Upper (Sneaton) Potash, assuming a thickness of 6 m and a KCl content averaging 17% KCl (≡ 10% K_2O)". This so-called "reserve" has no current validity, and is based upon raw data that are no longer available for us to check. It does, however, set the scene that this horizon is significantly lower grade than the Boulby Seam.

21.5 No separate exploration programme needs to be devised at this stage for the Sneaton seam. The horizon will be penetrated by all exploration boreholes, and the geological model can be refined on an ongoing basis to assess whether or not a recoverable resource exists. Meanwhile we can estimate, on the basis of the existing data, a potential onshore Exploration Target. There is currently no realistic likelihood of gaining additional exploration data on the Sneaton seam offshore, so that area can be disregarded.

21.6 The data available for York's AOI, and closely adjacent areas are provided in Appendix 1. Offshore boreholes 41/24A-2 and 41/14-1 at the eastern limit of the Crown Estates Area continue to show sylvinite as the main mineral, but the grade (judged by the γ response) is low. The basinward transition to carnallite must lie further east and all York's AOI lies within the K4 sylvite zone. The western limit of recognizable seam is east of the Boulby seam limit. No impoverishment zone is noticeable in the south (where the Boulby seam nips out). The overall onshore area in which the Sneaton seam is likely to be present in the AOI can be estimated as 280 km^2; or roughly 133 km^2 within the 5 m seam isopach, and after allowance for urban areas and a first pass allowance for geological losses against known fault zones and the Cleveland Dyke (Table 10).

21.7 Seam thickness – including all bands – increases in a fairly regular pattern from the western limit of deposition to >10 m in offshore boreholes 41/24A-1 and 2, and ca. 25 m in 41/25A-1 (see Figure A 2.5). We are only concerned with that area where seam thickness appears to exceed 5 m, so that a 3 m mining cut can be taken.

21.8 Grade has been estimated partly from gamma ray logs and partly from historical core assays of boreholes in the north of the AOI (Table 9). The assay values should be regarded as indicative only. In some cases it was stated that the potassium content has been determined independently of clay minerals in the insoluble fraction. In others it is unclear. In such cases the potassium (hence KCl) content may be overstated as a result of inclusion of potassium present within clay.

Similar reservations apply to interpretation of gamma logs, that reflect the total K content – including K within any insoluble matter in clay partings – and can lead to overestimation of grade. Further, detailed, analysis of the wireline logs – in the light of future core assay – might be possible.

The data suggest a highly banded deposit – often clearly separated into an upper and lower sylvite seam (e.g. Cloughton 'A', 41/18-1 and F4). Sylvite values, whether assayed or interpreted from gamma ray responses, are mostly in the range 10 to 20% KCl. The two most reliable assays (A2 and A3) reported 16.3 and 29% KCl (soluble). A "high grade" gamma signature is shown by the Stoupe Beck BH (3 bands, up to 60% KCl, in 10 m), but is regarded as unreliable.

21.9 The Exploration Target within the 5 m seam isopach can be cut at 3 and 4 m to allow a further degree of uncertainty with respect to small scale seam variations.

21.10 The Sneaton Potash field in the York AOI appears to contain, therefore, an Exploration Target that currently comprises low grade KCl (apparently 10 to 20%; equivalent to 6 to 12% K_2O say) – within which higher grade material (up to 29% KCl) might locally be present.

In situ Exploration Target tonnages (Table 10), after making allowances for urban areas, and certain geological losses, has been estimated as in the order of 840 to 1,100 million tonnes in the AOI as a whole; or ca. 140 to 180 million tonnes within the areas currently under Contract.

21.11 In conclusion, the Sneaton Potash is apparently a low grade deposit that might be mineable locally, in conjunction with working the deeper seams; but would never constitute an underground mineable resource in isolation. Opportunities for solution mining any richer pockets could be assessed in future, if such activity could be isolated from underground mining in the deeper seams.

22 SUMMARY

22.1 York's Project 40 potash prospect lies in the Zechstein Basin, that hosts one of the best known evaporite sequences in the world, and is reported to provide ca. 20% of world annual potash production (Warren, 2006).

22.2 The Zechstein evaporites extend from Poland and Germany, under the Southern North Sea and come onshore for a few tens of kilometres in Northeast England. Potash was discovered in North Yorkshire in 1939 and, following exploration campaigns in the 1950s and 60s, three companies applied for planning consent to mine (two by conventional dry mining; the third by solution mining). Consent was eventually granted for all three, but only Cleveland Potash Ltd (CPL – which was the first to be awarded planning consent) proceeded. Boulby Mine began production in 1973.

22.3 Three potash seams are recognised as holding potential interest (two sylvite type ores, the third polyhalite).

22.4 York Potash Ltd has identified during 2010 an Area of Interest (AOI) of roughly 1000 km^2 immediately south of CPL, that encompasses most of the onshore prospect areas of CPL's previous competitors. York has access to some (but not yet all) drilling data relating to these two historical projects. York has acquired Contracts in relation to mineral rights over 608 km^2 within its AOI and is confident of acquiring significantly more. The offshore Contract Area extends to ca. 16 km (10 miles) from the coast.

Undersea mining is already carried out at Boulby, and coastal collieries in Durham and Northumberland had reached ca. 10 to 11 km offshore when the local coal industry closed down in the 1980s. There is, therefore, precedent for very large scale mining offshore in the region (albeit at shallower depths).

22.5 York has not carried out any additional, intrusive, exploratory work yet, and the future potential of the AOI can only be assessed from the historical data currently available to its advisors. Given the need to maintain confidentiality while the minerals position was built up, some owners of historical data have not yet been approached. This is now in hand, as is another project to acquire, remodel and reinterpret 3,100 km of legacy seismic data to produce a detailed subsurface model of the entire AOI.

22.6 FWSC has created and reviewed a database of historical/legacy boreholes totalling over 97 km in total, in and around the AOI during the preparation of this report; and has reviewed published papers, and unpublished reports on the relevant evaporites.

22.7 Given the paucity of core data, much of the modelling of mineral purity, or potash grade, is based upon interpretation of downhole gamma ray logs. A method has been devised for this, that compares well with results obtained by other means.

22.8 The AOI is largely underlain by a seam of relatively pure polyhalite in the Z2 Fordon Evaporite Formation. Continuity is indicated over a 350 km length of Zechstein Basin margin in a belt of at least 50 km width. Bed thickness within the AOI is >10 m, and the purity ranges from 67 to 94% polyhalite (equivalent to 19 to 27% K_2SO_4), with an arithmetic mean of 82% polyhalite, in boreholes in and around the AOI. Seam depth is significant and rock temperatures will be high – requiring refrigerated ventilation for any future mining operation. Opportunities for exploiting geothermal energy from the mine will be examined as part of the planned exploration project.

FWSC has assessed the exploration potential of the polyhalite-bearing seam, cut at 5 m, firstly within the AOI as a whole, and, secondly, just within York's Contract Areas.

Estimates have been made covering the entire area – assuming total continuity (less allowances for known fault zones etc.) to the eastern, offshore, AOI boundary and also for a smaller area – reducing the seaward limit down to 11 km (see Figure 20). No allowances have been made for mining layout/recovery/ dilution.

Exploration Target tonnages are summarized in Table 11.

22.9 The K3 Boulby Potash seam underlies much of the AOI. It usually contains relatively high grade sylvinite ore (typically 35 to 40% KCl).

Thickness averages 7.5 m in oreshoots worked at Boulby, but varies over very short distances from 0 to nearly 30 m. A reasonable understanding of the controls on mineable oreshoots has been gained from experience at Boulby. The mechanism for this variation has resulted in KCl enrichment in the thicker areas of the seam. Forty nine boreholes in the AOI (and more in adjacent areas) prove continuity of the seam; the northern part of the AOI being better known than the south. Exploration Targets (for the area shown in Figure 21) have been estimated (Table 11) as:-

Total AOI: 900 to 1,200 million tonnes @ 35 to 40% KCl in situ

York Contract Area only: 330 to 400 million tonnes @ 35 to 40% KCl in situ

Reasonable allowances have been made for areas of known faulting, urban development, suspected impoverishment and suspected transition to carnallite. Seam thickness has been cut at 3.5 m. No allowance has been made for future mining layout/recovery/dilution.

22.10 The K4 Sneaton Potash is relatively low grade and prone to splitting. Interpretation of legacy boreholes in and around the AOI indicates Exploration Targets (Figure 23, Tables 10 and 11) of:-

Total AOI: 840 to 1,100 million tonnes @ 10 to 20% KCl in situ

York Contract Area: 140 to 180 million tonnes @ 10 to 20% KCl in situ

Reasonable allowances have been made for areas of known faulting and urban development; and seam thickness has been cut at 3 and 4 m. No allowance has been made for future mining layout/recovery/dilution.

22.11 An outline of the first phase Exploration Strategy designed to test the validity of the Target estimates for the seams, and in particular the Z2 polyhalite, is as follows:-

- Continue to acquire and consolidate mineral agreements;
- Continue acquisition of legacy data, including that currently held by previous mining companies;
- Acquire, reprocess, and reinterpret legacy seismic data (using specialist contractors) to produce detailed subsurface models at various horizons in the evaporite sequence, with particular focus on faults;
- Identify the need, if any, for additional seismic work on and offshore, and commence fieldwork;
- Commence programme of five to 10 boreholes onshore to core the K3 and K2 potash seams at locations determined primarily to improve confidence in the continuity and quality of the K2 polyhalite;
- Review legacy data in light of reliably logged and assayed York boreholes, and reinterpret where necessary;
- Assess requirements for offshore, and further onshore drilling.

Preliminary budgets for this work are being prepared.

[redacted]

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24 GLOSSARY AND CONVERSION FACTORS

MINERAL SPECIES	**FORMULA**	**SPECIFIC GRAVITY**
Anhydrite	$CaSO_4$	2.9 – 3.0
Carnallite	$KCl\ MgCl_2\ 6H_2O$	1.6
Halite	NaCl	2.1 – 2.2
Polyhalite	$K_2SO_4\ MgSO_4\ 2CaSO_4\ 2H_2O$	2.78
Sylvite	KCl	1.98

CONVERSION FACTORS
Polyhalite contains 28.9% K_2SO_4, or 15.6% K_2O equivalent
KCl x 0.632 = K_2O mass equivalent
K_2SO_4 x 0.541 = K_2O mass equivalent

TABLE: 1

A REVISED NOMENCLATURE FOR UPPER PERMIAN STRATA IN EASTERN ENGLAND

Group	Cycle	YORKSHIRE PROVINCE (outcrop)	DURHAM PROVINCE (outcrop and subsurface)	YORKSHIRE PROVINCE (subsurface)	NORTH SEA, GERMANY THE NETHERLANDS	Cycle
ESKDALE	EZ5	ROXBY FORMATION (Upper Marls) ↓	ROXBY FORMATION (Upper or Saliferous Marls) ↓	ROXBY FORMATION (Upper or Saliferous Marls) LITTLEBECK FORMATION (Top Anhydrite) SLEIGHTS (SILTSTONE) FM	ZECHSTEINLETTEN GRENZANHYDRIT	Z5
STAINTONDALE	EZ4	↓	↓ SHERBURN (ANHYDRITE) FM (Upper Anhydrite)	SNEATON (HALITE) FORMATIONS: including SNEATON POTASH MEMBER (Upper Halite and Potash) SHERBURN (ANHYDRITE) FM (Upper Anhydrite) UPGANG FORMATION CARNALLITIC MARL FM	ALLER HALIT and EQUIVALENTS PEGMATITANHYDRIT and EQUIVALENTS ROTOR SALZTON	Z4
TEESSIDE	EZ3	↓ BROTHERTON (MAGNESIAN LIMESTONE) FORMATION (Upper Magnesian Limestone)	BILLINGHAM (ANHYDRITE) FM (Billingham Main Anhydrite) SEAHAM FORMATION (part of Upper Magnesian Limestone)	BOULBY (HALITE) FORMATION: including BOULBY POTASH MEMBER (Middle Halite and Potash) BILLINGHAM (ANHYDRITE) FM (Billingham Main Anhydrite) BROTHERTON (MAGNESIAN LIMESTONE) FORMATION (Upper Magnesian Limestone)	LEINE HALIT and EQUIVALENTS HAUPTANHYDRIT PLATTENDOLOMIT GRAUER SALZTON	Z3
AISLABY	EZ2	EDLINGTON FORMATION (Middle Marls) ↓	South of Province: EDLINGTON FORMATION (Middle Marls) ↓ East of Province: FORDON (EVAPORITE) FORMATION AND SEAHAM RESIDUE ? ROKER (DOLOMITE) FM (Hartlepool and Roker Dolomite) ? CONCRETIONARY LIMESTONE FM (parts of upper Magnesian Limestone)	FORDON (EVAPORITE) FM KIRKBY ABBEY FORMATION	STASSFURT SALZE HAUPTDOLOMIT	Z2
DON	EZ1	↓ CADEBY (MAGNESIAN LIMESTONE) FM (Lower Magnesian Limestone) { SPROTBROUGH Mbr Upper Subdivision) / WETHERBY Mbr (Lower Subdivision) }	HARTLEPOOL (ANHYDRITE) FM FORD (MAGNESIAN LIMESTONE) FM (Middle Magnesian Limestone) RAISBY (MAGNESIAN LIMESTONE) FM (Lower Magnesian Limestone) MARL SLATE FORMATION	HAYTON (ANHYDRITE) FM CADEBY (MAGNESIAN LIMESTONE) FORMATION MARL SLATE FORMATION	WERRAANHYDRIT WERRADOLOMIT and ZECHSTEINKALK KUPFERSCHIEFER	Z1

TABLE: 2

ABBREVIATIONS USED IN THIS STUDY

SHORT HAND THIS REPORT	FULL FORMATION NAME		OBSOLETE NAMES
A5	Littlebeck Anhydrite	(EZ5A)	Top Anhydrite
SS	Sleights Siltstone	(EZ5T)	
Na4	Sneaton Halite	(EZ4Na)	Upper Halite
K4	Sneaton Potash	(EZ4K)	Upper Potash
A4	Sherburn Anhydrite	(EZ4A)	Upper Anhydrite
CM	Carnallitic Marl	(EZ4T)	Rotten Marl
Na3	Boulby Halite	(EZ3Na)	Middle Halite
K3	Boulby Potash	(EZ3K)	Middle Potash
A3	Billingham Anhydrite	(EZ3A)	Main Anhydrite
Ca3	Brotherton Formation	(EZ3Ca)	Upper Magnesian Limestone
GS	Grauer Salzton	(EZ3T)	
FE	Fordon Evaporite Formation	(EZ2)	Lower Evaporites
Ca2	Kirkby Abbey Formation	(EZ2Ca)	Middle Magnesian Limestone
A1	Hayton Anhydrite	(EZ1A)	
Ca1	Cadeby Formation	(EZ1Ca)	Lower Magnesian Limestone

NOTE: The Upgang formation (EZ4Ca) is usually very thin and has not been recognized on any of the geophysical logs. Where present, we can assume it is included with Sherburn Anhydrite.

TABLE: 3

LOG CHARACTERISTICS OF EVAPORITE MINERALS AND ASSOCIATED STRATA (ADAPTED FROM NURMI, 1978)

MINERAL AND COMPOSITION	SP. GR.	LOG DENSITY	AVERAGE* ΔT	ϕ N** (GNT)	ϕ N** (CNL)	GAMMA-RAY DEFLECTION (API, d = 8")	APPARENT K_2O%
EVAPORITES							
Non-Radioactive							
Halite NaCl	2.165	2.032	67	0	-3	0	0
Anhydrite $CaSO_4$	2.96	2.977	50	0	-2	0	0
Gypsum $CaSO_4.2H_2O$	2.32	2.351	52	49	>60	0	0
Trona $Na_2(CO_3).Na(HCO_3).2H_2O$	2.12	2.10	65	40	35	0	0
Tachyhydrite $CaMg_2Cl_6.12H_2O$	1.68	1.66	94	?	>60	0	0
Kieserite $MgSO_4.H_2O$	2.57	2.59	?	38	43	0	0
Bischofite $MgCl_2.6\ H_2O$	1.59	1.54	?	>50	>60	0	-
Radioactive							
Sylvite KCl	1.984	1.863	74	0	-3	>500	63.0
Carnallite $KMgCl_3.\ 6\ H_2O$	1.61	1.57	78	65	>60	200 to 220	17.0
Langbeinite $K_2Mg_2(SO_4)_3$	2.83	2.82	52	0	-2	275 to 290	22.6
Polyhalite $K_2MgCa_2(SO_4)_4.2H_2O$	2.78	2.81	58	15	25	180 to 220	15.5
Kainite $MgSO_4.KCl.3\ H_2O$	2.13	2.12	?	45	>60	225 to 245	18.9
Rinneite $3KCl.NaCl.FeCl_2$	2.35	?	?	0	0	?	-
SEDIMENTARY MINERALS							
Calcite $CaCO_3$	2.71	2.71	48	0	-1	0	0
Dolomite $CaMg(CO_3)_2$	2.87	2.876	44	4	1	0	0
Quartz SiO_2	2.654	2.648	52	-4	-2	0	0
SEDIMENTARY FORMATIONS							
Limestone (e.g. when ϕ = 10%)	2.54	2.54	62	10	-1 to 30	5 to 10	0
Dolomite (e.g. when ϕ = 10%)	2.68	2.683	58	13.5	1 to 30	10 to 20	0
Sandstone (e.g. when ϕ = 10%)	2.489	2.485	65	3	-2 to 25	10 to 30	0
Shale		2.2 to 2.75	70 to 150	25 to 60	25 to 75	80 to 140	2 to 10

* ΔT = internal transit time from a sonic log
ϕ N** = apparent limestone porosity from a neutron log
GNT = combined gamma-ray tool (Schlumberger), no longer used
CNL = compensated neutron log

TABLE: 4

AVERAGE MINERAL COMPOSITION (VOLUME PERCENT) OF THE SUB-UNITS OF THE FORDON EVAPORITES OF FORDON NO 1 BOREHOLE, AS ESTIMATED BY STEWART (1963, TABLE 4)

Cycle	Subzone	Depth below surface	Thickness	Anhydrite	Polyhalite	Kieserite	Halite	Carbonate and Clay	Glauberite	Aphthitalite	Celestine	Talc	Pyrite	Sulphoborite
		feet	*feet*											
Upper	Upper halite-anhydrite	5877-6039	162	33	-	-	64	3	-	-	tr	tr	tr	tr
	Upper anhydrite	6039-6075	36	95	-	-	2	3	-	-	-	-	tr	tr
Middle	Halite-kieserite-anhydrite	6075-6198	123	3	tr	9	87	<1	-	tr	-	-	-	-
	Halite-polyhalite-anhydrite	6198-6456	258	5	7	-	87	1	-	-	-	tr	-	-
	Halite-polyhalite-kieserite	6456-6556	100	-	22	2	75	1	-	-	-	tr	-	-
	Halite-polyhalite	6556-6594	38	?tr	45	-	54	1	-	-	-	tr	-	-
	Polyhalite-anhydrite-halite	6594-6660	66	33	40	tr	25	2	-	-	-	tr	-	-
	Anhydrite-polyhalite	6660-6805	145	66	30	?tr	1	3	tr	tr	-	tr	tr	-
Lower	Lower halite-anhydrite	9805-6934	129	30	1	-	64	5	-	-	-	tr	tr	-
	Lower anhydrite	6934-6946	12	70	-	-	tr	30	-	-	-	-	tr	-

The quantities have been estimated from inspection of cores and well cuttings, taken together with rough modal study of a large number of thin sections, and a study of the gamma-ray log.

tr indicates trace, < less than

TABLE: 5

SUBDIVISION OF THE Z3 AND Z4 HALITES IN YORKSHIRE

<table>
<tr><td></td><td rowspan="3">Eskdale Group</td><td colspan="2">Saliferous Marl</td><td>metres
150+</td></tr>
<tr><td>Z5</td><td colspan="2">Littlebeck Anhydrite</td><td>0.6 to 1.2</td></tr>
<tr><td></td><td colspan="2">Sleights Siltstone</td><td>2.1 to 3.7</td></tr>
<tr><td rowspan="7">Z4</td><td rowspan="8">Staintondale Group</td><td rowspan="5">Sneaton Halite</td><td>E Halite, almost pure</td><td>1.8 to 4.9</td></tr>
<tr><td>D Halite, with abundant fine red clastic sediment</td><td>13.7 to 23.0</td></tr>
<tr><td>C Halite with potash minerals and fairly abundant fine clastic sediment ("Sneaton Potash")</td><td>0 to 8.5</td></tr>
<tr><td>B Halite, almost pure</td><td rowspan="3">12.5 to 14.5
5.2 to 8.5</td></tr>
<tr><td>A Halite with anhydrite laminae</td></tr>
<tr><td colspan="2">Sherburn Anhydrite</td></tr>
<tr><td colspan="2">Upgang Formation</td><td>0.3 to 1.2</td></tr>
<tr><td></td><td colspan="2">Carnallitic Marl</td><td>9.4 to 19.5</td></tr>
<tr><td rowspan="6">Z3</td><td rowspan="6">Teesside Group</td><td rowspan="4">Boulby Halite</td><td>D Halite with fine clastics and some anhydrite</td><td>0 to 5.2</td></tr>
<tr><td>C Halite with potash minerals and some fine clastic sediment ("Boulby Potash")</td><td>0 to 11.0</td></tr>
<tr><td>B Halite, almost pure</td><td>25.0 to 84.4</td></tr>
<tr><td>A Halite with laminae and thin beds of anhydrite</td><td rowspan="2">15.2 to 28.0</td></tr>
<tr><td colspan="2">Billingham Main Anhydrite</td></tr>
<tr><td colspan="2">Brotherton Formation</td><td>35.6 to 55.8</td></tr>
</table>

(Adapted from: Smith, D.B., 1973)

TABLE: 6

PLANNING HISTORY (FROM STATHAM, 1971)

	CPL	YPL	WPL
Mining Method:	Dry	Dry	Solution
Mining Area (Acres):	20,000 onshore	min. 7,450 onshore	12,000
Estimated annual output of product (m TPA):	1 to 1.5	1 to 1.5	0.45
Public inquiry:	Aug.'68	Apr/May '69	May/June '69
Consent granted:	1969	May '70	May '70
Direct jobs originally estimated:	500	405	220
Estimated cost (£M):	25	30	15
Mine/refinery area (acres):	180	90	84 (+ wellheads)

TABLE: 7

DETAILS OF SUB-ZONE 3a – MAIN POLYHALITE BED

	APPROX. BASE DEPTH (m bgl)	THICKNESS (m)	γ API UNITS	ESTIMATED % POLYHALITE (WHOLE BED UNLESS OTHERWISE STATED)
BOREHOLE NO.				
S1	1,240	15	128	71
E2 (NAPIER)	1,378	13.7	-	3 spot cores >95% (chem)
E3 (STEWART)	(1,576)	(137)**	-	spot core 85% (chem)
E5 (RAYMOND)	1,337	7.3	-	
E12	N/A	N/A	N/A	
EGTON HM 1	ABSENT	0	-	polyhalite is absent
LOCKTON 2A	1,719	N/A	N/A	
LOCKTON 3	1,652	17	132	73
LOCKTON 5	1,800	12*	125	69
LOCKTON 7	1,693	N/A	N/A	
LOCKTON 8	1,730	N/A	N/A	
LOCKTON EAST 1	1,632	N/A	N/A	
ROBIN HOOD'S BAY	1,340	16	cps only	
STOUPE BECK	(1,469)	(54)	(240)***	(very high)
FORDON 1	2,027	10	cps only	
ATWICK 1	1,881	12*	160	72.6% (mineralogy); 89% (γ)
WYKEHAM 1	1,695	10*	120	67
YP14	1,610	14	170	94
CLOUGHTON A	1,646	15	150	83
41/14-1	1,833	23	170	94
41/18-1	1,465	11	150	83
41/24A-2	1,653	17*	145	81
41/25A-1	1,643	10	N/A	
36/26-1	1,364	11	N/A	

*	=	Banded with halite
**	=	Whole polyhalite zone, not just high grade section (no wireline/core logs are available to make subdivision)
***	=	γAPI is too high for polyhalite, but S.G. reads 2.8 and neutron 15%, that are exactly correct for pure polyhalite. We assume the log has an error on the γ scale
N/A	=	These logs are not currently available for double-checking (FWSC has manuscript notes only from previous work)
chem	=	Chemical analysis published for spot core samples only
cps	=	Counts per second (i.e. raw data, not converted to API units)

TABLE: 8

POLYHALITE TARGET DETAILS

	ONSHORE	OFFSHORE
ENTIRE AOI		
Total Areas of Polyhalite Target in AOI are (measured from Fig.20):	345 km^2	530 km^2
LESS urban areas:	26 km^2	-
Rural/Offshore Target Areas (Polyhalite) are:	319 km^2	530 km^2
LESS geological losses as follows:-		
• Allowance for Faults and Peak Trough:	9 km^2	100 km^2
• Allowance for Cleveland Dyke:	3 km^2	-
Effective Target Areas (Polyhalite) are:	**307 km^2**	**430 km^2**
TOTAL "DISCOUNTED" POLYHALITE TARGET AOI = 737 km^2		
Target Tonnes Polyhalite Seam (cut at 5 m) in Whole AOI Target:- **737,000,000 m^2 x 5 x 2.6 = 9,581 million tonnes**		
CONTRACT AREAS WITHIN AOI		
Strickland Estates:	27.72 km^2	-
Duchy (within polyhalite boundary):	19.9 km^2	-
The Crown Estate:	-	530 km^2
Total Areas of Potential Polyhalite under Contract (10/1/11) are:	**47.62 km^2**	**530 km^2**
LESS urban areas:	0.5 km^2	-
LESS geological losses as follows:-		
• Strickland (Faults and Dyke):	1.7 km^2	-
• Duchy (Faults and Dyke):	0.6 km^2	-
• TCE (Peak Trough):	-	100 km^2
Effective Target Areas (Polyhalite) under Contract are:	**44.82 km^2**	**430 km^2**
TOTAL "DISCOUNTED" POLYHALITE TARGET AREA UNDER CONTRACT = 474.82 km^2		
Target Tonnes Polyhalite Seam (cut at 5 m) in Contract Target Area:- **474,820,000 m^2 x 5 x 2.6 = 6,172 million tonnes**		

TABLE: 9

SNEATON POTASH – HISTORICAL ASSAY DATA

BOREHOLE	SOURCE	THICKNESS (m)	GRADE % KCl *	COMMENTS
E2	Stewart, 1951	7.9	-	Spot samples 3.2 and 6.7% KCl
E3	Raymond, 1951	6.7	15-18	DBS notes say 5.5 m @ 19% KCl
E4	Raymond, 1951	4.3	10	Some figures quoted by Hemingway
E6	Raymond, 1951	8.5	20	
E12	DBS log	3.65	-	9.5 to 14.1% by visual estimate
F2	DBS ms notes	7.0	26	From Hemingway
A2	WPL files	1.2	16.3	Reliable assay
A3	WPL files	6.9	29	Reliable assay
F4	Borehole core log		-	Analysis of a spot sample gave "25% K". Two seams, 2.4 and 2.9 m, separated by 3.8 m of halite and marl
CLOUGHTON 'A'	Gamma log	10.7	-	Two seams, 3 and 4.5 m; lower seam is ca. 150 API (≡ 21% KCl)
STOUPE BECK	Gamma log	10.0	-	Three sylvite leaves, max. 424 API (≡ 60% KCl)
LOCKTON EAST 1	Gamma log	7.0	-	Sylvite, spiky, averaging ca. 140 API (≡ 20% KCl)
41/18-1	Gamma log	12.8	-	Two seams, max 200 API (≡ 28.5% KCl)
41/14-1	Gamma log	6.7	-	40 to 85 API (≡ 6 to 12% KCl)
41/24A-1	Gamma log	12.5	-	Traces only
41/24A-2	Gamma log	19.5	-	90 to 120 API (≡ 12 to 17% KCl)

* Quoted as a chemical analysis

TABLE: 10

SNEATON POTASH (K4) LOW GRADE TARGET DETAILS

	ONSHORE
ENTIRE AOI	
Total Area of K4 in AOI is (measured from Fig. 23):	280 km^2
Area where seam thickness >5 m is:	160 km^2
LESS urban areas:	24 km^2
fault and dyke losses:	3 km^2
TOTAL "DISCOUNTED" K4 TARGET AREA (AOI) = 133 km^2	
Target Tonnes K4 seam (10 to 20% KCl) in AOI Target @ 3 m cut:-	
133,000,000 m^2 x 3 x 2.1 = 838 million tonnes (say 840 Mt)	
Target Tonnes K4 seam (10 to 20% KCl) in AOI Target @ 4 m cut:-	
133,000,000 m^2 x 4 x 2.1 = 1,117 million tonnes (say 1,100 Mt)	
CONTRACT AREAS WITHIN AOI	
Strickland Estates:	6.8 km^2
Duchy (within K4 boundary):	17.4 km^2
The Crown Estate:	NIL
Total Areas of Potential K4 under Contract (10/1/11) is:	24.2 km^2
LESS urban areas:	0.2 km^2
fault and dyke losses:	2.4 km^2
TOTAL "DISCOUNTED" K4 TARGET AREA UNDER CONTRACT = 21.6 km^2	
Target Tonnes K4 (10 to 20% KCl) in Contract Target Area @ 3 m cut:-	
21,600,000 m^2 x 3 x 2.1 = 136 million tonnes (say 140 Mt)	
Target Tonnes K4 (10 to 20% KCl) in Contract Target Area @ 4 m cut:-	
21,600,000 m^2 x 4 x 2.1 = 181 million tonnes (say 180 Mt)	

NOTE: K4 seam appears to range mostly 10 to 20% KCl in boreholes drilled within the Target Area. See Table 9.

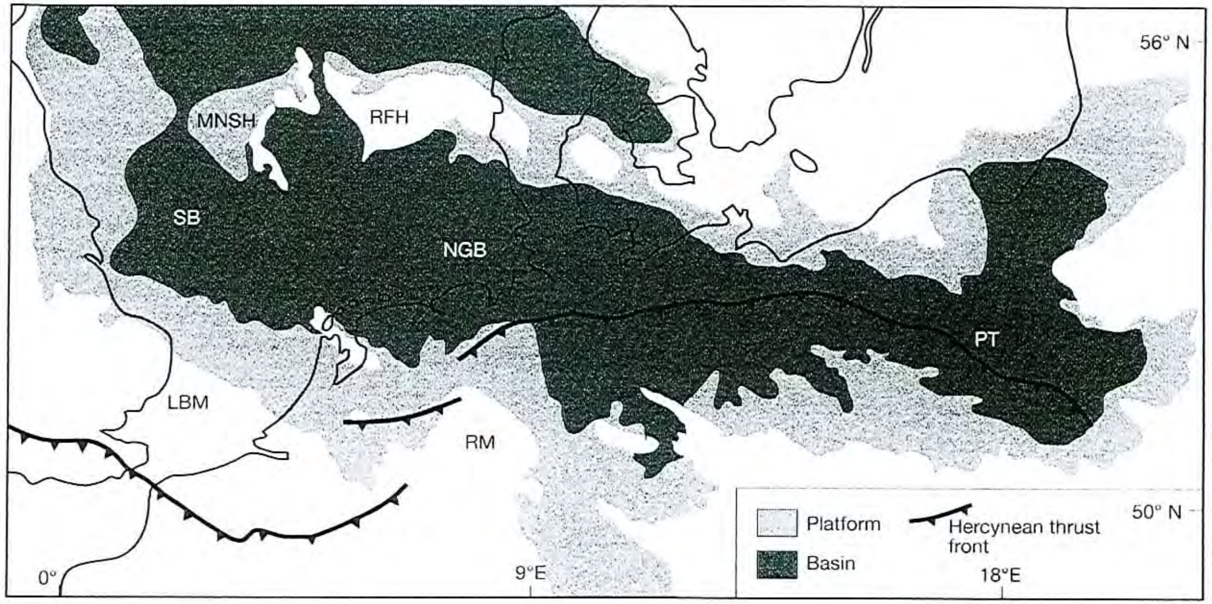
TABLE: 11

SUMMARY OF EXPLORATION TARGETS BASED ON REVIEW OF HISTORICAL DATA

NOTE: To be read in conjunction with Notice in Preface on Page 1 of this Report.

	WITHIN THE ENTIRE YORK AOI	UNDER CONTRACT 10/1/2011
K4 SNEATON POTASH SEAM (SYLVITE)		
- A relatively low grade seam, prone to splitting, but at the top of the sequence and so will be tested by all surface drill holes.		
- Locally up to 29% KCl (historical data).		
- Targeted onshore only, within area where seam is expected to be >5 m in thickness.	840 to 1,100 M tonnes @ 10 to 20% KCl	140 to 180 M tonnes @ 10 to 20% KCl
- Exploration Target model based on historical boreholes.		
- Allowances made for urban areas and known areas of major fault and dyke disturbance; assume range from 3 m to 4 m extraction. No allowance for mine layout/recovery.		
K3 BOULBY POTASH SEAM (SYLVITE)		
- A high grade seam, mined since 1973 at Boulby, prone to lateral variation over short distances.		
- Explored in the 1960s by 24 boreholes in the northern part of the AOI, that led to planning applications for two mines.		
- A further 25boreholes indicate continuity in southern part of AOI.	900 to 1,200 M tonnes @ 35-40% KCl	330 to 400 M tonnes @ 35-40% KCl
- Exploration Target defined on basis of similar characteristics to areas drilled, by others, in the 1960s; and mined at Boulby. Allowances made for urban areas and major faulting. No allowance for mine layout/ recovery		
K2 POLYHALITE		
- An apparently very consistent seam of relatively high purity polyhalite and >10 m thickness.		
- Continuity indicated over 350 km around the Zechstein Basin margin.		
- Boulby Mine commenced development in this seam in 2010.		
- >19 historical borehole intersections in or near the AOI (NB: no full core analyses – all interpretation is from wireline logs).	6,800 to 9,500 M tonnes @ 67 to 94% polyhalite (≡ 19 to 27% K_2SO_4)	3,300 to 6,000 M tonnes @ 67 to 94% polyhalite (≡ 19 to 27% K_2SO_4)
- Exploration Target model based on geological interpretation of historical boreholes.		
- Allowances made for urban areas and known areas of major fault and dyke disturbance; assume 5 m extraction. No allowance for mine layout/ recovery. Targets calculated over a range assuming extent to absolute seaward limit, or cut off at 11 km offshore.		

FIGURES



Facies distribution in the southern Zechstein Basin (after Geluk, 2000). The basin is bordered to the north by the Mid North Sea High and Ringkøbing-Fyn High and the London-Brabant Massif in the south. The solid black line represents the location of the Variscan Thrust Front. MNSH: Mid North Sea High; RFH: Ringkøbing-Fyn High; SB: Silverpit Basin; LBM: London Brabant Massif; RM: Rhenish Massif; NGB: North German Basin; PT: Polish Trough.

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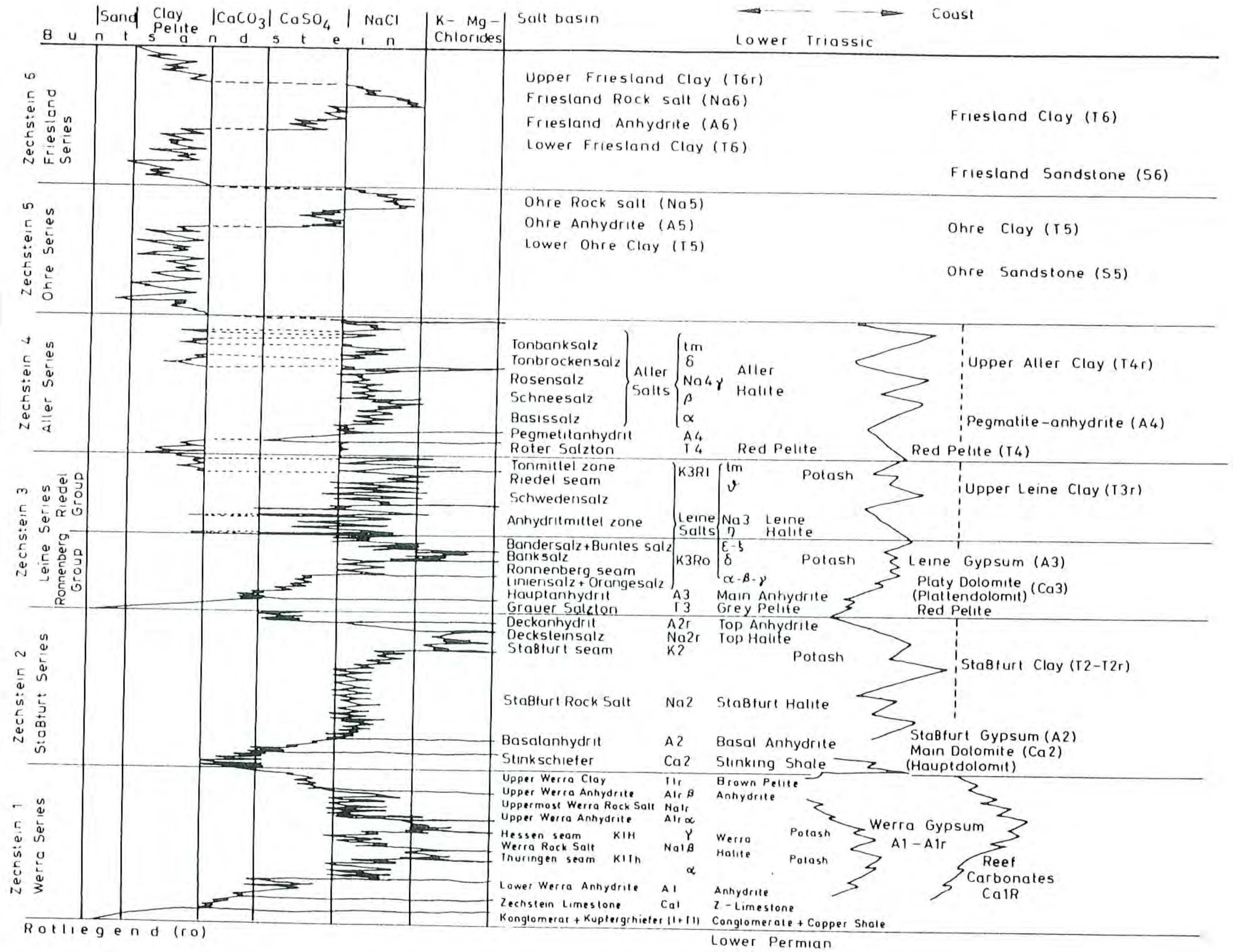

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DATE

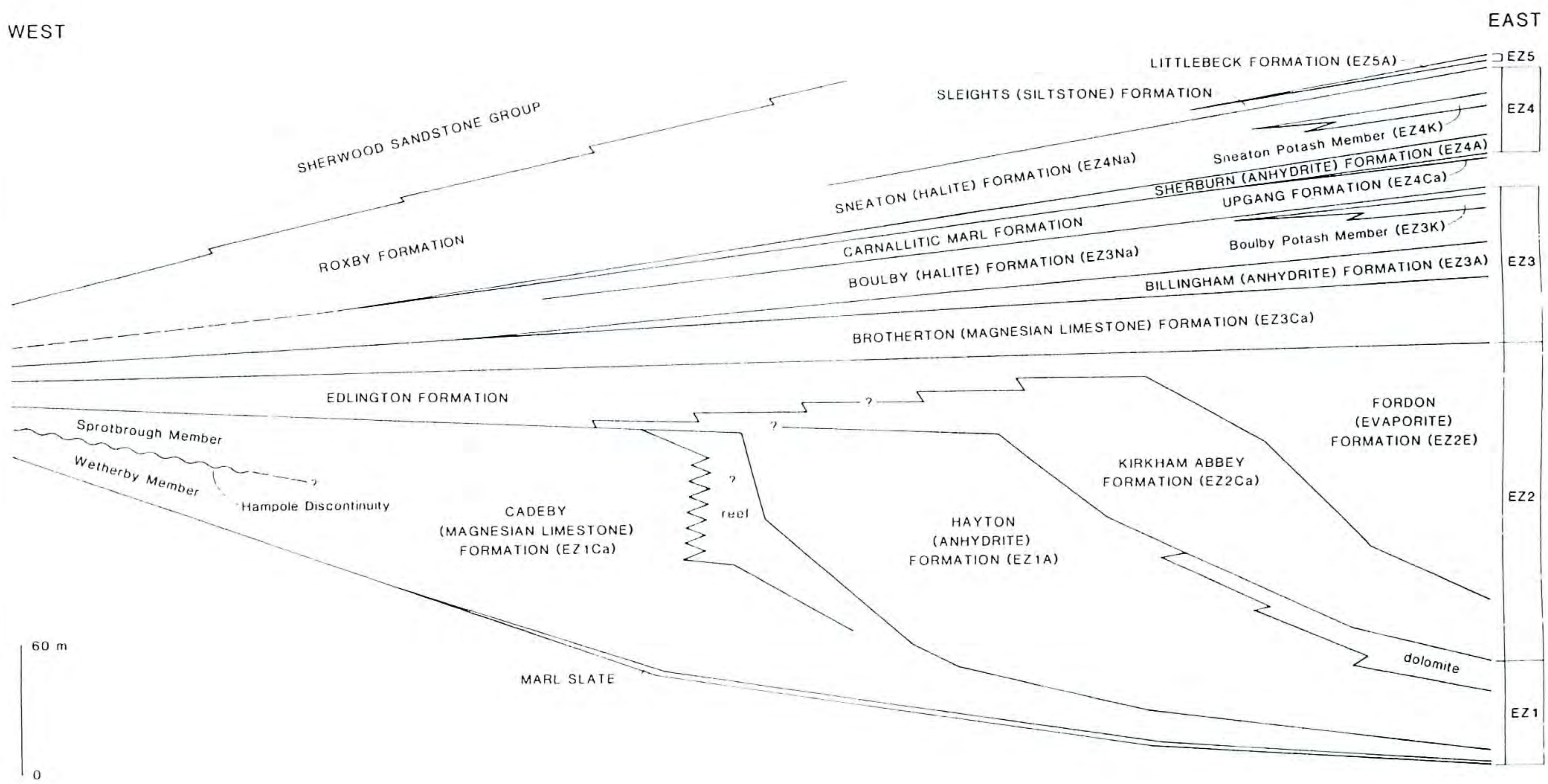
10/01/2011

SCALE

NA

DRAWING TITLE - FIGURE 2

SEDIMENTATION AND STRATIGRAPHY OF GERMAN ZECHSTEIN, AFTER RICHTER-BERNBURG. (ZECHSTEIN 5 AND 6 ADDED AFTER KADING)



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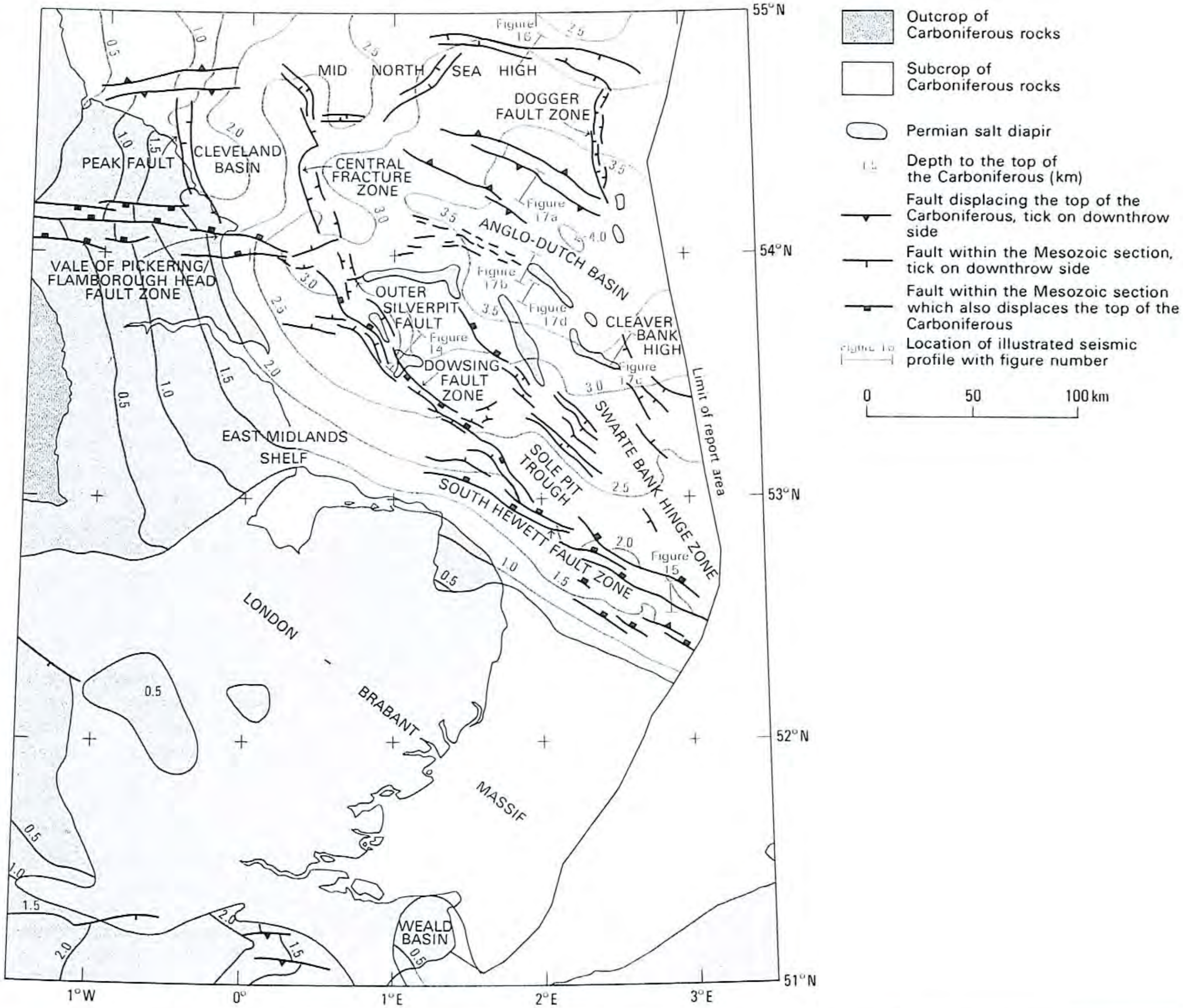

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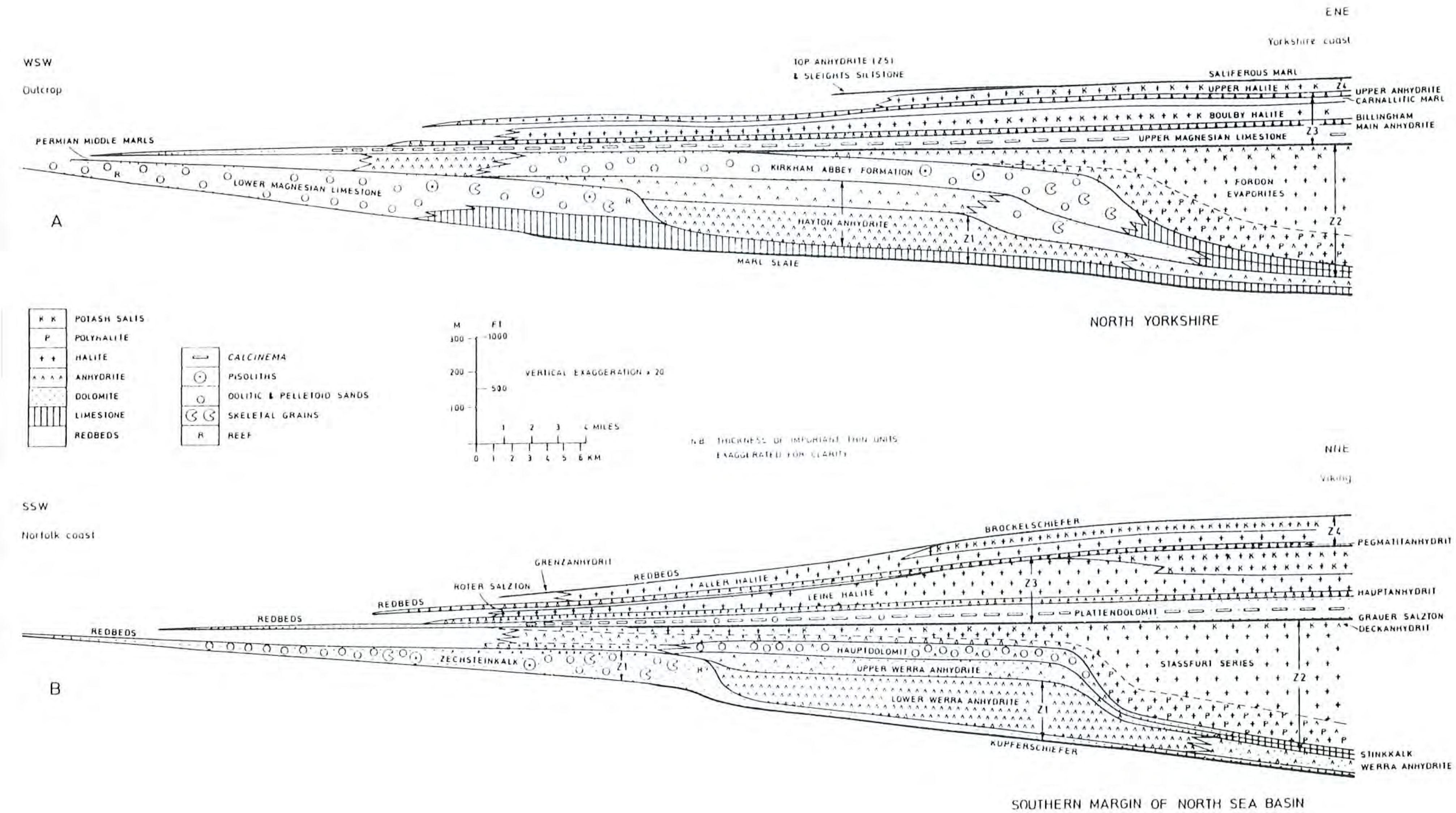
JOB TITLE	CLIENT	DATE	DRAWING TITLE - FIGURE 4
TECHNICAL REPORT PROJECT STATUS – JANUARY 2011 PROJECT 40	YORK POTASH LTD	10/01/2011 SCALE NTS	DEPTH TO THE TOP OF THE CARBONIFEROUS ROCKS, AND THE LOCATION OF PRINCIPAL MESOZOIC FAULT ZONES (FROM CAMERON *ET AL.* 1992)



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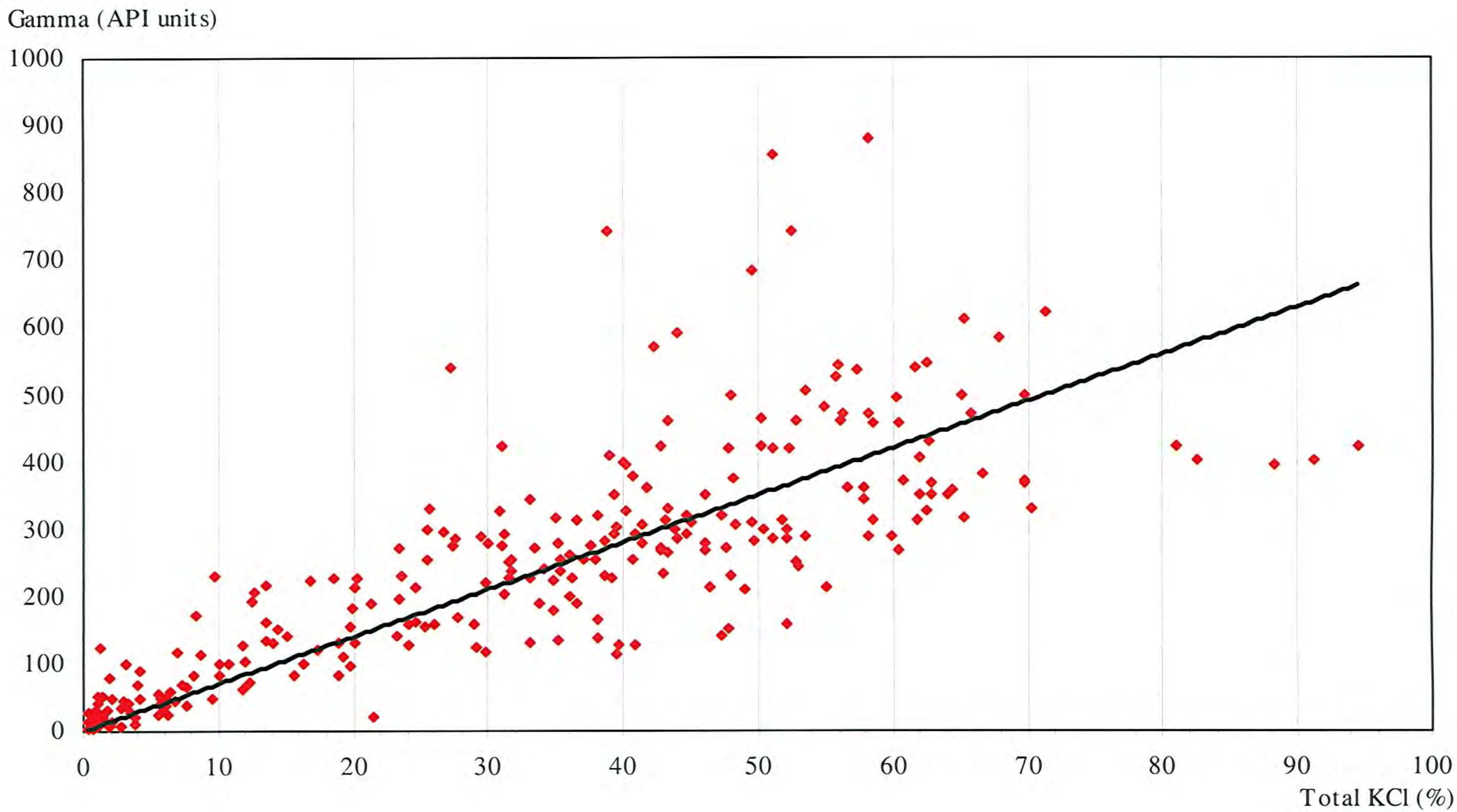

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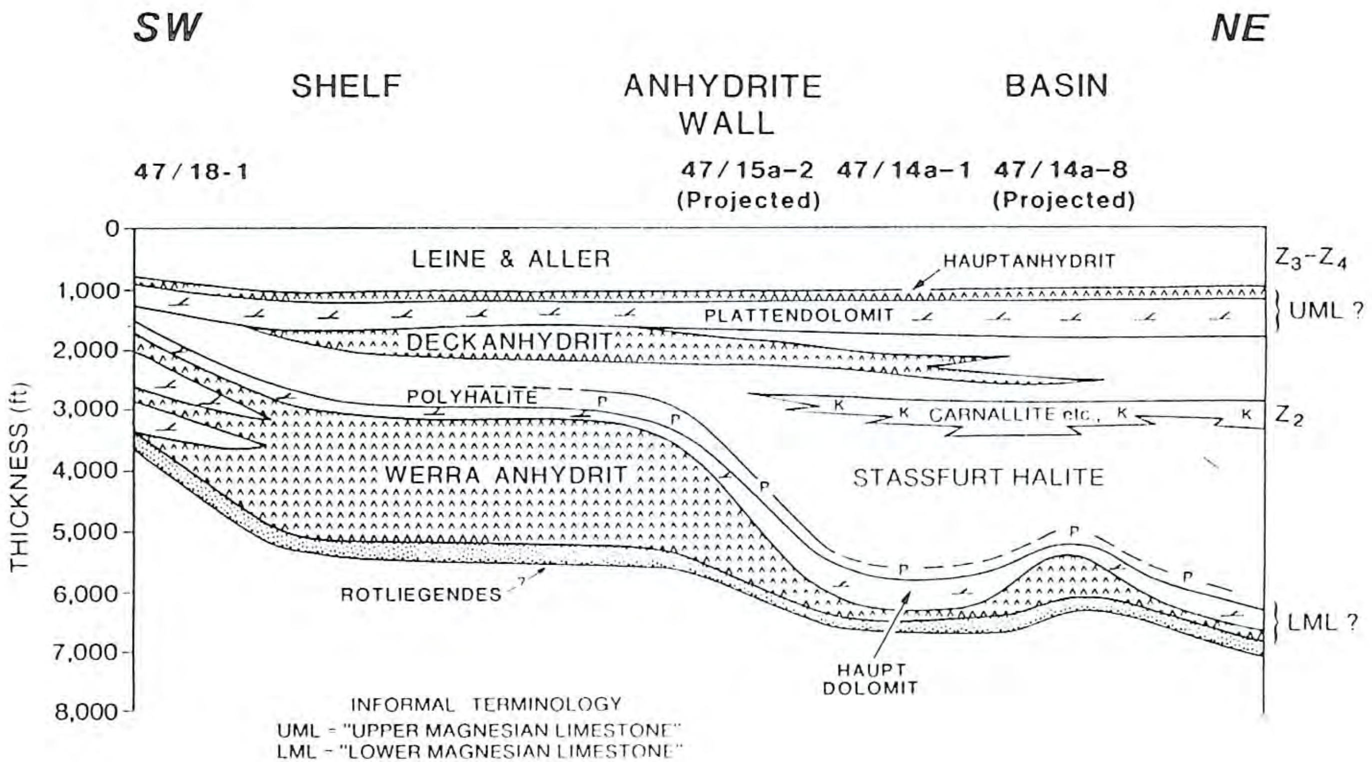
JOB TITLE	CLIENT	DATE	DRAWING TITLE - FIGURE 6
TECHNICAL REPORT PROJECT STATUS – JANUARY 2011 PROJECT 40	YORK POTASH LTD	10/01/2011	CORRELATION OF CORE ASSAYS WITH GAMMA VALUES, WHITBY POTASH HOLES
		SCALE NA	



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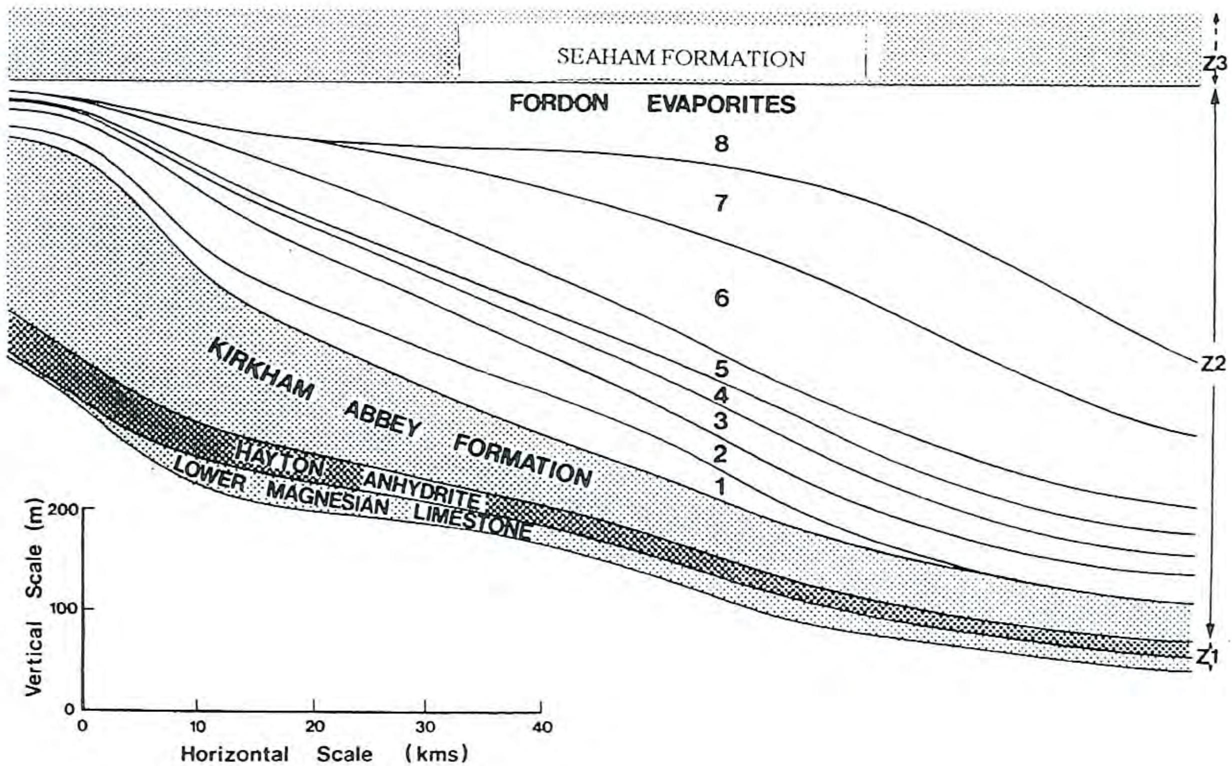

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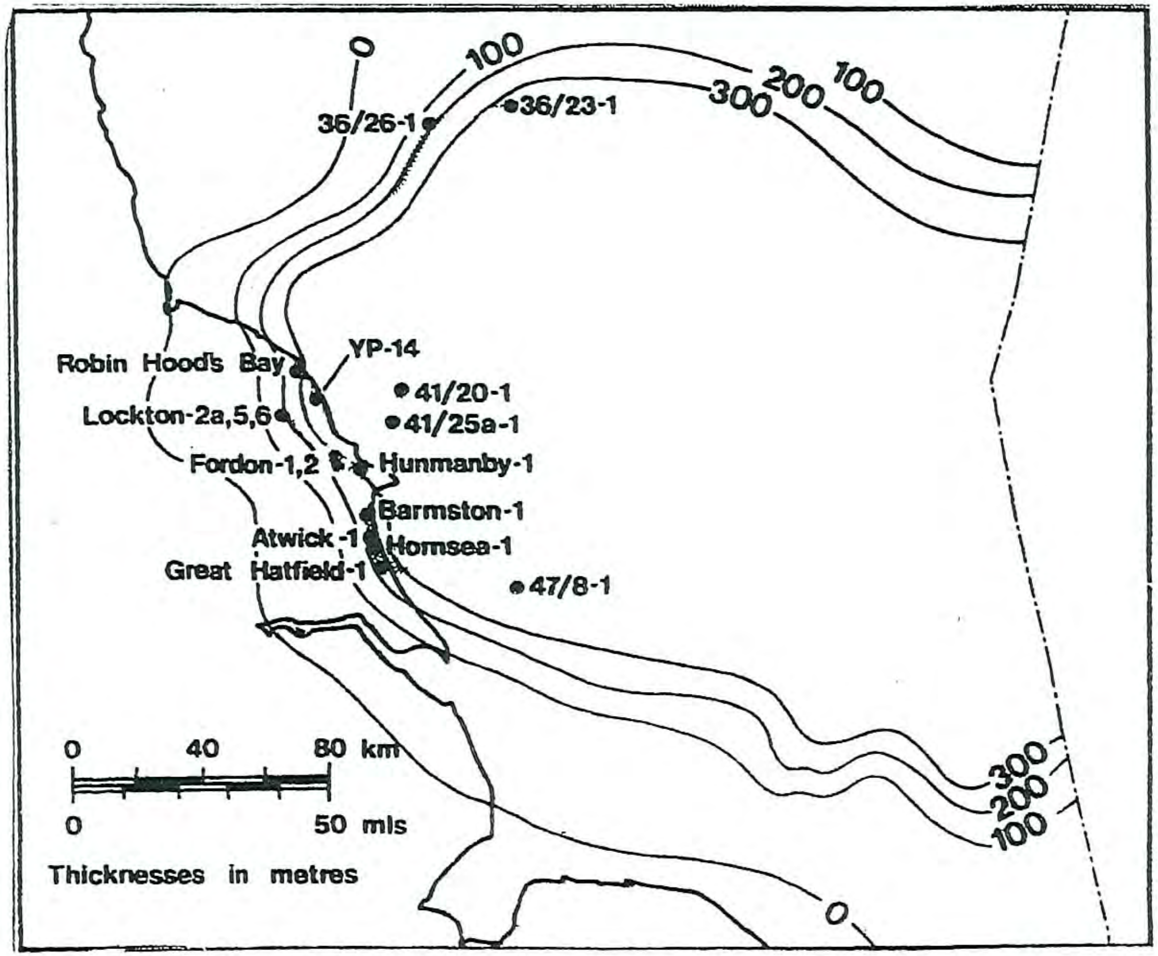
JOB TITLE	CLIENT	DATE	DRAWING TITLE - FIGURE 8
TECHNICAL REPORT PROJECT STATUS – JANUARY 2011 PROJECT 40	YORK POTASH LTD	10/01/2011 SCALE NTS	FORESETTING OF UNITS OF THE FORDON EVAPORITES, AS INTERPRETED BY COLTER & REED (1980)



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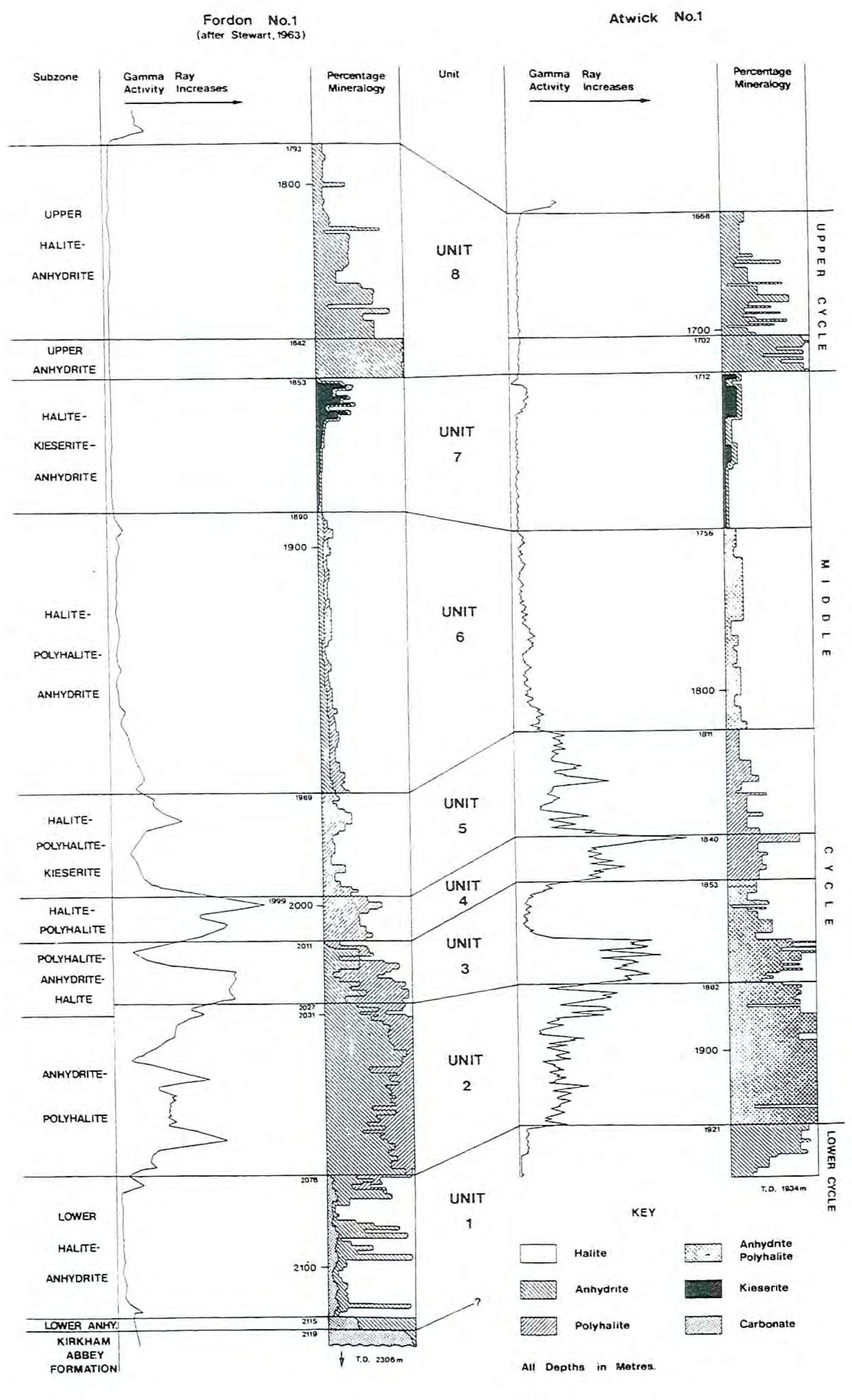
TECHNICAL REPORT PROJECT STATUS – JANUARY 2011 PROJECT 40	YORK POTASH LTD	10/01/2011 SCALE NTS	BROAD DISTRIBUTION OF THE FORDON FORMATION (COLTER & REED, 1980)



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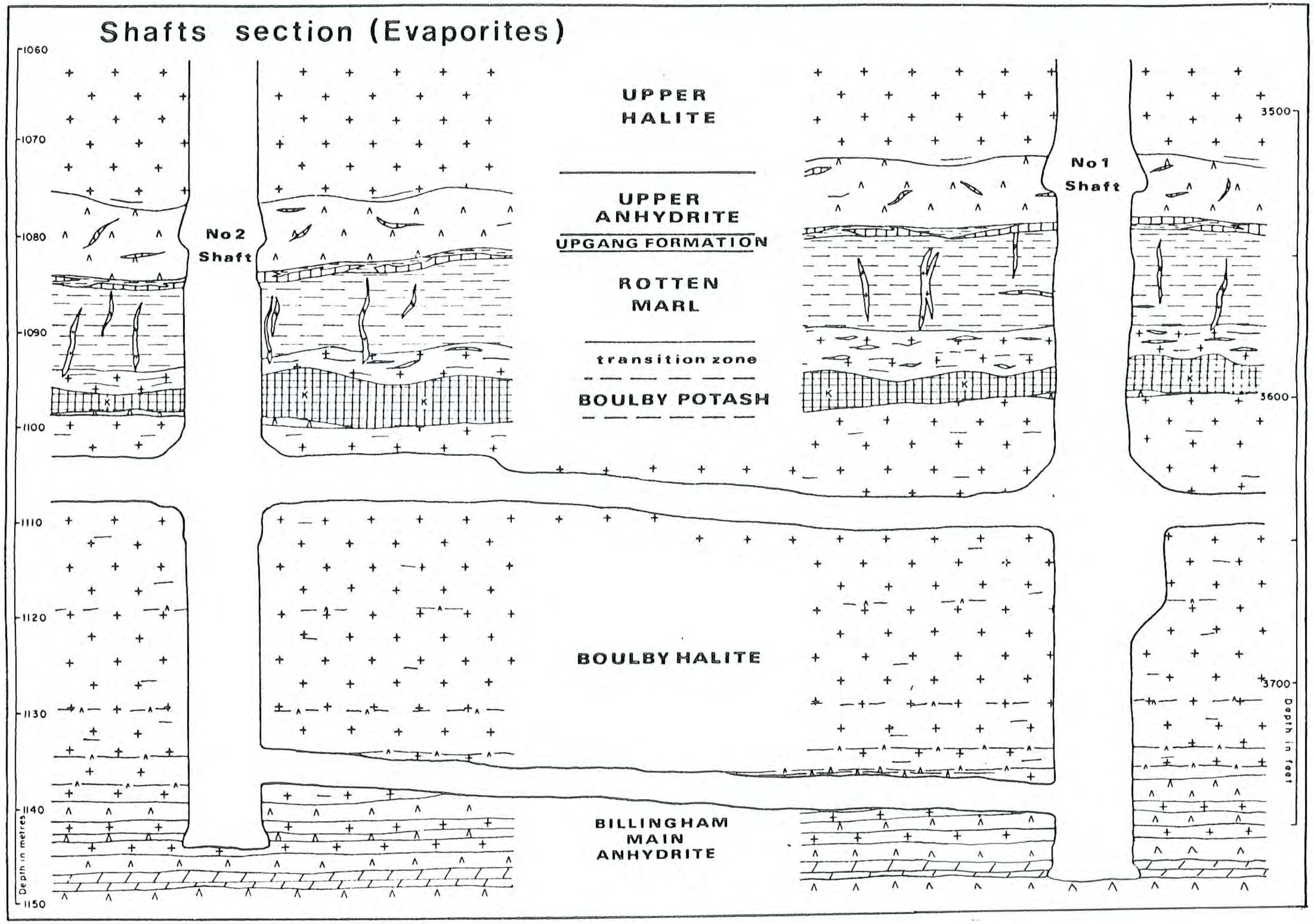
DRAWING TITLE - FIGURE 10

CORRELATION OF THE FORDON EVAPORITES IN FORDON 1 AND ATWICK 1 BOREHOLES, NORTHEAST ENGLAND. FROM COLTER & REED (1980, FIGURE 1)

SCALE
NA

DATE
10/01/2011



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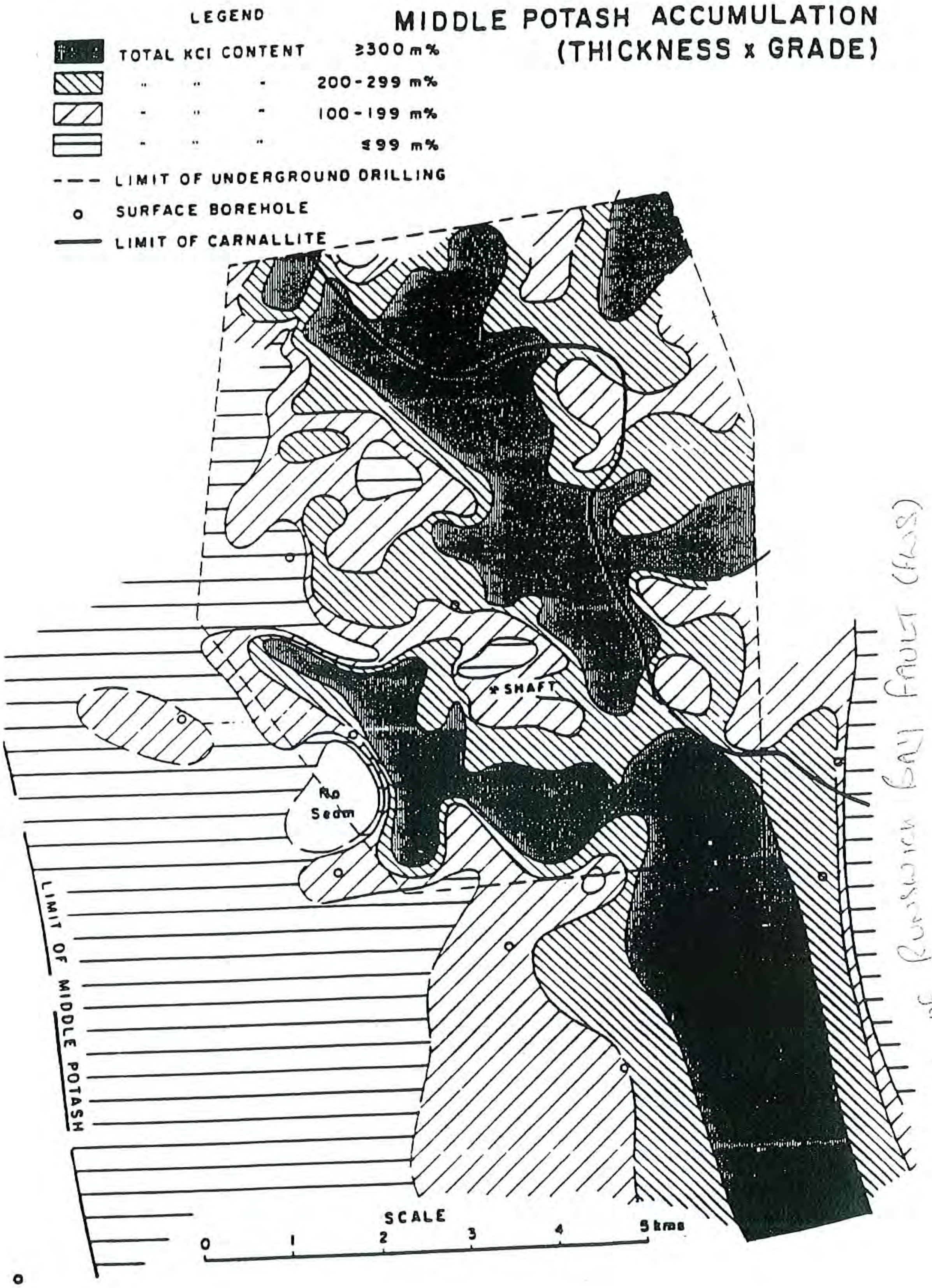

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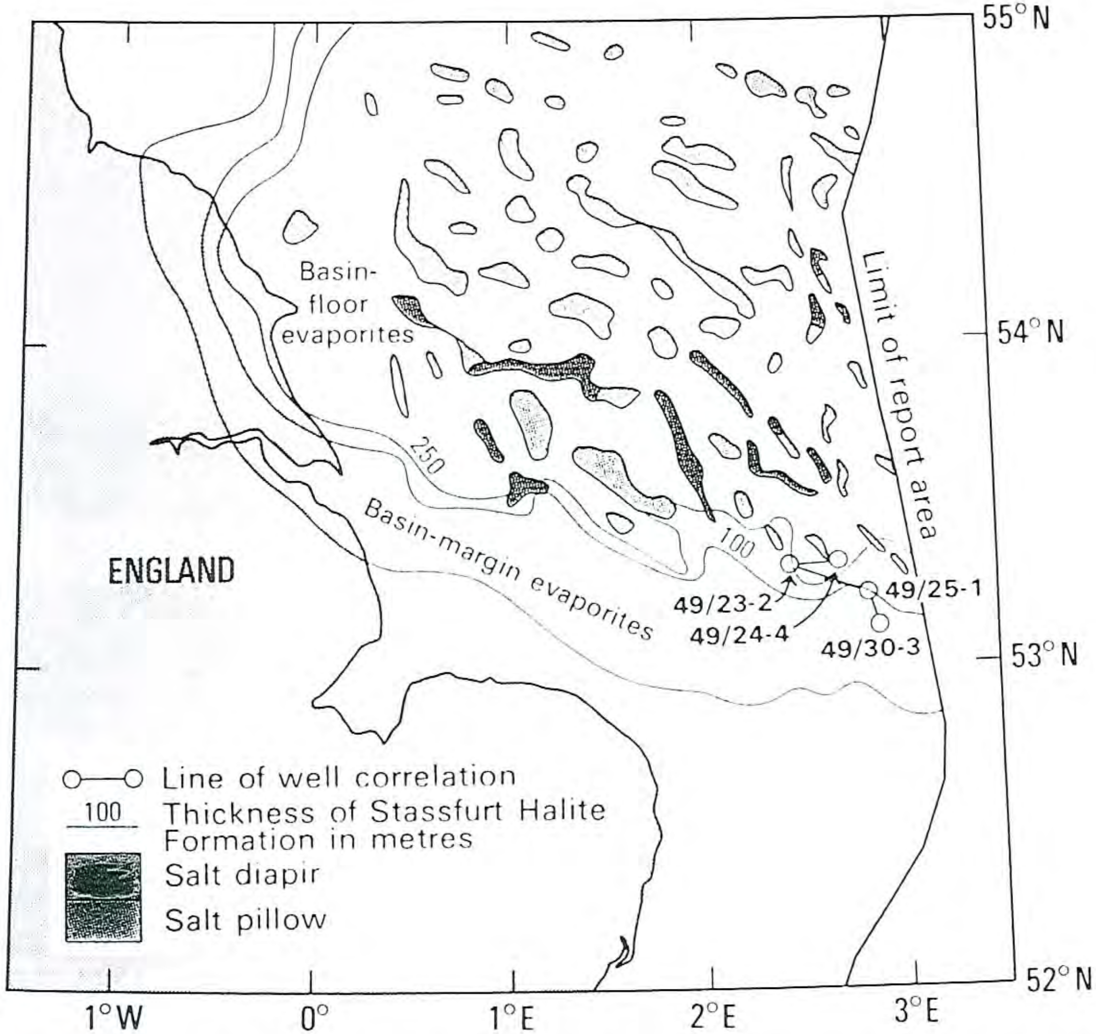
	CLIENT YORK POTASH LTD	SCALE NA / DATE 10/01/2011



Map depicting the distribution and generalised thickness of the Stassfurt Halite Formation, and equivalent formations in eastern England. Where deformed by halokinesis in the centre of the basin, the Stassfurt Halite is locally less than 50 m thick in zones of salt withdrawal, and more than 2500 m thick in some of the largest salt diapirs.

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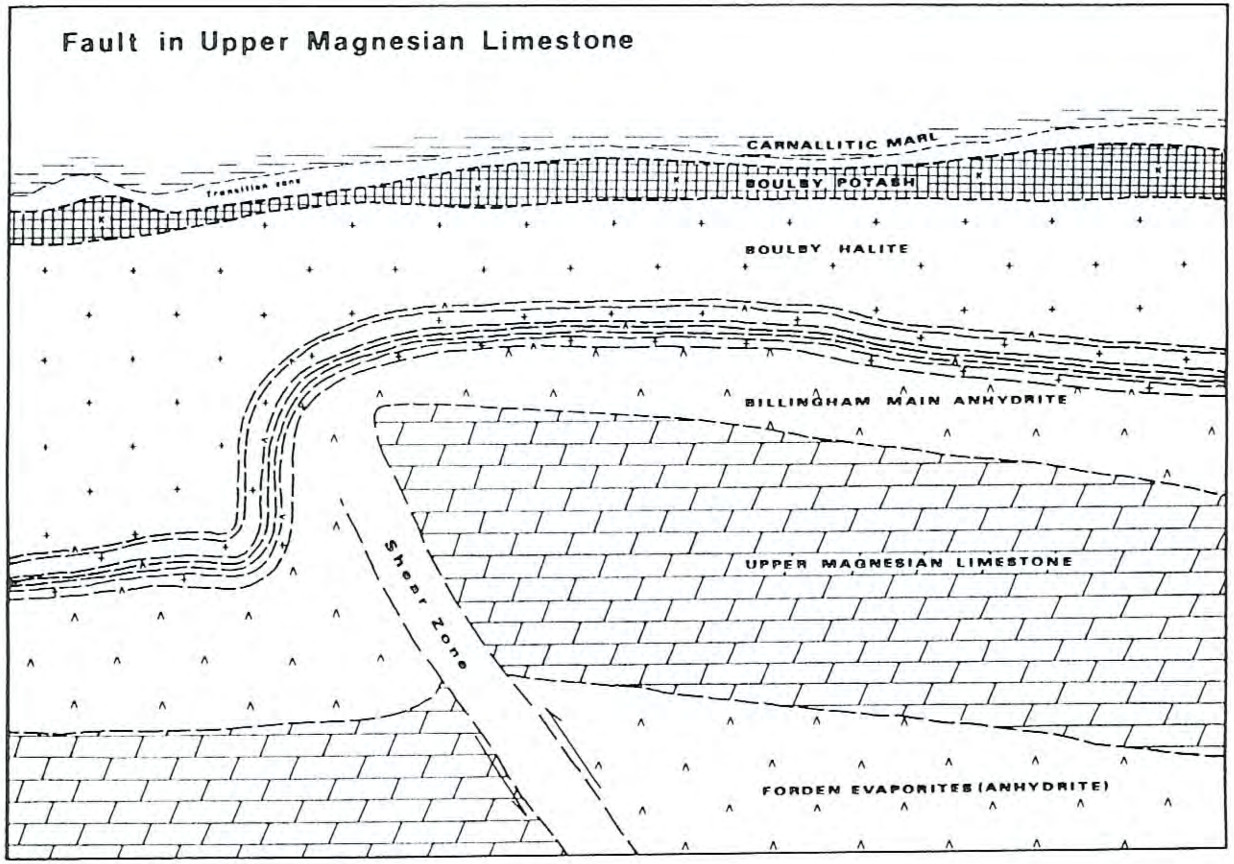
JOB TITLE	CLIENT	DATE	DRAWING TITLE - FIGURE 13
TECHNICAL REPORT PROJECT STATUS – JANUARY 2011 PROJECT 40	YORK POTASH LTD	10/01/2011 SCALE NTS	MAP DEPICTING THE DISTRIBUTION AND GENERALISED THICKNESS OF THE STASSFURT HALITE FORMATION, AND EQUIVALENT FORMATIONS IN EASTERN ENGLAND



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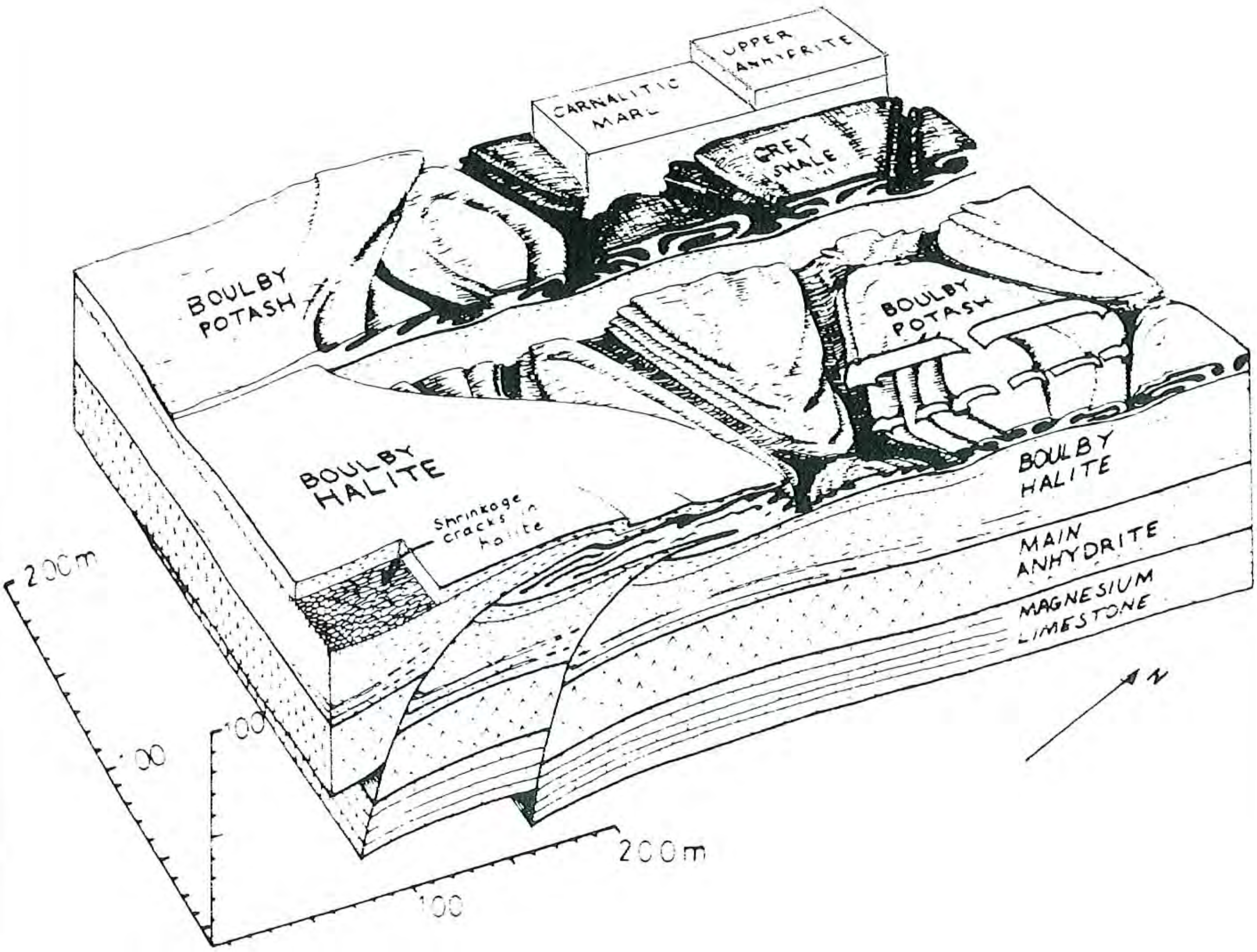
JOB TITLE	CLIENT	DATE	DRAWING TITLE - FIGURE 14
TECHNICAL REPORT PROJECT STATUS – JANUARY 2011 PROJECT 40	YORK POTASH LTD	10/01/2011 SCALE NTS	FAULT IN THE UPPER MAGNESIAN LIMESTONE (FROM WOODS 1979)



Schematic block diagram of the near-seam geology of part of the southwestern corner of Boulby Mine. The Boulby Potash and the grey shale can be seen to have deformed in the movement cells on two scales (indicated by arrows over one major cell). The shape of the larger set of movement cells are longitudinal rolls beneath lobes of Boulby Halite and progressively grade to hexagons away from such lobes.

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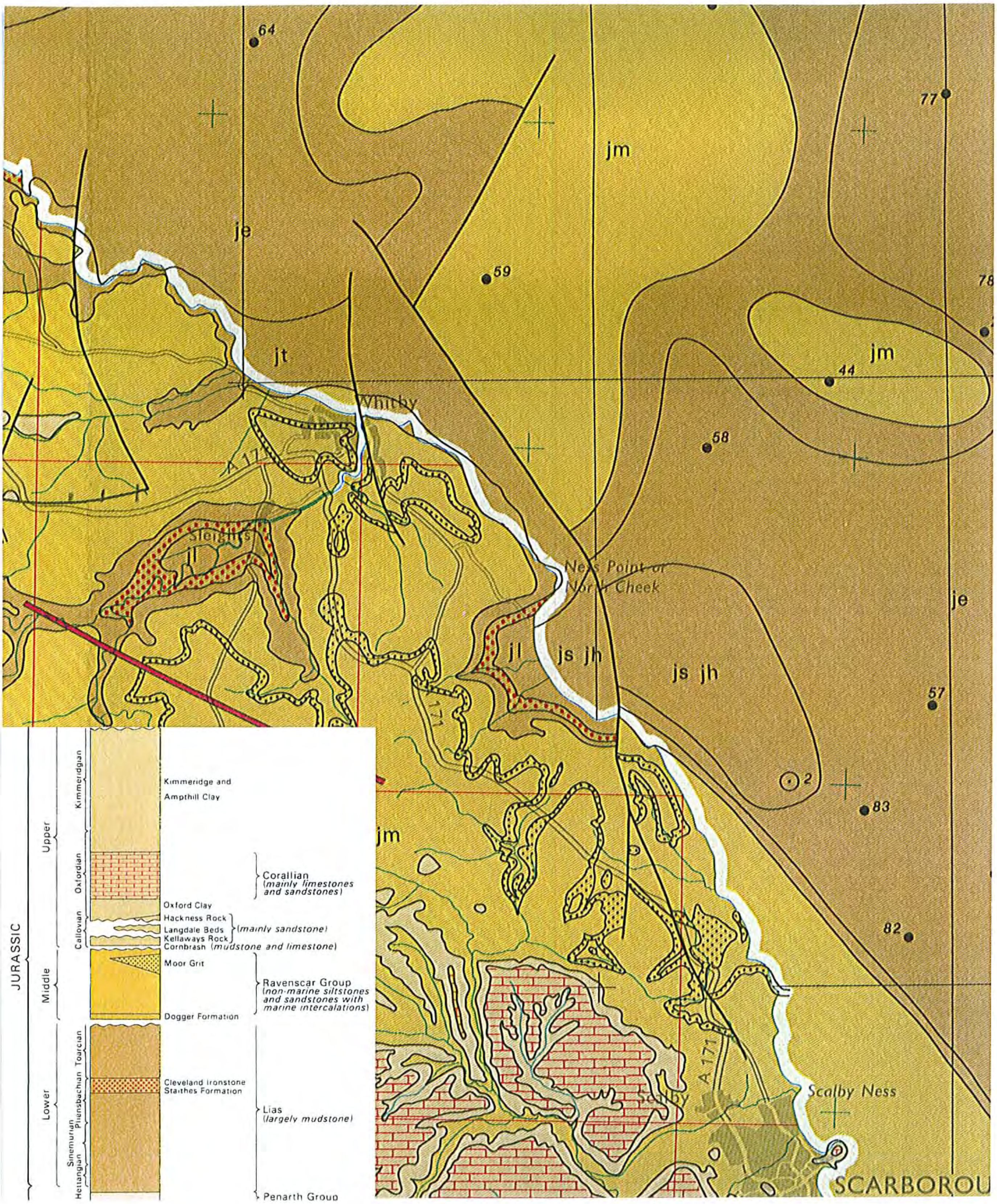
JOB TITLE	DRAWING TITLE - FIGURE 15	
TECHNICAL REPORT PROJECT STATUS – JANUARY 2011 PROJECT 40	EXTRACT FROM TALBOT ET AL. 1982 SHOWING DEFORMATION OF BOULBY POTASH	
CLIENT YORK POTASH LTD	SCALE NA	DATE 10/01/2011



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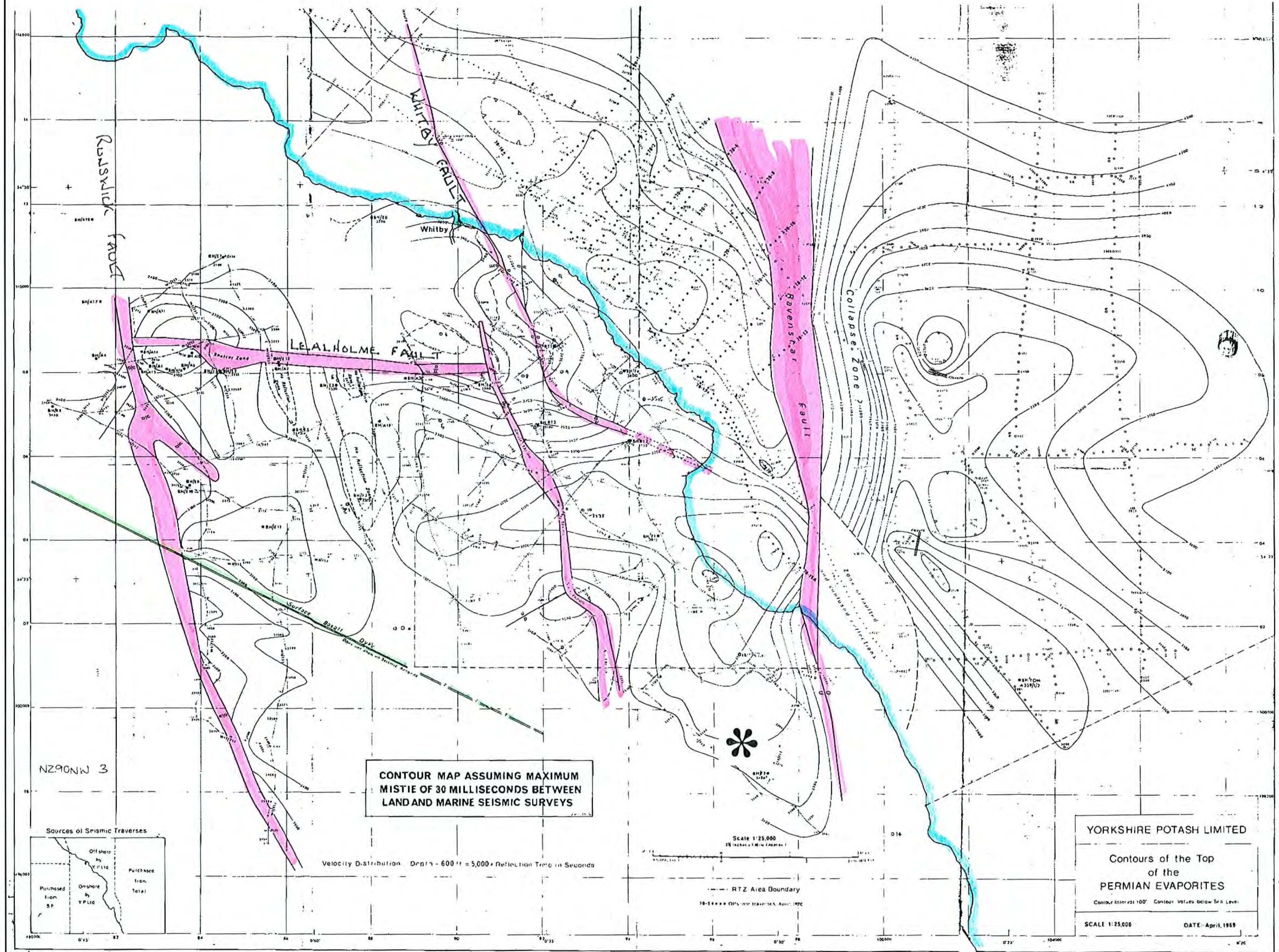
DRAWING TITLE - FIGURE 16

OUTLINE GEOLOGY (FROM – IGS. TYNE TEES 1:250,000)

SCALE
NOT TO SCALE

DATE
10/01/2011



HARWOOD DALE FOREST

FAULT

CLEVELAND DYKE

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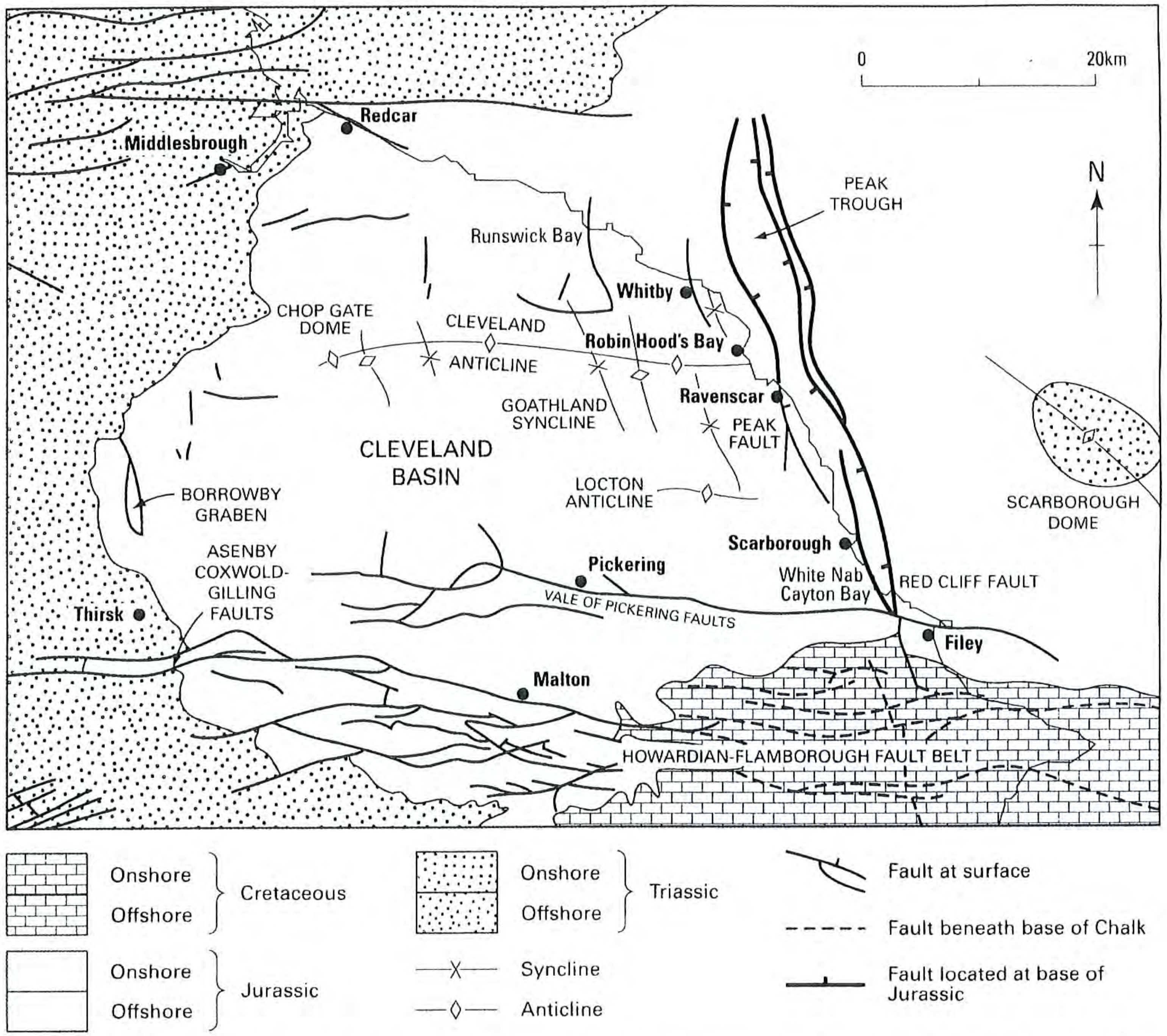
DRAWING TITLE - FIGURE 17

CONTOURS ON THE TOP OF THE PERMIAN EVAPORITES (YPL SEISMIC RESULTS)

SCALE	DATE
NTS	10/01/2011



Major structural features in the Cleveland Basin. (After Kirby & Swallow 1987; Milsom & Rawson 1989; Kent 1980*b*; Rawson & Wright 2000 with additions).

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DRAWING TITLE - FIGURE 18

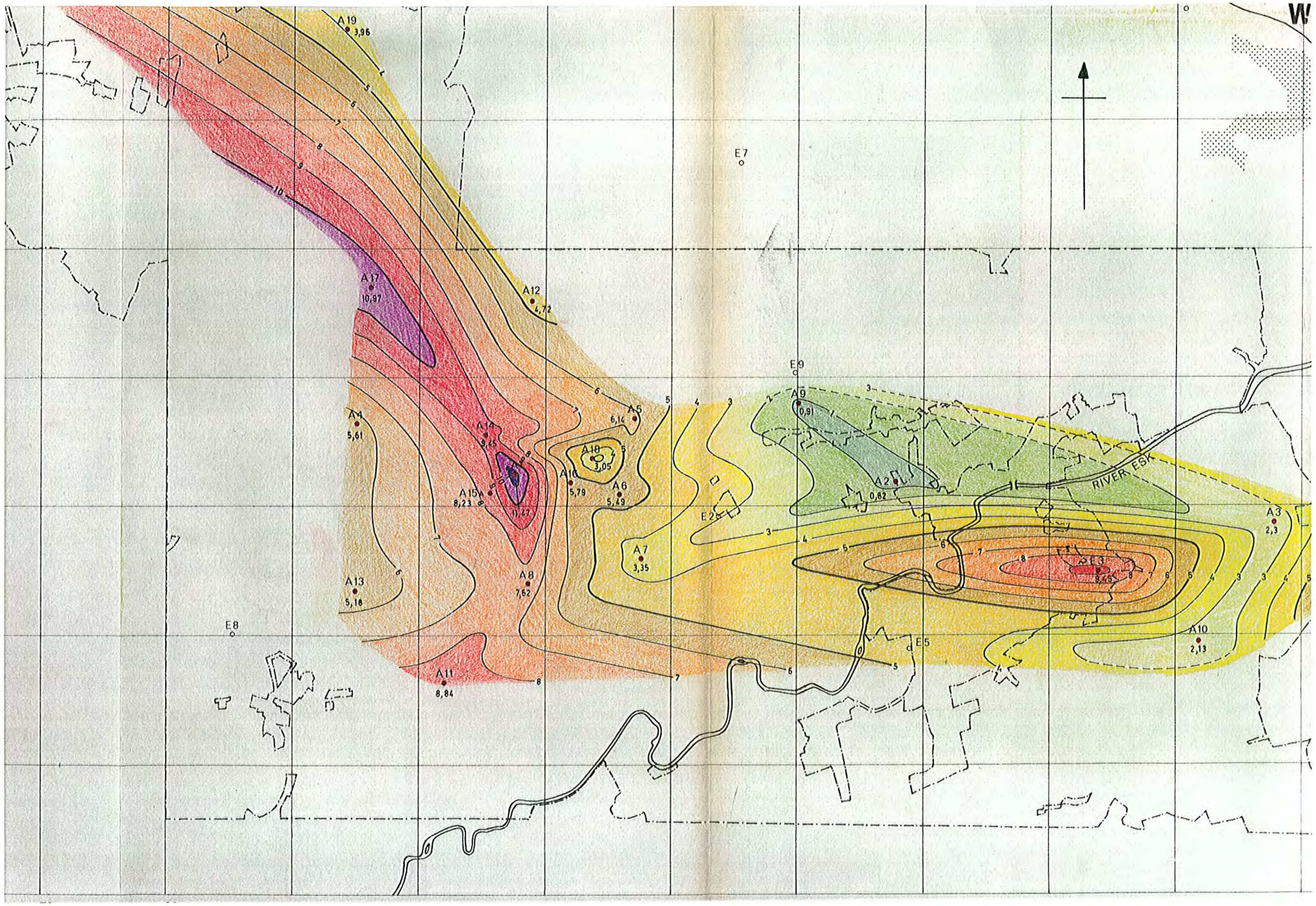
MAJOR STRUCTURAL FEATURES IN THE CLEVELAND BASIN (FROM POWELL 2010)

SCALE

NTS

DATE

10/01/2011



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DATE

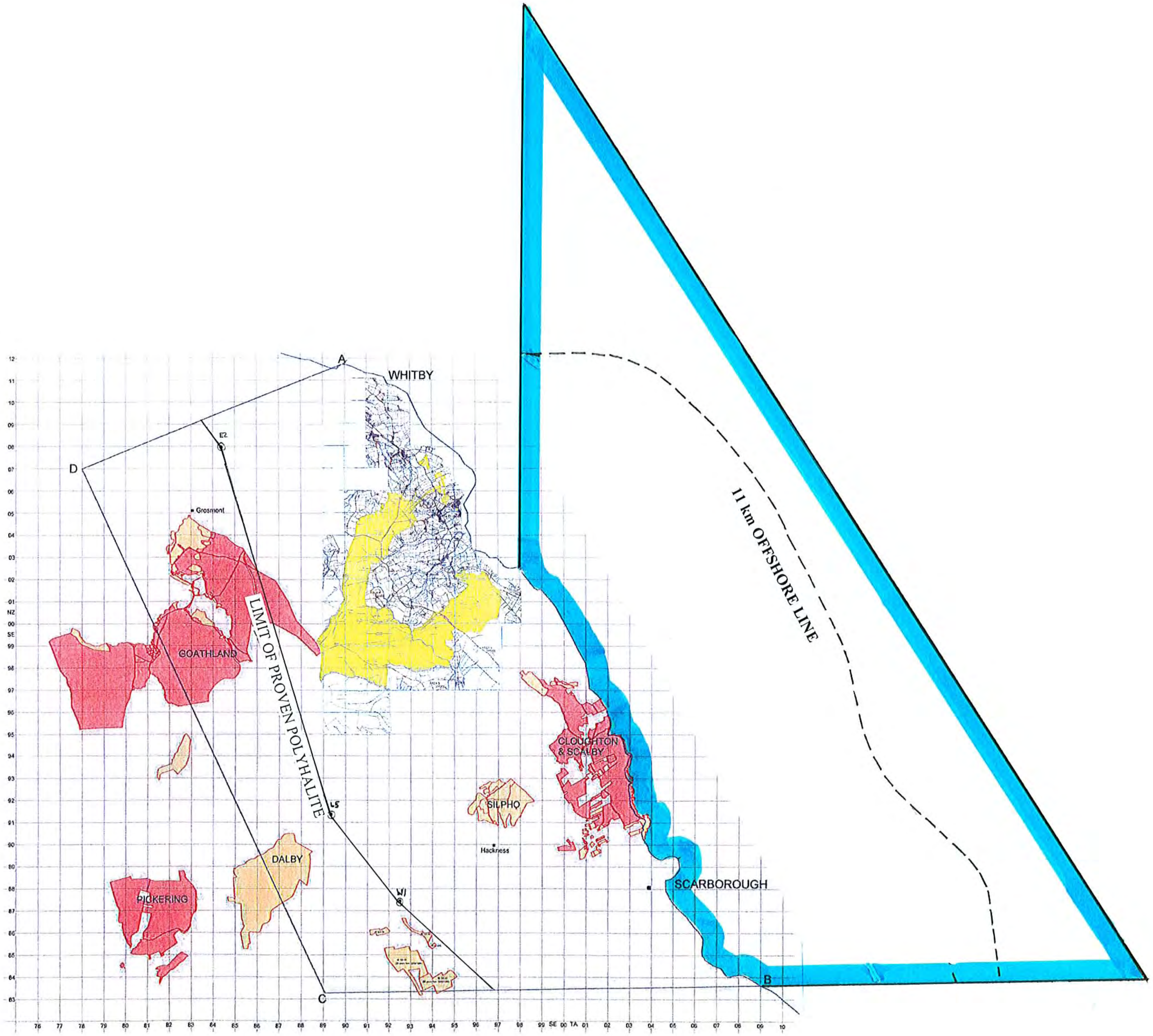
10/01/2011

SCALE

NTS

DRAWING TITLE - FIGURE 19

ISOPACHS ON K3 IN THE WPL AREA (EXTRACT FROM MAYRHOFER, 1975)



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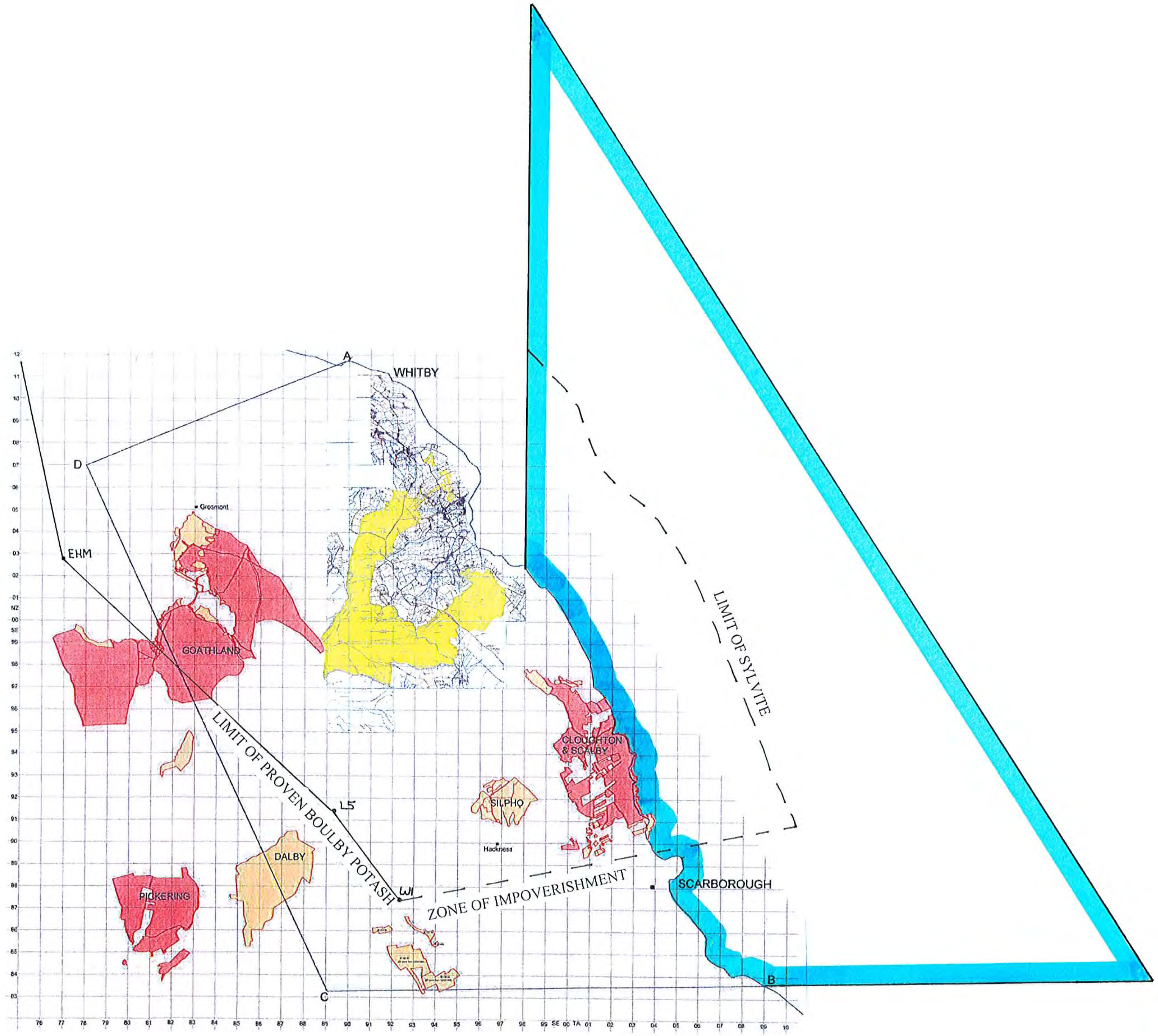
DRAWING TITLE - FIGURE 20

POLYHALITE EXPLORATION TARGET

SCALE	DATE
Approx 1:200,000	10/01/2011



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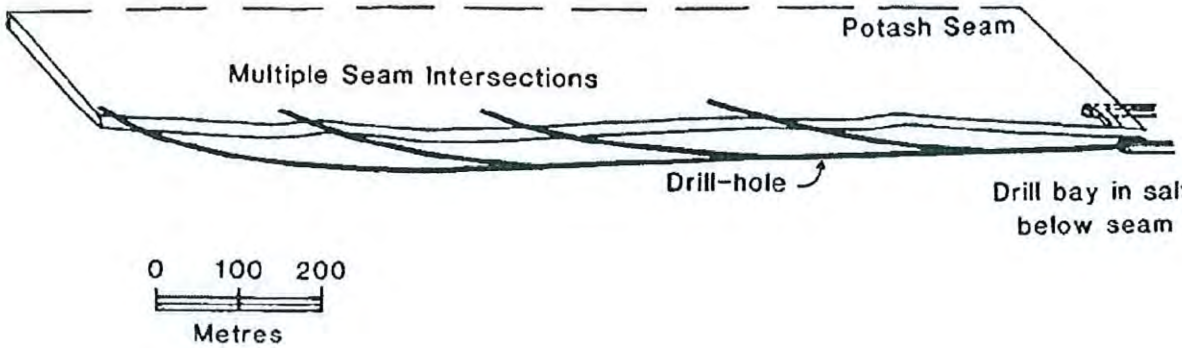
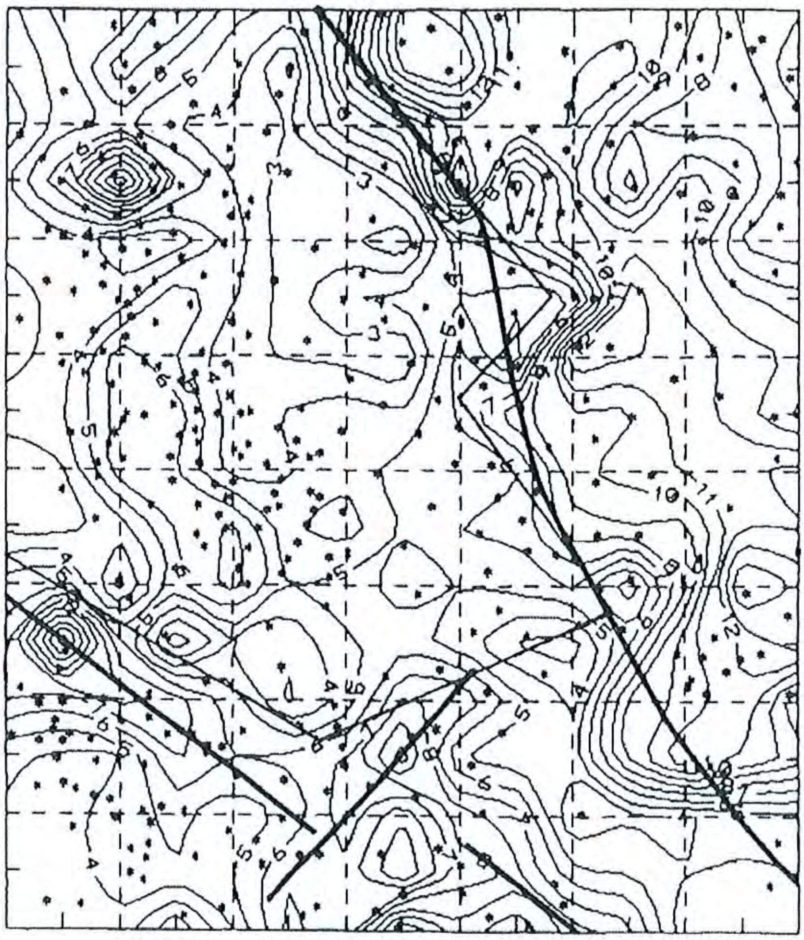
DRAWING TITLE - FIGURE 21

BOULBY POTASH EXPLORATION TARGET

SCALE	DATE
Approx 1:200,000	10/01/2011



IN-SEAM DRILLING WITH UPWARD ORIENTATED DEFLECTION FOR ADVANCE EXPLORATION OF THE BOULBY POTASH



BOULBY POTASH MINE: ISOPACH MAP OF VERTICAL THICKNESS (IN METRES) SHOWING LOCATION OF SEAM INTERSECTIONS, INTERPRETED FAULTS IN THE UNDERLYING UPPER MAGNESIAN LIMESTONE (THICK LINES). GRID DIMENSIONS 500 m X 500 m.

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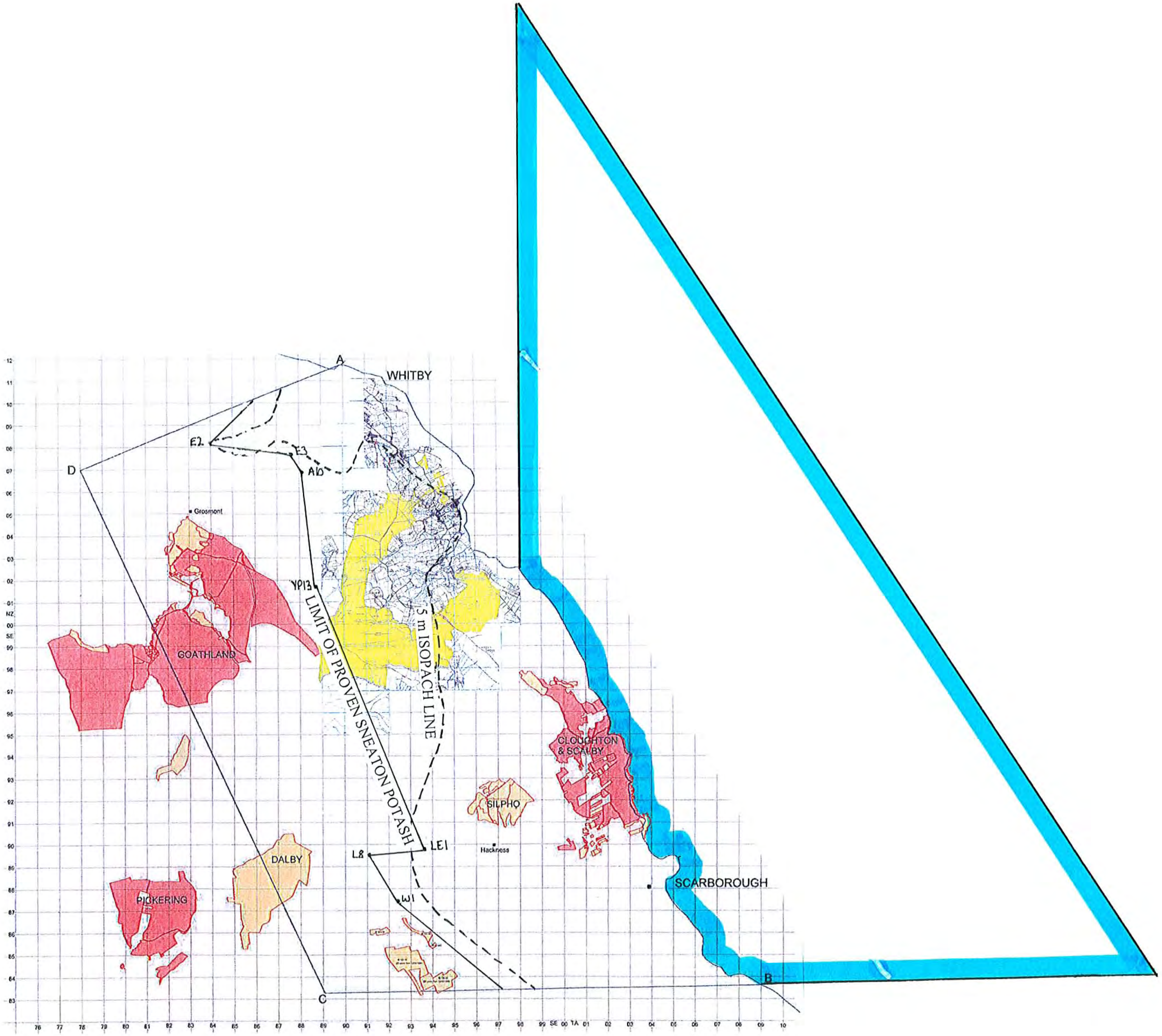
DRAWING TITLE - FIGURE 22

DETAIL OF UNDERGROUND DRILLING TECHNIQUE AND TYPICAL PATTERN OF SEAM INTERSECTIONS (ANNELS & INGRAM, 1992)

SCALE NA

DATE 10/01/2011



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DRAWING TITLE - FIGURE 23

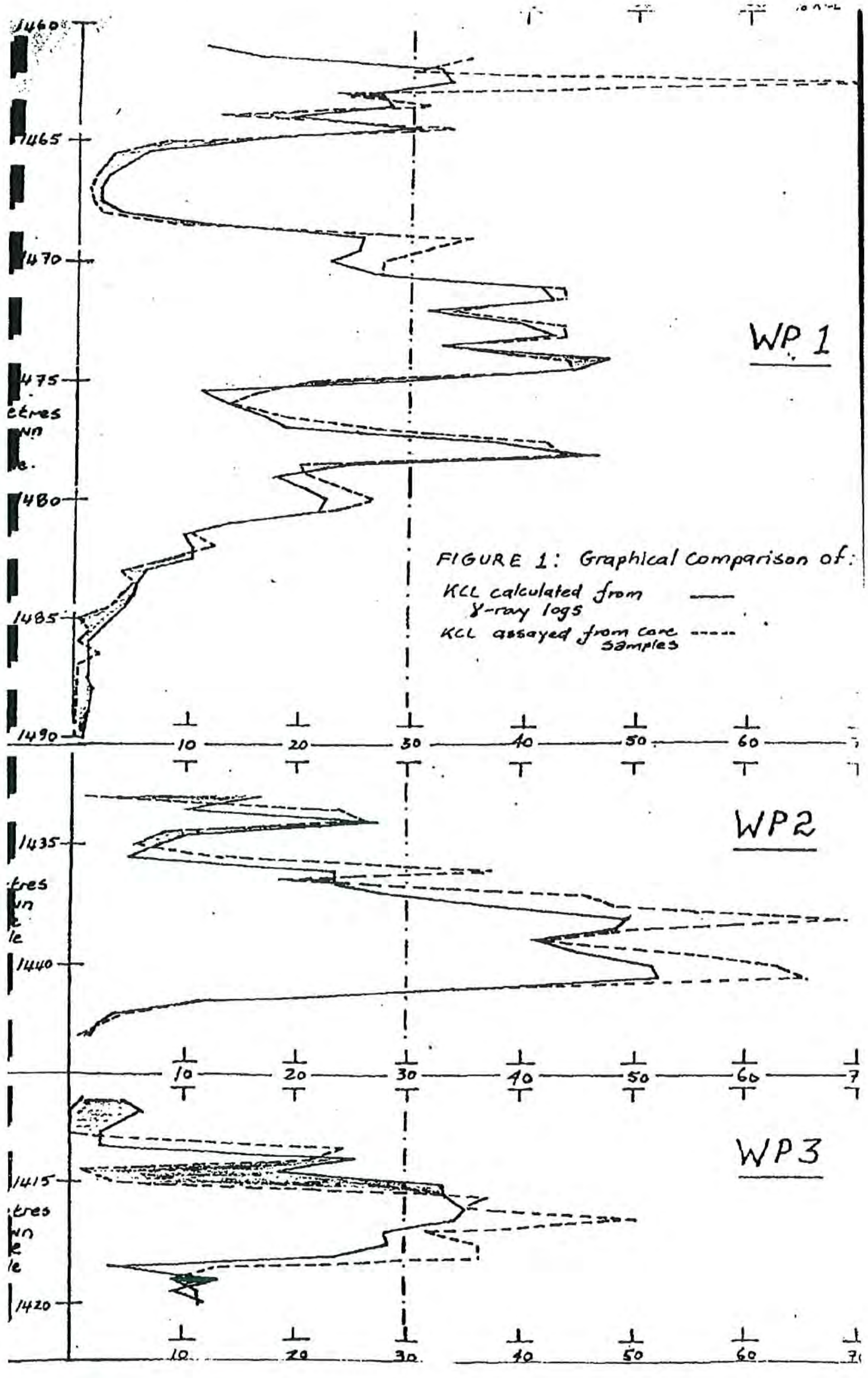
SNEATON POTASH EXPLORATION TARGET

SCALE

Approx 1:200,000

DATE

10/01/2011



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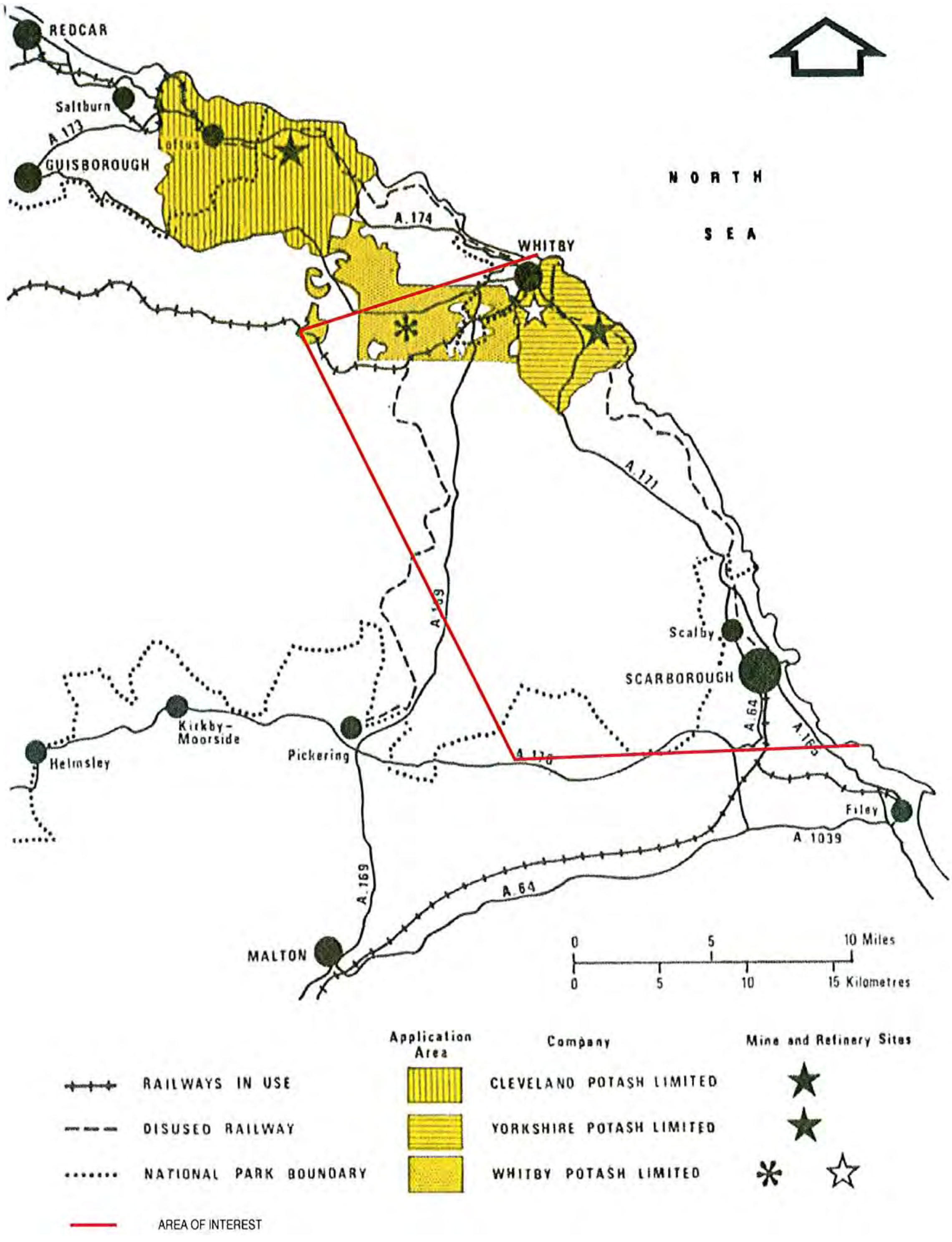
DRAWING TITLE - FIGURE 24

GRAPHICAL COMPARISON OF KCl CALCULATED FROM GAMMA RAY LOGS WITH KCl ASSAYS (STAGG, 1979)

SCALE
NA

DATE
10/01/2011



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DRAWING TITLE - FIGURE 25

POTASH LEASES AND PLANNING APPLICATION BOUNDARIES (STATHAM, 1971)

SCALE
NOT TO SCALE

DATE
10/01/2011

APPENDIX 1

BOREHOLE DATABASE

M/F		Well Number or name	Well Number or name on figures	Company	Date	Latitude	Longitude	Eastings	Northings	TD (data)	TD (m)
F	1	**A1**	A1	Armour Chemicals				482810	508275	4496.0	1370.4
M	2	**A2**	A2	Armour Chemicals	1962			485777	508180	1223.1	1223.1
M	3	**A3**	A3	Armour Chemicals	1962			488772	507851	1337.7	1337.7
M	4	**A4**	A4	Armour Chemicals	1962			481554	508567	1361.3	1361.3
M	5	**A5**	A5	Armour Chemicals	1962			483756	508619	1355.5	1355.5
F	8	**A8**	A8	Armour Chemicals	1963			482946	506950	4213.2	1284.2
M	9	**A9**	A9	Armour Chemicals	1963			484979	508799	1373.4	1373.4
M	10	**A10**	A10	Armour Chemicals				488186	506950	1282.6	1282.6
F	12	**A12**	A12	Armour Chemicals	1963			482888	509593	4576.0	1394.8
M	13	**A13**	A13	Armour Chemicals	1963			481497	507345	1366.9	1366.9
F	17	**A17**	A17	Armour Chemicals	1968			481601	509697	4235.2	1290.9
F		**A18**	A18	Whitby Potash	1968			483369	508370	4502.0	1372.2
M	19	**A19**	A19	Armour Chemicals	1968			481414	511714	1407.6	1407.6
F	20	**A20**	A20	Armour Chemicals	1968			478690	512272	4442.0	1353.9
F		**Cloughton A**	CA	Bow Valley Petroleum Ltd	1986			499391	496802	10100.0	3078.5
F		**Egton High Moor 1**	EHM1	BP	1969			477000	502793	5361.0	1634.0
F	2	**Eskdale 2**	E2	D'Arcy Exploration	1939			484441	508038	5040.0	1536.2
F	3	**Eskdale 3**	E3	ICI	1948			487723	507791		No Data
F	4	**Eskdale 4**	E4	ICI	1949			490405	507874		No Data
F	5	**Eskdale 5**	E5	ICI	1950			485929	506489		No Data
F	6	**Eskdale 6**	E6	ICI	1950			488006	511784		No Data
F	7	**Eskdale 7**	E7	ICI	1951			484550	510773		No Data
F		**Eskdale 8**	E8	ICI	1952			480670	507210	4403.0	1342.0
M	11	**Eskdale 11**	E11	BP	1957			485430	504300	1849.8	1849.8
F	12	**Eskdale 12**	E12	BP	1963			485850	508200	6145.0	1873.0
F		**Fordon 1**	FO1	BP Exploration Ltd	1956			506001.14	475677		No Data
F		**Fordon 2**	FO2	BP Development Ltd	1974			506890	473604	8020.0	2444.5
F		**Hunmanby 1**	H1	Burmah Oil	1973			513010	475880	7390.0	2252.5
M	2	**Lockton 2A**	L2A					490258	490140		No Data
F	3	**Lockton 3**	L3	Home Oil of Canada	1967			490890	492884	7244.0	2208.0
F	4	**Lockton 4**	L4		1967			486948	488913	6546.0	1995.2
F	5	**Lockton 5**	L5	Home Oil of Canada	1967			489318	491371	6205.0	1891.3
F	7	**Lockton 7**	L7	BP	1968			491730	490178	7004.0	2134.8
F	8	**Lockton 8**	L8	Home Oil	1971			491060	489590	6830.0	2081.8
M		**Lockton East No. 1**	LE1	Taylor Woodrow	1980			493711	489826	1898.5	1898.5
M		**Newton Mulgrave 1**	NM	Home Oil				477402	513656	2059.2	2059.2
F		**Robin Hoods Bay/Fison 1**	F1	BP and Fisons	1957			494790	504037		No Data
F	1	**S1**	S1	Home Oil	1965			476959	518507	4982.0	1518.5
F	3	**S3**	S3	ICI Ltd	1966			477802	517088	4089.0	1246.3
F	5	**S5**	S5	ICI Minerals	1968			472545	517809	3975.0	1211.6
F	6	**S6**	S6	ICI Minerals	1968			474435	517572	4116.0	1254.6
F	10	**S10**	S10	Cleveland Potash Ltd	1968			476096	515071	4347.0	1325.0
F	11	**S11**	S11	Cleveland Potash Ltd	1968			477746	515372	4000.0	1219.2
F	13	**S13**	S13	Cleveland Potash Ltd	1968			479877	517060	4037.0	1230.5
F	20	**S20**	S20	Cleveland Potash Ltd	1968			476034	518000	3947.0	1203.0
M		**Stoupe Beck 1**	SB1	Candecca Resources	1998			495360	503540	2025.0	2025.0
M	1	**WP1**	WP1	Whitby Potash Ltd	1977			480842	510102	1500.0	1500.0
M	2	**WP2**	WP2	Whitby Potash Ltd	1977			480500	511130	1500.0	1500.0
M	3	**WP3**	WP3	Whitby Potash Ltd				481630	510700		No Data
F		**Wykeham No 1**	W1	Home Oil of Canada	1971	54° 16' 30"	00° 35' 44"	492380	487344	6610.0	2014.7
F		**YP1**	YP1	Rio Tinto Zinc	1967			492255	508782	4429.0	1350.0
F		**YP2**	YP2	Rio Tinto Zinc	1968			493991	506366	4223.4	1287.3
F		**YP3**	YP3	Rio Tinto Zinc	1968			491810	506694	4166.0	1269.8
F		**YP4**	YP4	Rio Tinto Zinc	1970			492445	508013	4373.0	1332.9
F		**YP5**	YP5	Rio Tinto Zinc	1970			489566	506853	4219.5	1286.1
F		**YP6**	YP6	Yorkshire Potash	1970			489598	508940	4276.0	1303.3
F		**YP7**	YP7	Yorkshire Potash				494374	507370		No Data
F		**YP8**	YP8	Yorkshire Potash	1970			491540	507922	4651.3	1417.7
F		**YP 10**	YP 10	Yorkshire Potash	1970			492946	504716	4308.0	1313.1
F		**YP 10 DIVERSION**	YP 10	Yorkshire Potash	1970			492946	504716	4160.0	1268.0
F		**YP 11**	YP 11	Rio Tinto Zinc	1970			492540	501470	4650.0	1417.3
F		**YP12**	YP12	Yorkshire Potash	1971			496630	501310	4500.0	1371.6
F		**YP13**	YP13	Yorkshire Potash Ltd	1971			488716	501881		No Data
F		**YP14**	YP14	Gas Council	1971			500280	497029	5524.0	1683.7
F		**FISONS 4**	F4	Fisons	1951			497200	498500	4301.0	1310.9
M		**FISONS 2**	F2	Fisons				497350	498420	1345.7	1345.7
M		**FISONS 3**	F3	Fisons	1952			487410	504838	1327.4	1327.4
F		**41/14-1**	41/14-1	Conoco (UK) Ltd	1990			509265	522380	11360.0	3462.5
F		**41/18-1**	41/18-1	Total (A339/1-2)	1966			503157	500724	6774.0	2064.7
M		**41/24A-1**	41/24A-1	Total Oil Marine	1969			514786	491078	5843.0	1780.9
F		**41/24A-2**	41/24A-2	Total Oil Marine	1981			514979	490614	1680.0	1680.0
M		**41/25-A1**	41/25-A1	Total Oil Marine	1969			522061	489785	5810.0	1770.9

Well Number or name	Basal horizon	No. of casing strings thru' evaps.	Casing notes	Confidence	KBE/RTE (data)	KBE/RTE (m)
A1	EZ3	none		high	796	242.6
A2	EZ3	none		high	336.82	336.8
A3	EZ3	none		high	87.05	87.1
A4	EZ3			medium	208.33	208.3
A5	EZ3			high	261.05	261.1
A8	EZ3			high	444	135.3
A9	EZ3			high	222.22	222.2
A10	EZ3			high	126.72	126.7
A12	EZ3			high	668.56	203.8
A13	EZ3	none		high	199.9	199.9
A17	EZ3	none		high	543.04	165.5
A18					860.1	262.2
A19	EZ3	none		high	138.33	138.3
A20	EZ3	none		high	620.3	189.1
Cloughton A	Carboniferous			high	573	174.7
Egton High Moor 1	Carboniferous			low; only basic logs available	983.2	299.7
Eskdale 2	EZ2			medium (cores)	403	122.8
Eskdale 3				high (Raymond 1951 for cores)	43.6	13.3
Eskdale 4				high (Raymond 1951 for cores)	265.1	80.8
Eskdale 5				high (Raymond 1951 for cores)	224.1	68.3
Eskdale 6				high (Raymond 1951 for cores)	77.8	23.7
Eskdale 7				high (Raymond 1951 for cores)	505.9	154.2
Eskdale 8					623.5	190.0
Eskdale 11				low (reconstructed from notes)	146	146.0
Eskdale 12				low (taken from FWS summary notes)	345	105.2
Fordon 1	Carboniferous			high	429	130.8
Fordon 2	Carboniferous			high	222.1	67.7
Hunmanby 1	Carboniferous	one	4½ ins	medium	265	80.8
Lockton 2A				low	240.2	240.2
Lockton 3	carboniferous		cased to 4226'	high for depths; but logged through mud; gamma, neutron and sonic	402.5	122.7
Lockton 4				details from note attached to Lockton 3 log. BGS shows TD to be 2025.7 m		No Data
Lockton 5	EZ2			medium high (gamma, sonic, neutron logs	759.5	231.5
Lockton 7	Carboniferous	3		low	738.3	225.0
Lockton 8				medium	817.89	249.3
Lockton East No. 1				medium/high	83.27	83.3
Newton Mulgrave 1	Carboniferous			low, cutting log only; no wireline logs	217.93	217.9
Robin Hoods Bay/Fison 1	Carboniferous			medium	202.8	61.8
S1	Carboniferous	none		high	225.3	68.7
S3	EZ3	none		high	230	70.1
S5	EZ3	none		high	375.5	114.5
S6	EZ3	none		high	500	152.4
S10	EZ3	none		high	685.25	208.9
S11	EZ3	none		high	380	115.8
S13	EZ3	none		high	312.7	95.3
S20	FE	none		high	278	84.7
Stoupe Beck 1	Carboniferous	none			53.19	53.2
WP1	EZ3	none		high	174	174.0
WP2	EZ3	none		high	161	161.0
WP3	EZ3	none		high	148	148.0
Wykeham No 1	Carboniferous		cased to 968'	medium to high	728.0	221.9
YP1					229.57	70.0
YP2					562.46	171.4
YP3					423.7	129.1
YP4					360.54	109.9
YP5					491.62	149.8
YP6					166.23	50.7
YP7					436.07	132.9
YP8					284.8	86.8
YP 10	Ca3		cased to 652' diameter 8.5" diesel based mud			
YP 10 DIVERSION	Na3		Borehole starts at 3660 ', 8.5" diameter, no info on hole survey or verticality thru' evaporites			
YP 11	A3		wireline log only (core/bh log is "confidential")			
YP12					890	271.3
YP13				high YPL core log and assay	696	212.1
YP14				medium (old FWS notes)	448.67	136.8
FISONS 4					348	106.1
FISONS 2						No Data
FISONS 3						No Data
41/14-1	Carboniferous			low-medium	113.0	34.4
41/18-1	Carboniferous		original log acquired + interpreted; (but no density log) May 2010		103.0	31.4
41/24A-1	Carboniferous			low for minerals; gamma very faint; no neutron for K4/3; log scale error on gamma?	109.0	33.2
41/24A-2	Carboniferous			depths - high; minerals - low (K3)	35.0	35.0
41/25-A1	Carboniferous			depths - high; beds - low	113.0	34.4

Well Number or name	Top Anhydrite (A5)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1		4156	1266.7	1024.1	4158	1267.4	1024.7	0.6	
A2		1139.34	1139.3	802.5	1140.56	1140.6	803.7	1.2	
A3		1210.06	1210.1	1123.0	1211.27	1211.3	1124.2	1.2	
A4		1250.59	1250.6	1042.3	1251.51	1251.5	1043.2	0.9	
A5		1250.9	1250.9	989.9	1252.12	1252.1	991.1	1.2	
A8		3836	1169.2	1033.9	3838	1169.8	1034.5	0.6	
A9		1265.22	1265.2	1043.0	1266.14	1266.1	1043.9	0.9	
A10		1173.5	1173.5	1046.8	1174.39	1174.4	1047.7	0.9	
A12		4152	1265.5	1061.8	4154	1266.1	1062.4	0.6	
A13		1253.34	1253.3	1053.4	1254.25	1254.3	1054.4	0.9	
A17			No Data	No Data		No Data	No Data	No Data	faulted out
A18			No Data	No Data		No Data	No Data	No Data	
A19		1336.85	1336.9	1198.5	1338.07	1338.1	1199.7	1.2	
A20		4212	1283.8	1094.8	4214	1284.4	1095.4	0.6	
Cloughton A		4151	1265.2	1090.6	4155	1266.4	1091.8	1.2	
Egton High Moor 1		3680	1121.7	822.0	3688	1124.1	824.4	2.4	
Eskdale 2			No Data	No Data		No Data	No Data	No Data	no info.
Eskdale 3		3602	1097.9	1084.6	3605	1098.8	1085.5	0.9	
Eskdale 4			No Data	No Data		No Data	No Data	No Data	no info
Eskdale 5			No Data	No Data		No Data	No Data	No Data	no info
Eskdale 6			No Data	No Data		No Data	No Data	No Data	no info
Eskdale 7			No Data	No Data		No Data	No Data	No Data	no info
Eskdale 8			No Data	No Data		No Data	No Data	No Data	
Eskdale 11		1221.95	1222.0	1076.0	1224.99	1225.0	1079.0	3.0	
Eskdale 12		3765	1147.6	1042.4	3768	1148.5	1043.3	0.9	
Fordon 1			No Data	No Data		No Data	No Data	0.0	absent
Fordon 2		5000	1524.0	1456.3	5002	1524.6	1456.9	0.6	
Hunmanby 1		4949	1508.5	1427.7	4954	1510.0	1429.2	1.5	
Lockton 2A		1514.0	1514.0	1273.8	1515.0	1515.0	1274.8	1.0	
Lockton 3		4498	1371.0	1248.3	4502	1372.2	1249.5	1.2	
Lockton 4			No Data	No Data		No Data	No Data	No Data	
Lockton 5		4964	1513.0	1281.5	4966	1513.6	1282.1	0.6	
Lockton 7		4952	1509.4	1284.3	4956	1510.6	1285.6	1.2	
Lockton 8		4955	1510.3	1261.0	4960	1511.8	1262.5	1.5	
Lockton East No. 1		1343	1343.0	1259.7	1344	1344.0	1260.7	1.0	
Newton Mulgrave 1		1237.18	1237.2	1019.3	1238.18	1238.2	1020.3	1.0	approximate
Robin Hoods Bay/Fison 1			No Data	No Data		No Data	No Data	No Data	
S1		3345	1019.6	950.9	3347	1020.2	951.5	0.6	
S3		3568	1087.5	1017.4	3571	1088.4	1018.3	0.9	
S5		3662	1116.2	1001.7	3664	1116.8	1002.3	0.6	
S6		3713	1131.7	979.3	3716	1132.6	980.2	0.9	
S10		3980	1213.1	1004.2	3982	1213.7	1004.8	0.6	
S11		3678	1121.1	1005.2	3681	1122.0	1006.1	0.9	
S13		3648	1111.9	1016.6	3650	1112.5	1017.2	0.6	
S20		3431	1045.8	961.0	3434	1046.7	961.9	0.9	
Stoupe Beck 1		973	973.0	919.8	973.8	973.8	920.6	0.8	
WP1		1335.6	1335.6	1161.6	1336.4	1336.4	1162.4	0.8	
WP2		1381.6	1381.6	1220.6	1382.4	1382.4	1221.4	0.8	
WP3		1348.9	1348.9	1200.9	1349.8	1349.8	1201.8	0.9	
Wykeham No 1		4807.0	1465.2	1243.3	4810.0	1466.1	1244.2	0.9	
YP1			No Data	No Data		No Data	No Data	No Data	
YP2		3899.5	1188.6	1017.1	3901.5	1189.2	1017.7	0.6	
YP3			No Data	No Data		No Data	No Data	No Data	
YP4			No Data	No Data		No Data	No Data	No Data	
YP5			No Data	No Data		No Data	No Data	No Data	
YP6			No Data	No Data		No Data	No Data	No Data	
YP7			No Data	No Data	3928.6	1197.4	1064.5		
YP8			No Data	No Data		No Data	No Data	No Data	
YP 10		3894	1186.9	1186.9	3896	1187.5	1187.5	0.6	
YP 10 DIVERSION		3881	1182.9	1182.9	3884	1183.8	1183.8	0.9	
YP 11		4274	1302.7	1302.7	4276	1303.3	1303.3	0.6	
YP12			No Data	No Data		No Data	No Data	No Data	
YP13			No Data	No Data		No Data	No Data	No Data	
YP14		4164	1269.2	1132.4	4168	1270.4	1133.7	1.2	
FISONS 4		3945.75	1202.7	1096.6	3947.42	1203.2	1097.1	0.5	
FISONS 2			No Data	No Data		No Data	No Data	No Data	
FISONS 3			No Data	No Data		No Data	No Data	No Data	
41/14-1		4222.0	1286.9	1252.4	4232.0	1289.9	1255.5	3.0	
41/18-1		3227.0	983.6	952.2	3230	984.5	953.1	0.9	
41/24A-1		3288.0	1002.2	969.0	3291.0	1003.1	969.9	0.9	
41/24A-2		1021.0	1021.0	986.0	1022.0	1022.0	987.0	1.0	
41/25-A1		3592.0	1094.8	1060.4	3595.0	1095.8	1061.3	0.9	

Well Number or name	Sneaton Halite (Na4)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1		4165	1269.5	1026.9	4313	1314.6	1072.0	45.1	some low gamma spikes towards top Max. 60 API
A2		1143	1143.0	806.2	1173.3	1173.3	836.5	30.3	
A3		1214.02	1214.0	1127.0	1282.6	1282.6	1195.6	68.6	
A4		1254.25	1254.3	1045.9	1292.35	1292.4	1084.0	38.1	No K?
A5		1253.95	1254.0	992.9	1300.25	1300.3	1039.2	46.3	(K trace only @ 1263?)
A8		3845	1172.0	1036.6	3960	1207.0	1071.7	35.1	no K
A9		1269.49	1269.5	1047.3	1322.83	1322.8	1100.6	53.3	no K
A10		1177.14	1177.1	1050.4	1221.64	1221.6	1094.9	44.5	
A12		4162	1268.6	1064.8	4357	1328.0	1124.2	59.4	K traces only
A13		1256.38	1256.4	1056.5	1284.73	1284.7	1084.8	28.3	No K (tr. Sylv. @ 1270)
A17			No Data	No Data		No Data	No Data	No Data	faulted out
A18			No Data	No Data	4315	1315.2	1053.1		
A19		1340.51	1340.5	1202.2	1381.05	1381.1	1242.7	40.5	(trs sylv. & car. 1362-1368 m not showing on gamma log)
A20		4225	1287.8	1098.7	4332	1320.4	1131.3	32.6	K tr. peak @ 1305 m only
Cloughton A		4160	1268.0	1093.3	4228	1288.7	1114.0	20.7	
Egton High Moor 1		3700	1127.8	828.1	3800	1158.2	858.6	30.5	
Eskdale 2		3655	1114.0	991.2	3840	1170.4	1047.6	56.4	
Eskdale 3		3614	1101.5	1088.3	3743	1140.9	1127.6	39.3	
Eskdale 4		4031	1228.6	1147.8	4145	1263.4	1182.6	34.7	
Eskdale 5		3664	1116.8	1048.5	3805	1159.8	1091.5	43.0	
Eskdale 6		3778	1151.5	1127.8	3958	1206.4	1182.7	54.9	
Eskdale 7		4117	1254.9	1100.7	4254	1296.6	1142.4	41.8	
Eskdale 8		4089	1246.3	1056.3	4170	1271.0	1081.0	24.7	
Eskdale 11		1224.99	1225.0	1079.0	1264.31	1264.3	1118.3	39.3	? No K
Eskdale 12		3768	1148.5	1043.3	3860	1176.5	1071.4	28.0	
Fordon 1		5268	1605.7	1474.9	5400	1645.9	1515.2	40.2	
Fordon 2		5010	1527.0	1459.4	5159	1572.5	1504.8	45.4	
Hunmanby 1		4962	1512.4	1431.6	5108	1556.9	1476.1	44.5	
Lockton 2A		1518.0	1518.0	1277.8	1541.5	1541.5	1301.3	23.5	
Lockton 3		4510	1374.6	1252.0	4652	1417.9	1295.2	43.3	
Lockton 4			No Data	No Data		No Data	No Data	No Data	
Lockton 5		4974	1516.1	1284.6	5116	1559.4	1327.9	43.3	
Lockton 7		4966	1513.6	1288.6	5034	1534.4	1309.3	20.7	
Lockton 8		4970	1514.9	1265.6	5130	1563.6	1314.3	48.8	
Lockton East No. 1		1347	1347.0	1263.7	1385	1385.0	1301.7	38.0	
Newton Mulgrave 1		1241.15	1241.2	1023.2	1269.5	1269.5	1051.6	28.3	no K salts
Robin Hoods Bay/Fison 1		3205	976.9	915.1	3351	1021.4	959.6	44.5	trace sylvite at base
S1		3368	1026.6	957.9	3507	1068.9	1000.3	42.4	
S3		3595	1095.8	1025.7	3720	1133.9	1063.8	38.1	
S5		3679	1121.4	1006.9	3765	1147.6	1033.1	26.2	
S6		3738	1139.3	986.9	3842	1171.0	1018.6	31.7	
S10		3999	1218.9	1010.0	4104	1250.9	1042.0	32.0	
S11		3695	1126.2	1010.4	3790	1155.2	1039.4	29.0	
S13		3674	1119.8	1024.5	3753	1143.9	1048.6	24.1	
S20		3452	1052.2	967.4	3550	1082.0	997.3	29.9	
Stoupe Beck 1		976.6	976.6	923.4	1024.4	1024.4	971.2	47.8	
WP1		1338	1338.0	1164.0	1414.5	1414.5	1240.5	76.5	no K
WP2		1384.4	1384.4	1223.4	1413.6	1413.6	1252.6	29.2	no K
WP3		1352.4	1352.4	1204.4	1388	1388.0	1240.0	35.6	no K
Wykeham No 1		4814.0	1467.3	1245.4	4930.0	1502.7	1280.8	35.4	
YP1			No Data	No Data		No Data	No Data	No Data	
YP2		3908.9	1191.4	1020.0	4050.9	1234.7	1063.3	43.3	
YP3			No Data	No Data	4008.8	1221.9	1092.7		
YP4		4135.4	1260.5	1150.6	4260	1298.4	1188.6	38.0	
YP5			No Data	No Data	4064.8	1239.0	1089.1		
YP6			No Data	No Data	4239.9	1292.3	1241.7		
YP7		3935.5	1199.5	1066.6	4084.1	1244.8	1111.9	45.3	
YP8		4075	1242.1	1155.3	4223	1287.2	1200.4	45.1	
YP 10		3903	1189.6	1189.6	4041	1231.7	1231.7	42.1	
YP 10 DIVERSION		3892	1186.3	1186.3	4022	1225.9	1225.9	39.6	
YP 11		4282	1305.2	1305.2	4406	1342.9	1342.9	37.8	
YP12		4075	1242.1	970.8	4213	1284.1	1012.9	42.1	
YP13			No Data	No Data	4555.4	1388.5	1176.3	#VALUE!	
YP14		4175	1272.5	1135.8	4290	1307.6	1170.8	35.1	
FISONS 4		3976.66	1212.1	1106.0	4079	1243.3	1137.2	31.2	
FISONS 2			No Data	No Data		No Data	No Data	40.5	
FISONS 3			No Data	No Data		No Data	No Data	43.9	
41/14-1		4232.0	1289.9	1255.5	4419.0	1346.9	1312.5	57.0	
41/18-1		3240.0	987.6	956.2	3404	1037.5	1006.1	50.0	
41/24A-1		3298.0	3298.0	3264.8	3483.0	1061.6	1028.4	56.4	
41/24A-2		1024.5	1024.5	989.5	1073.5	1073.5	1038.5	49.0	
41/25-A1		3600.0	1097.3	1062.8	3835.0	1168.9	1134.5	71.6	

Well Number or name	Sneaton Potash (K4)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1			No Data	No Data		No Data	No Data	0.0	absent
A2		1162.05	1162.1	825.2	1173.3	1173.3	836.5	11.3	sylv. (1 m @ 20% KCl)
A3		1237.18	1237.2	1150.1	1245.11	1245.1	1158.1	7.9	6.9 m @ 29% KCl, sylvinite
A4			No Data	No Data		No Data	No Data	0.0	absent
A5			No Data	No Data		No Data	No Data	0.0	trace at 1263
A8			No Data	No Data		No Data	No Data	0.0	absent
A9			No Data	No Data		No Data	No Data	0.0	absent
A10		1200	1200.0	1073.3	1204.87	1204.9	1078.2	4.9	sylv. Interbedded with halite
A12			No Data	No Data		No Data	No Data	0.0	traces only
A13			No Data	No Data		No Data	No Data	0.0	trace at 1270 metres
A17			No Data	No Data		No Data	No Data	No Data	faulted out
A18			No Data	No Data		No Data	No Data	No Data	
A19			No Data	No Data		No Data	No Data	0.0	absent
A20			No Data	No Data		No Data	No Data	0.0	notes tr @ 1305
Cloughton A		4228	1288.7	1114.0	4263	1299.4	1124.7	10.7	150-200 API gamma; cockscomb; med/hi grade sylvite. Inc 3m halite band
Egton High Moor 1			No Data	No Data		No Data	No Data	0.0	not recorded - absent on gamma log
Eskdale 2		3800	1158.2	1035.4	3826	1166.2	1043.3	7.9	spot assays of 3.22 and 6.66% KCl
Eskdale 3		3675	1120.1	1106.9	3697	1126.8	1113.6	6.7	sylvite: 6.7 m @ 16% KCl
Eskdale 4		4081	1243.9	1163.1	4095	1248.2	1167.4	4.3	sylvite: 4.3 m @ 10% KCl
Eskdale 5			No Data	No Data		No Data	No Data	0.0	absent
Eskdale 6		3867	1178.7	1154.9	3895	1187.2	1163.5	8.5	sylvite: 8.5 m @ 20% KCl
Eskdale 7			No Data	No Data		No Data	No Data	0.0	absent
Eskdale 8		4168.2	1270.5	1080.4	4170	1271.0	1081.0	0.5	No significant Potash
Eskdale 11			No Data	No Data		No Data	No Data	0.0	not recorded
Eskdale 12		3826	1166.2	1061.0	3839	1170.1	1065.0	4.0	recorded as sylvinite
Fordon 1		5321	1621.8	1491.1	5344	1628.9	1498.1	7.0	25% K2O over 7.0 m; sylvite
Fordon 2		5068	1544.7	1477.0	5108	1556.9	1489.2	12.2	gamma up to 240 API; sylvite
Hunmanby 1		4978	1517.3	1436.5	5063	1543.2	1462.4	25.9	?banded sylvinite ?low gr. w trace carn. at top
Lockton 2A			No Data	No Data		No Data	No Data	0.0	absent
Lockton 3			No Data	No Data		No Data	No Data	0.0	absent
Lockton 4			No Data	No Data		No Data	No Data	No Data	
Lockton 5		5048	1538.6	1307.1	5062	1542.9	1311.4	4.3	80-90 API sylvite
Lockton 7			No Data	No Data		No Data	No Data	0.0	absent
Lockton 8		5050	1539.2	1289.9	5088	1550.8	1301.5	11.6	low grade. API max 80
Lockton East No. 1		1366	1366.0	1282.7	1373	1373.0	1289.7	7.0	sylvite, low/medium grade?; API max 220
Newton Mulgrave 1			No Data	No Data		No Data	No Data	0.0	absent
Robin Hoods Bay/Fison 1			No Data	No Data	3282	1000.4	938.5	0.0	absent (marly)
S1			No Data	No Data		No Data	No Data	0.0	absent
S3			No Data	No Data		No Data	No Data	0.0	absent
S5			No Data	No Data		No Data	No Data	0.0	absent
S6			No Data	No Data		No Data	No Data	0.0	absent
S10			No Data	No Data		No Data	No Data	0.0	absent
S11			No Data	No Data		No Data	No Data	0.0	absent
S13			No Data	No Data		No Data	No Data	0.0	absent
S20			No Data	No Data		No Data	No Data	0.0	absent
Stoupe Beck 1		994	994.0	940.8	1004	1004.0	950.8	10.0	gamma 424, three peaks, hi. grade sylv.
WP1			No Data	No Data		No Data	No Data	0.0	absent
WP2			No Data	No Data		No Data	No Data	0.0	absent
WP3			No Data	No Data		No Data	No Data	0.0	absent
Wykeham No 1		4876.0	1486.2	1264.3	4889.0	1490.2	1268.3	4.0	low-medium grade sylvite [N.B. thin lo gr K (or shale) from 1417.6 - 1474.6
YP1			No Data	No Data		No Data	No Data	No Data	
YP2		3984.4	1214.4	1043.0	4010.2	1222.3	1050.9	7.9	1.6m high grade sylvinite above 6.2m v. low grade
YP3			No Data	No Data		No Data	No Data	No Data	
YP4		4180.66	1274.3	1164.4	4204.6	1281.6	1171.7	7.3	including 3.5m of halite/ms bands
YP5		3997.1	1218.3	1068.5	4015.2	1223.8	1074.0	5.5	5.5 m of low grade sylv and halite (w. mst)
YP6		4193	1278.0	1227.4	4204.1	1281.4	1230.7	3.4	3.4m low grade
YP7		3996.75	1218.2	1085.3	4023.66	1226.4	1093.5	8.2	?medium grade overall (banded with halite and mudstone)
YP8		4128	1258.2	1171.4	4144.6	1263.3	1176.5	5.1	low grade sylvite, max. 25% K20
YP 10		3985	1214.6	1214.6	3988	1215.5	1215.5	0.9	(very low grade - maybe mudstone)
YP 10 DIVERSION		3974	1211.3	1211.3	3976.5	1212.0	1212.0	0.8	low grade (540cps)
YP 11		4344	1324.1	1324.1	4352	1326.5	1326.5	2.4	595 cps; lower (?) sylvite horizon 4396-4406'
YP12		4127	1257.9	986.6	4161	1268.3	997.0	10.4	low grade sylvite; 5 to 15% K20 to 1260; then interbedded with halite and mudstone
YP13		4499.6	1371.5	1159.3	4505.4	1373.2	1161.1	1.8	584' as 14.1% K2O Sylvinite, with mudstone and halite
YP14		4195	1278.6	1141.9	4260	1298.4	1161.7	19.8	recorded as sylvite
FISONS 4		4008.5	1221.8	1115.7	4038.75	1231.0	1124.9	9.2	
FISONS 2			No Data	No Data		No Data	No Data	8.2	
FISONS 3			No Data	No Data		No Data	No Data	No Data	
41/14-1		4322.0	1317.3	1282.9	4344.0	1324.1	1289.6	6.7	gamma 60 API (max 85), cockscomb, ?lo.gr. sylv.
41/18-1		3313.0	1009.8	978.4	3355	1022.6	991.2	12.8	medium grade sylvinite in two shaly bands (max 200 API units) separated by 14' of salt
41/24A-1		3364.0	1025.3	992.1	3405.0	1037.8	1004.6	12.5	very faint gamma log; but cockscomb trace ?sylv.
41/24A-2		1039.0	1039.0	1004.0	1058.5	1058.5	1023.5	19.5	gamma 90-120, cockscomb, low gr. sylvinite?
41/25-A1		3683.0	1122.6	1088.1	3770.0	1149.1	1114.7	26.5	low grade sylvinite with three peaks gamma 164-182 API; cockscomb

Well Number or name	Sherburn Anhydrite (A4)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1		4313	1314.6	1072.0	4333	1320.7	1078.1	6.1	
A2		1173.3	1173.3	836.5	1178.51	1178.5	841.7	5.2	
A3		1282.6	1282.6	1195.6	1295.2	1295.2	1208.2	12.6	
A4			No Data	No Data		No Data	No Data	0.0	absent? log unusable
A5		1300.25	1300.3	1039.2	1308.81	1308.8	1047.8	8.6	
A8		3960	1207.0	1071.7	3994	1217.4	1082.0	10.4	from G Riddler notes
A9		1322.83	1322.8	1100.6	1327.25	1327.3	1105.0	4.4	
A10		1221.64	1221.6	1094.9	1230.01	1230.0	1103.3	8.4	
A12		4357	1328.0	1124.2	4394	1339.3	1135.5	11.3	
A13		1284.73	1284.7	1084.8	1290.83	1290.8	1090.9	6.1	
A17		4016	1224.1	1058.6	4042	1232.0	1066.5	7.9	
A18		4315	1315.2	1053.1	4335.3	1321.4	1059.2	6.2	
A19		1381.05	1381.1	1242.7	1384.4	1384.4	1246.1	3.4	
A20		4332	1320.4	1131.3	4345	1324.4	1135.3	4.0	
Cloughton A		4263	1299.4	1124.7	4316	1315.5	1140.9	16.2	
Egton High Moor 1		3800	1158.2	858.6	3821	1164.6	865.0	6.4	
Eskdale 2		3840	1170.4	1047.6	3860	1176.5	1053.7	6.1	
Eskdale 3		3743	1140.9	1127.6	3769	1148.8	1135.5	7.9	
Eskdale 4		4145	1263.4	1182.6	4173	1271.9	1191.1	8.5	
Eskdale 5		3805	1159.8	1091.5	3827	1166.5	1098.2	6.7	
Eskdale 6		3958	1206.4	1182.7	3984	1214.3	1190.6	7.9	
Eskdale 7		4254	1296.6	1142.4	4271	1301.8	1147.6	5.2	
Eskdale 8		4170	1271.0	1081.0	4202	1280.8	1090.7	9.8	
Eskdale 11		1264.31	1264.3	1118.3	1283.52	1283.5	1137.5	19.2	
Eskdale 12		3860	1176.5	1071.4	3870	1179.6	1074.4	3.0	
Fordon 1		5400	1645.9	1515.2	5425	1653.5	1522.8	7.6	
Fordon 2		5159	1572.5	1504.8	5183	1579.8	1512.1	7.3	
Hunmanby 1		5108	1556.9	1476.1	5135	1565.1	1484.4	8.2	
Lockton 2A			No Data	No Data		No Data	No Data	0.0	absent
Lockton 3		4652	1417.9	1295.2	4879	1487.1	1364.4	69.2	
Lockton 4			No Data	No Data		No Data	No Data	No Data	
Lockton 5			No Data	No Data		No Data	No Data	No Data	
Lockton 7			No Data	No Data		No Data	No Data	0.0	absent
Lockton 8		5130	1563.6	1314.3	5150	1569.7	1320.4	6.1	
Lockton East No. 1		1385	1385.0	1301.7	1391	1391.0	1307.7	6.0	
Newton Mulgrave 1		1269.5	1269.5	1051.6	1277.1	1277.1	1059.2	7.6	
Robin Hoods Bay/Fison 1		3351	1021.4	959.6	3379	1029.9	968.1	8.5	trace sylvite veins
S1		3507	1068.9	1000.3	3538	1078.4	1009.7	9.4	
S3		3720	1133.9	1063.8	3752	1143.6	1073.5	9.8	
S5		3765	1147.6	1033.1	3786	1154.0	1039.5	6.4	
S6		3842	1171.0	1018.6	3874	1180.8	1028.4	9.8	
S10		4104	1250.9	1042.0	4128	1258.2	1049.4	7.3	
S11		3790	1155.2	1039.4	3818	1163.7	1047.9	8.5	
S13		3753	1143.9	1048.6	3772	1149.7	1054.4	5.8	
S20		3550	1082.0	997.3	3578	1090.6	1005.8	8.5	
Stoupe Beck 1		1024.4	1024.4	971.2	1033.2	1033.2	980.0	8.8	
WP1		1414.5	1414.5	1240.5	1436.1	1436.1	1262.1	21.6	
WP2		1413.6	1413.6	1252.6	1419.4	1419.4	1258.4	5.8	
WP3		1388	1388.0	1240.0	1394	1394.0	1246.0	6.0	
Wykeham No 1		4930.0	1502.7	1280.8	4950.0	1508.8	1286.9	6.1	
YP1		4292	1308.2	1238.2	4311.8	1314.2	1244.3	6.0	
YP2		4050.9	1234.7	1063.3	4077	1242.7	1071.2	8.0	
YP3		4008.8	1221.9	1092.7	4041.4	1231.8	1102.7	9.9	Faulted
YP4		4260	1298.4	1188.6	4289.5	1307.4	1197.5	9.0	
YP5		4064.8	1239.0	1089.1	4093.66	1247.7	1097.9	8.8	
YP6		4239.9	1292.3	1241.7	4255.4	1297.0	1246.4	4.7	
YP7		4084.1	1244.8	1111.9	4111.4	1253.2	1120.2	8.3	
YP8		4223	1287.2	1200.4	4250	1295.4	1208.6	8.2	
YP 10		4041	1231.7	1231.7	4069	1240.2	1240.2	8.5	
YP 10 DIVERSION		4022	1225.9	1225.9	4056	1236.3	1236.3	10.4	
YP 11		4406	1342.9	1342.9	4425	1348.7	1348.7	5.8	
YP12		4213	1284.1	1012.9	4241	1292.7	1021.4	8.5	
YP13		4555.4	1388.5	1176.3	4580.3	1396.1	1183.9	7.6	
YP14		4290	1307.6	1170.8	4317	1315.8	1179.1	8.2	
FISONS 4		4079	1243.3	1137.2	4109.16	1252.5	1146.4	9.2	
FISONS 2			No Data	No Data		No Data	No Data	9.3	
FISONS 3			No Data	No Data		No Data	No Data	7.8	
41/14-1		4419.0	1346.9	1312.5	4447.0	1355.4	1321.0	8.5	
41/18-1		3404.0	1037.5	1006.1	3430	1045.5	1014.1	7.9	
41/24A-1		3483.0	1061.6	1028.4	3508.0	1069.2	1036.0	7.6	
41/24A-2		1073.5	1073.5	1038.5	1080.0	1080.0	1045.0	6.5	
41/25-A1		3770.0	1149.1	1114.7	3863.0	1177.4	1143.0	28.3	

Well Number or name	Carnallitic Marl (CM)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1		4333	1320.7	1078.1	4377	1334.1	1091.5	13.4	
A2		1178.51	1178.5	841.7	1183.72	1183.7	846.9	5.2	
A3		1295.2	1295.2	1208.2	1325.6	1325.6	1238.6	30.4	
A4		1292.35	1292.4	1084.0	1301.8	1301.8	1093.5	9.5	
A5		1308.81	1308.8	1047.8	1319.78	1319.8	1058.7	11.0	
A8		3994	1217.4	1082.0	4034	1229.6	1094.2	12.2	
A9		1327.25	1327.3	1105.0	1349.78	1349.8	1127.6	22.5	
A10		1230.01	1230.0	1103.3	1244.37	1244.4	1117.7	14.4	
A12		4394	1339.3	1135.5	4478	1364.9	1161.1	25.6	
A13		1290.83	1290.8	1090.9	1301.06	1301.1	1101.2	10.2	
A17		4042	1232.0	1066.5	4079	1243.3	1077.8	11.3	
A18		4335.3	1321.4	1059.2	4404.9	1342.6	1080.5	21.2	
A19		1384.4	1384.4	1246.1	1388.64	1388.6	1250.3	4.2	
A20		4345	1324.4	1135.3	4374	1333.2	1144.1	8.8	
Cloughton A		4316	1315.5	1140.9	4400	1341.1	1166.5	25.6	marl throughout
Egton High Moor 1		3821	1164.6	865.0	3863	1177.4	877.8	12.8	
Eskdale 2		3860	1176.5	1053.7	3910	1191.8	1068.9	15.2	
Eskdale 3		3769	1148.8	1135.5	3817	1163.4	1150.1	14.6	
Eskdale 4		4173	1271.9	1191.1	4213	1284.1	1203.3	12.2	
Eskdale 5		3827	1166.5	1098.2	3873	1180.5	1112.2	14.0	
Eskdale 6		3984	1214.3	1190.6	4039	1231.1	1207.4	16.8	
Eskdale 7		4271	1301.8	1147.6	4317	1315.8	1161.6	14.0	
Eskdale 8		4202	1280.8	1090.7	4240.8	1292.6	1102.6	11.8	
Eskdale 11		1283.52	1283.5	1137.5	1288.09	1288.1	1142.1	4.6	
Eskdale 12		3870	1179.6	1074.4	3911	1192.1	1086.9	12.5	
Fordon 1		5425	1653.5	1522.8	5501	1676.7	1545.9	23.2	
Fordon 2		5183	1579.8	1512.1	5305	1617.0	1549.3	37.2	consistent log traces, marl throughout
Hunmanby 1		5135	1565.1	1484.4	5242	1597.8	1517.0	32.6	
Lockton 2A		1541.5	1541.5	1301.3	1550.0	1550.0	1309.8	8.5	
Lockton 3		4679	1426.2	1303.5	4738	1444.1	1321.5	18.0	
Lockton 4		5060	1542.3	#VALUE!	5134	1564.8	#VALUE!	#VALUE!	
Lockton 5		5140	1566.7	1335.2	5231	1594.4	1362.9	27.7	base from neutron log
Lockton 7		5034	1534.4	1309.3	5079	1548.1	1323.0	13.7	
Lockton 8		5150	1569.7	1320.4	5240	1597.2	1347.9	27.4	
Lockton East No. 1		1391	1391.0	1307.7	1412	1412.0	1328.7	21.0	
Newton Mulgrave 1		1277.1	1277.1	1059.2	1287.5	1287.5	1069.6	10.4	
Robin Hoods Bay/Fison 1		3379	1029.9	968.1	3442	1049.1	987.3	19.2	carn and rinn veins
S1		3538	1078.4	1009.7	3588	1093.6	1025.0	15.2	
S3		3752	1143.6	1073.5	3823	1165.3	1095.1	21.6	
S5		3786	1154.0	1039.5	3810	1161.3	1046.8	7.3	
S6		3874	1180.8	1028.4	3892	1186.3	1033.9	5.5	
S10		4128	1258.2	1049.4	4179	1273.8	1064.9	15.5	
S11		3818	1163.7	1047.9	3833	1168.3	1052.5	4.6	
S13		3772	1149.7	1054.4	3807	1160.4	1065.1	10.7	
S20		3578	1090.6	1005.8	3612	1100.9	1016.2	10.4	
Stoupe Beck 1		1033.2	1033.2	980.0	1061.6	1061.6	1008.4	28.4	?halite bands 1052-1056
WP1		1436.1	1436.1	1262.1	1461.9	1461.9	1287.9	25.8	
WP2		1419.4	1419.4	1258.4	1432.8	1432.8	1271.8	13.4	
WP3		1394	1394.0	1246.0	1409.8	1409.8	1261.8	15.8	
Wykeham No 1		4950.0	1508.8	1286.9	5017.0	1529.2	1307.3	20.4	medium grade (190 API) sylvite (?) veins in the marl; cavity >16"
YP1		4311.8	1314.2	1244.3	4341.6	1323.3	1253.3	9.1	
YP2		4077	1242.7	1071.2	4113.7	1253.9	1082.4	11.2	
YP3		4041.3	1231.8	1102.6	4110.3	1252.8	1123.7	21.0	
YP4		4289.5	1307.4	1197.5	4330.66	1320.0	1210.1	12.5	
YP5		4093.66	1247.7	1097.9	4170.6	1271.2	1121.4	23.5	
YP6		4255.4	1297.0	1246.4	4262.2	1299.1	1248.5	2.1	
YP7		4111.4	1253.2	1120.2	4181.6	1274.6	1141.6	21.4	
YP8		4250	1295.4	1208.6	4299	1310.3	1223.5	14.9	
YP 10		4069	1240.2	1240.2	4127.5	1258.1	1258.1	17.8	(k spike at top) 300 cps
YP 10 DIVERSION		4056	1236.3	1236.3	4116	1254.6	1254.6	18.3	300cps; k mineral spike (700 cps) at top
YP 11		4425	1348.7	1348.7	4480	1365.5	1365.5	16.8	k spike at top
YP12		4241	1292.7	1021.4	4310	1313.7	1042.4	21.0	interbedded with halite in bottom 3.3 m
YP13		4580.3	1396.1	1183.9	4630.7	1411.4	1199.3	15.4	Sylvinite and carnallite
YP14		4317	1315.8	1179.1	4364	1330.1	1193.4	14.3	
FISONS 4		4109.16	1252.5	1146.4	4140.42	1262.0	1155.9	9.5	
FISONS 2			No Data	No Data		No Data	No Data	18.1	
FISONS 3			No Data	No Data		No Data	No Data	12.8	
41/14-1		4447.0	1355.4	1321.0	4454.0	1357.6	1323.1	2.1	
41/18-1		3430.0	1045.5	1014.1	3492	1064.4	1033.0	18.9	sylvinite at top (?vein)
41/24A-1		3508.0	1069.2	1036.0	3632.0	1107.0	1073.8	37.8	carnallite reported
41/24A-2		1080.0	1080.0	1045.0	1102.0	1102.0	1067.0	22.0	carn. band at 1094 m; then v. salty
41/25-A1		3863.0	1177.4	1143.0	3986.0	1214.9	1180.5	37.5	

Well Number or name	Boulby Halite (Na3)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1		4377	1334.1	1091.5	>4496	No Data	No Data	No Data	
A2		1183.72	1183.7	846.9	1220.5	1220.5	883.7	36.8	
A3		1325.6	1325.6	1238.6	>1337	No Data	No Data	No Data	
A4		1301.8	1301.8	1093.5	1342.95	1343.0	1134.6	41.2	
A5		1319.78	1319.8	1058.7	>1355	No Data	No Data	No Data	(?polyhalite between CM and K3)
A8		4034	1229.6	1094.2	>4212	No Data	No Data	No Data	
A9		1349.78	1349.8	1127.6	>1373	No Data	No Data	No Data	
A10		1244.37	1244.4	1117.7	>1282.6	No Data	No Data	No Data	
A12		4478	1364.9	1161.1	>4576	No Data	No Data	No Data	
A13		1301.66	1301.7	1101.8	1348.13	1348.1	1148.2	46.5	
A17		4079	1243.3	1077.8	>4250	No Data	No Data	No Data	
A18		4404.9	1342.6	1080.5		No Data	No Data	No Data	
A19		1388.64	1388.6	1250.3	>1407.6	No Data	No Data	No Data	
A20		4374	1333.2	1144.1	>4442	No Data	No Data	No Data	
Cloughton A		4400	1341.1	1166.5	4490	1368.6	1193.9	27.4	
Egton High Moor 1		3863	1177.4	877.8	3977	1212.2	912.5	34.7	
Eskdale 2		3910	1191.8	1068.9	4196	1278.9	1156.1	87.2	
Eskdale 3		3817	1163.4	1150.1	4142	1262.5	1249.2	99.1	
Eskdale 4		4213	1284.1	1203.3	4396	1339.9	1259.1	55.8	
Eskdale 5		3873	1180.5	1112.2	4024	1226.5	1158.2	46.0	
Eskdale 6		4039	1231.1	1207.4	4209	1282.9	1259.2	51.8	
Eskdale 7		4317	1315.8	1161.6	4445	1354.8	1200.6	39.0	
Eskdale 8		4240.8	1292.6	1102.6	4400.5	1341.3	1151.2	48.7	
Eskdale 11		1288.09	1288.1	1142.1	1341.73	1341.7	1195.7	53.6	? No K
Eskdale 12		3911	1192.1	1086.9	4032	1229.0	1123.8	36.9	
Fordon 1		5501	1676.7	1545.9	5640	1719.1	1588.3	42.4	no K salts in core
Fordon 2		5305	1617.0	1549.3	5409	1648.7	1581.0	31.7	no K3
Hunmanby 1		5242	1597.8	1517.0	5300	1615.4	1534.7	17.7	
Lockton 2A		1550.0	1550.0	1309.8	1605.0	1605.0	1364.8	55.0	
Lockton 3		4738	1444.1	1321.5	4886	1489.3	1366.6	45.1	
Lockton 4			No Data	No Data		No Data	No Data	No Data	
Lockton 5		5231	1594.4	1362.9	5372	1637.4	1405.9	43.0	
Lockton 7		5079	1548.1	1323.0	5200	1585.0	1359.9	36.9	
Lockton 8		5240	1597.2	1347.9	5373	1637.7	1388.4	40.5	
Lockton East No. 1		1412	1412.0	1328.7	1433	1433.0	1349.7	21.0	halite band, spiky
Newton Mulgrave 1		1287.5	1287.5	1069.6	1345.08	1345.1	1127.2	57.6	
Robin Hoods Bay/Fison 1		3442	1049.1	987.3	3592	1094.8	1033.0	45.7	
S1		3588	1093.6	1025.0	3751	1143.3	1074.6	49.7	
S3		3823	1165.3	1095.1	4026	1227.1	1157.0	61.9	medium grade sylvite: gamma 230
S5		3810	1161.3	1046.8	3918	1194.2	1079.8	32.9	
S6		3892	1186.3	1033.9	4055	1236.0	1083.6	49.7	
S10		4179	1273.8	1064.9	4330	1319.8	1110.9	46.0	
S11		3833	1168.3	1052.5	>4000	No Data	No Data	No Data	
S13		3807	1160.4	1065.1	3978	1212.5	1117.2	52.1	
S20		3612	1100.9	1016.2	3758	1145.4	1060.7	44.5	
Stoupe Beck 1		1061.6	1061.6	1008.4	1110	1110.0	1056.8	48.4	
WP1		1461.9	1461.9	1287.9	>1500	No Data	No Data	No Data	
WP2		1432.8	1432.8	1271.8	1493	1493.0	1332.0	60.2	K breccia at top contact
WP3		1409.8	1409.8	1261.8	>1440	No Data	No Data	No Data	
Wykeham No 1		5017.0	1529.2	1307.3	5166.0	1574.6	1352.7	45.4	
YP1		4341.6	1323.3	1253.3		No Data	No Data	No Data	
YP2		4113.7	1253.9	1082.4		No Data	No Data	No Data	
YP3		4110.3	1252.8	1123.7		No Data	No Data	No Data	
YP4		4330.66	1320.0	1210.1		No Data	No Data	No Data	
YP5		4170.6	1271.2	1121.4		No Data	No Data	No Data	
YP6		4262.2	1299.1	1248.5		No Data	No Data	No Data	
YP7		4181.6	1274.6	1141.6		No Data	No Data	No Data	
YP8		4299	1310.3	1223.5		No Data	No Data	No Data	
YP 10		4127.5	1258.1	1258.1	4272	1302.1	1302.1	44.0	30 cps
YP 10 DIVERSION		4116	1254.6	1254.6	4160	1268.0	1268.0	13.4	
YP 11		4480	1365.5	1365.5	4636	1413.1	1413.1	47.5	
YP12		4310	1313.7	1042.4		No Data	No Data	No Data	
YP13		4630.7	1411.4	1199.3		No Data	No Data	No Data	
YP14		4364	1330.1	1193.4	4504	1372.8	1236.1	42.7	10 m anhyd. bands at base
FISONS 4		4140.42	1262.0	1155.9	4262.5	1299.2	1193.1	37.2	
FISONS 2			No Data	No Data		No Data	No Data	No Data	
FISONS 3			No Data	No Data		No Data	No Data	No Data	
41/14-1		4454.0	1357.6	1323.1	4574.0	1394.2	1359.7	36.6	dirty, gamma 20-45 API, unusual
41/18-1		3492.0	1064.4	1033.0	3638	1108.9	1077.5	44.5	
41/24A-1		3632.0	1107.0	1073.8	3692.0	1125.3	1092.1	18.3	
41/24A-2		1102.0	1102.0	1067.0	1116.5	1116.5	1081.5	14.5	
41/25-A1		3986.0	1214.9	1180.5	4060.0	1237.5	1203.0	22.6	

Well Number or name	Boulby Potash (K3)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1		4381	1335.3	1092.7	4419	1346.9	1104.3	11.6	sylvite 11.4 m @ 51% KCl (D.B.S ?60% KCl /?65% KCl)
A2		1183.72	1183.7	846.9	1184.76	1184.8	847.9	1.0	sylv. (1.2 m @ 16% KCl)
A3		1326.18	1326.2	1239.1	1328.5	1328.5	1241.5	2.3	2.3 m @ 46% KCl; sylvinite (D.B.S ?50% KCl /7.8m c.15% KCl)
A4		1303.07	1303.1	1094.7	1307.48	1307.5	1099.2	4.4	4.1 m @ 42% KCl; sylvinite (D.B.S 6.4m ?50%
A5		1320.94	1320.9	1059.9	1326.69	1326.7	1065.6	5.8	5.8 m @ 46% KCl; sylvinite
A8		4040	1231.4	1096.1	4092	1247.2	1111.9	15.8	6.9 m @ 47% KCl plus lower grade lower section, below halite band
A9		1350.98	1351.0	1128.8	1351.5	1351.5	1129.3	0.5	0.9 m @ 19.4% KCl; (low grade; 15µgR 238 API)
A10		1250.72	1250.7	1124.0	1252.52	1252.5	1125.8	1.8	2.1 m @ 44.3% KCl; sylv.
A12		4482	1366.1	1162.3	4498	1371.0	1167.2	4.9	4.7 m @ 31% KCl; sylv.
A13		1303.31	1303.3	1103.4	1308.51	1308.5	1108.6	5.2	5.1 m @ 30.4% KCl; sylv.
A17		4079	1243.3	1077.8	4118	1255.2	1089.6	11.9	10.8 m @ 53.4% KCl; sylv.
A18		4409	1343.9	1081.7	4419	1346.9	1084.8	3.0	27.74% K2O
A19		1392.73	1392.7	1254.4	1396.59	1396.6	1258.3	3.9	3.9 m @ 22.6% KCl sylv.
A20		4376	1333.8	1144.7	4417	1346.3	1157.2	12.5	8.4 m @ 41.3% KCl; sylv.
Cloughton A		4405	1342.6	1168.0	4417	1346.3	1171.7	3.7	80-140 API gamma; cockscomb; low grade sylvite
Egton High Moor 1		3868	1179.0	879.3	3880	1182.6	882.9	3.7	suspected low grade sylvite from gamma and cuttings
Eskdale 2		3818	1163.7	1040.9	3964	1208.2	1085.4	44.5	sylvinite cored; medium grade (D.B.S. ?9.75 or 8.53 m). Fleck says short core at 34% KCl then 30 ' core lost
Eskdale 3		3834	1168.6	1155.3	3865	1178.1	1164.8	9.4	9.4 m @ 40-45% KCl
Eskdale 4		4213	1284.1	1203.3	4246	1294.2	1213.4	10.1	10 m @ 25% KCl
Eskdale 5		3886	1184.5	1116.1	3897	1187.8	1119.5	3.4	3.4 m @ 21% KCl (D.B.S. 2.89 m @ 23.5% KCl)
Eskdale 6		4043	1232.3	1208.6	4055	1236.0	1212.3	3.7	3.7 m @ 31% KCl (D.B.S. 2.89 m@29.2%)
Eskdale 7		4323	1317.7	1163.5	4337	1321.9	1167.7	4.3	4.3 m @ 25% KCl
Eskdale 8		4249	1295.1	1105.1	4261	1298.8	1108.7	3.7	
Eskdale 11			No Data	No Data		No Data	No Data	0.0	not recorded
Eskdale 12		3911	1192.1	1086.9	3927	1196.9	1091.8	4.9	recorded as sylvinite
Fordon 1			No Data	No Data		No Data	No Data	0.0	absent
Fordon 2			No Data	No Data		No Data	No Data	0.0	absent
Hunmanby 1			No Data	No Data		No Data	No Data	0.0	absent
Lockton 2A		1565.0	1565.0	1324.8	1567.5	1567.5	1327.3	2.5	sylvite max API 240
Lockton 3		4746	1446.6	1323.9	4757	1449.9	1327.3	3.4	medium grade, max. 220 API, high neutron counts, assumed sylvite
Lockton 4			No Data	No Data		No Data	No Data	No Data	no information
Lockton 5		5234	1595.3	1363.8	5237	1596.2	1364.7	0.9	low grade, 90 API, neutron same as halite; i.e. sylvite
Lockton 7			No Data	No Data		No Data	No Data	0.0	absent
Lockton 8			No Data	No Data		No Data	No Data	0.0	absent
Lockton East No. 1			No Data	No Data		No Data	No Data	No Data	?cavity @ K3 horizon; complex logs
Newton Mulgrave 1		1287.5	1287.5	1069.6	1295.4	1295.4	1077.5	7.9	banded sylvinite - halite cored
Robin Hoods Bay/Fison 1		3448	1051.0	989.1	3470	1057.7	995.8	6.7	low grade sylvinite
S1		3589	1093.9	1025.3	3614	1101.5	1032.9	7.6	7.5 m @ 37% KCl; med. grade sylvite; low gamma response
S3		3827	1166.5	1096.4	3881	1182.9	1112.8	16.5	14.2 m @ 25% KCl; medium grade sylvite; gamma 230
S5		3813	1162.2	1047.8	3825	1165.9	1051.4	3.7	3.5 m @ 34% KCl; high grade sylvite gamma 460 API
S6		3901	1189.0	1036.6	3913	1192.7	1040.3	3.7	3.4 m @ 57% KCl; high grade sylvite
S10		4182	1274.7	1065.8	4195	1278.6	1069.8	4.0	3.8 m @ 49% KCl; high grade sylvite; gamma 523 API
S11		3841	1170.7	1054.9	3877	1181.7	1065.9	11.0	11.4 m @ 54% KCl; high grade sylvite; gamma 975
S13		3813	1162.2	1066.9	3846	1172.3	1076.9	10.1	8.8 m @ 25%, gamma 375; medium/high grade sylvite
S20		3615	1101.9	1017.1	3627	1105.5	1020.8	3.7	3.1 m @ 56% KCl; gamma 548 API; high grade sylvite
Stoupe Beck 1		1061.6	1061.6	1008.4	1062.8	1062.8	1009.6	1.2	single peak, gamma 333, med/hi gr.
WP1		1461.9	1461.9	1287.9	1480.9	1480.9	1306.9	19.0	sylvite 18.8 m @ 26% KCl; incl. Halite band 1465-1469
WP2		1434.8	1434.8	1273.8	1440	1440.0	1279.0	5.2	sylvite main bed (excl. breccia) 7.8% @ 38% KCl
WP3		1412.4	1412.4	1264.4	1416.8	1416.8	1268.8	4.4	sylvite 4.3 m @ 34% KCl (+ low grade K to 1421.6)
Wykeham No 1		5024.0	1531.3	1309.4	5035.0	1534.7	1312.8	3.4	[API 30-40, but SG 1.9, sylvite; caliper shows hole 15" from original 8.5"
YP1		4347.9	1325.2	1255.3	4369.1	1331.7	1261.7	6.5	
YP2		4147.5	1264.2	1092.7	4160.25	1268.0	1096.6	3.9	
YP3		4115.2	1254.3	1125.2	4145	1263.4	1134.3	9.1	
YP4		4332.9	1320.7	1210.8	4350.75	1326.1	1216.2	5.4	
YP5		4172.2	1271.7	1121.8	4190	1277.1	1127.3	5.4	low grade (?) Possibly disturbed
YP6		4262.6	1299.2	1248.6	4274	1302.7	1252.0	3.5	0.42m high grade sylvinite on 3.0m of low grade; faulted.
YP7		4182.6	1274.9	1141.9	4183.5	1275.1	1142.2	0.3	low grade sylv. Likely that sylvinite has been remobilised into the Carnallitic Marl, which is brecciated
YP8		4303	1311.6	1224.7	4328	1319.2	1232.4	7.6	med. grade sylvite, max. 45% K20
YP 10		4141	1262.2	1262.2	4146	1263.7	1263.7	1.5	high grade (1680cps), with low grade tail at 4149
YP 10 DIVERSION		4128	1258.2	1258.2	4135	1260.3	1260.3	2.1	two peaks, max. 450 cps, low grade sylvite, probably shaly (see density log)
YP 11		4486	1367.3	1367.3	4511	1375.0	1375.0	7.6	mostly 240-270 cps; neutron & density logs suggest mainly shale (cf. CM) from 4486-4496', then sylvite/carnallite spike (peak 440 cps) and low grade sylvite (ca.240 cps) 4476-4511
YP12		4324	1318.0	1046.7	4331	1320.1	1048.8	2.1	no published info. on minerals or grade
YP13		4642.4	1415.0	1202.9	4647.2	1416.5	1204.3	1.5	(4.8' as 8.1% K2O) Sylvinite
YP14		4364	1330.1	1193.4	4375	1333.5	1196.7	3.35	gamma 296, SG 2.07; medium gr. sylvinite
FISONS 4		4143.66	1263.0	1156.9	4160.5	1268.1	1162.1	5.1	
FISONS 2			No Data	No Data		No Data	No Data	2.0	
FISONS 3			No Data	No Data		No Data	No Data	9.2	
41/14-1		4505.0	1373.1	1338.7	4538.0	1383.2	1348.7	10.1	suspect carnallite; gamma 80 with vein spike 200; high neut; low dens.
41/18-1		3499.0	1066.5	1035.1	3517	1072.0	1040.6	5.5	
41/24A-1			No Data	No Data		No Data	No Data	0.0	absent
41/24A-2			No Data	No Data		No Data	No Data	0.0	absent
41/25-A1			No Data	No Data		No Data	No Data	0.0	absent

Well Number or name	Billingham Main Anhydrite (A3)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1			No Data	No Data		No Data	No Data	No Data	
A2		1220.5	1220.5	883.7	>1223.1	No Data	No Data	No Data	
A3			No Data	No Data		No Data	No Data	No Data	
A4		1342.95	1343.0	1134.6	1358.8	1358.8	1150.5	15.8	
A5			No Data	No Data		No Data	No Data	No Data	
A8			No Data	No Data		No Data	No Data	No Data	
A9			No Data	No Data		No Data	No Data	No Data	
A10			No Data	No Data		No Data	No Data	No Data	
A12			No Data	No Data		No Data	No Data	No Data	
A13		1348.13	1348.1	1148.2	1365.81	1365.8	1165.9	17.7	
A17			No Data	No Data		No Data	No Data	No Data	
A18			No Data	No Data		No Data	No Data	No Data	
A19			No Data	No Data		No Data	No Data	No Data	
A20			No Data	No Data		No Data	No Data	No Data	
Cloughton A		4490	1368.6	1193.9	4536	1382.6	1207.9	14.0	
Egton High Moor 1		3977	1212.2	912.5	4012	1222.9	923.2	10.7	
Eskdale 2		4155	1266.4	1143.6	4196	1278.9	1156.1	12.5	
Eskdale 3		4142	1262.5	1249.2	4200	1280.2	1266.9	17.7	
Eskdale 4		4396	1339.9	1259.1	4452	1357.0	1276.2	17.1	
Eskdale 5		4024	1226.5	1158.2	4104	1250.9	1182.6	24.4	
Eskdale 6		4209	1282.9	1259.2	>4282	No Data	No Data	No Data	
Eskdale 7		4445	1354.8	1200.6	4537	1382.9	1228.7	28.0	
Eskdale 8		4400.5	1341.3	1151.2		No Data	No Data	No Data	
Eskdale 11		1341.73	1341.7	1195.7	1355.75	1355.8	1209.8	14.0	
Eskdale 12		4032	1229.0	1123.8	4040	1231.4	1126.2	2.4	
Fordon 1		5640	1719.1	1588.3	5662	1725.8	1595.0	6.7	
Fordon 2		5409	1648.7	1581.0	5432	1655.7	1588.0	7.0	approximate base
Hunmanby 1		5300	1615.4	1534.7	5318	1620.9	1540.2	5.5	
Lockton 2A			No Data	No Data		No Data	No Data	0.0	?absent
Lockton 3		4886	1489.3	1366.6	4922	1500.2	1377.5	11.0	
Lockton 4			No Data	No Data		No Data	No Data	No Data	
Lockton 5		5372	1637.4	1405.9	5400	1645.9	1414.4	8.5	
Lockton 7		5200	1585.0	1359.9	5242	1597.8	1372.7	12.8	
Lockton 8		5373	1637.7	1388.4	5424	1653.2	1403.9	15.5	
Lockton East No. 1		1433	1433.0	1349.7	1449	1449.0	1365.7	16.0	
Newton Mulgrave 1		1345.08	1345.1	1127.2	1355.75	1355.8	1137.8	10.7	
Robin Hoods Bay/Fison 1		3592	1094.8	1033.0	3635	1107.9	1046.1	13.1	
S1		3751	1143.3	1074.6	3814	1162.5	1093.8	19.2	
S3		4026	1227.1	1157.0	>4089	No Data	No Data	No Data	
S5		3918	1194.2	1079.8	>3965	No Data	No Data	No Data	
S6		4055	1236.0	1083.6	4106	1251.5	1099.1	15.5	
S10		4330	1319.8	1110.9	>4347	No Data	No Data	No Data	
S11			No Data	No Data		No Data	No Data	No Data	
S13		3978	1212.5	1117.2	4034	1229.6	1134.3	17.1	
S20		3758	1145.4	1060.7	3808	1160.7	1075.9	15.2	
Stoupe Beck 1		1110	1110.0	1056.8	1122	1122.0	1068.8	12.0	
WP1			No Data	No Data		No Data	No Data	No Data	
WP2		1493	1493.0	1332.0	>1494	No Data	No Data	No Data	
WP3			No Data	No Data		No Data	No Data	No Data	
Wykeham No 1		5166.0	1574.6	1352.7	5205.0	1586.5	1364.6	11.9	
YP1			No Data	No Data		No Data	No Data	No Data	
YP2			No Data	No Data		No Data	No Data	No Data	
YP3			No Data	No Data		No Data	No Data	No Data	
YP4			No Data	No Data		No Data	No Data	No Data	
YP5			No Data	No Data		No Data	No Data	No Data	
YP6			No Data	No Data		No Data	No Data	No Data	
YP7			No Data	No Data		No Data	No Data	No Data	
YP8			No Data	No Data		No Data	No Data	No Data	
YP 10		4272	1302.1	1302.1	4299	1310.3	1310.3	8.2	
YP 10 DIVERSION			No Data	No Data		No Data	No Data	No Data	
YP 11		4636	1413.1	1413.1	4650	1417.3	1417.3	4.3	
YP12			No Data	No Data		No Data	No Data	No Data	
YP13			No Data	No Data		No Data	No Data	No Data	
YP14		4504	1372.8	1236.1	4550	1386.8	1250.1	14.0	
FISONS 4		4262.5	1299.2	1193.1		No Data	No Data	No Data	
FISONS 2			No Data	No Data		No Data	No Data	No Data	
FISONS 3			No Data	No Data		No Data	No Data	No Data	
41/14-1		4574.0	1394.2	1359.7	4651.0	1417.6	1383.2	23.5	
41/18-1		3638.0	1108.9	1077.5	3652	1113.1	1081.7	4.3	
41/24A-1		3692.0	1125.3	1092.1	3715.0	1132.3	1099.1	7.0	bands salt, anhyd., dol.
41/24A-2		1116.5	1116.5	1081.5	1124.0	1124.0	1089.0	7.5	
41/25-A1		4060.0	1237.5	1203.0	4128.0	1258.2	1223.8	20.7	

Well Number or name	Brotherton Formation = Upper Magnesian Limestone (Ca3)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1			No Data	No Data		No Data	No Data	No Data	
A2			No Data	No Data		No Data	No Data	No Data	
A3			No Data	No Data		No Data	No Data	No Data	
A4		1358.8	1358.8	1150.5	>1361.3	No Data	No Data	No Data	
A5			No Data	No Data		No Data	No Data	No Data	
A8			No Data	No Data		No Data	No Data	No Data	
A9			No Data	No Data		No Data	No Data	No Data	
A10			No Data	No Data		No Data	No Data	No Data	
A12			No Data	No Data		No Data	No Data	No Data	
A13		1365.81	1365.8	1165.9	>1368.8	No Data	No Data	No Data	
A17			No Data	No Data		No Data	No Data	No Data	
A18			No Data	No Data		No Data	No Data	No Data	
A19			No Data	No Data		No Data	No Data	No Data	
A20			No Data	No Data		No Data	No Data	No Data	
Cloughton A		4536	1382.6	1207.9	4754	1449.0	1274.4	66.4	
Egton High Moor 1		4012	1222.9	923.2	4102	1250.3	950.6	27.4	
Eskdale 2		4196	1278.9	1156.1	4315	1315.2	1192.4	36.3	
Eskdale 3		4200	1280.2	1266.9	4383	1335.9	1322.6	55.8	
Eskdale 4		4452	1357.0	1276.2	>4458	No Data	No Data	No Data	
Eskdale 5		4104	1250.9	1182.6	4234	1290.5	1222.2	39.6	
Eskdale 6			No Data	No Data		No Data	No Data	No Data	
Eskdale 7		4537	1382.9	1228.7	>4540	No Data	No Data	No Data	
Eskdale 8			No Data	No Data		No Data	No Data	No Data	
Eskdale 11		1355.75	1355.8	1209.8	1396.9	1396.9	1250.9	41.2	
Eskdale 12		4050	1234.4	1129.3	4402	1341.7	1236.6	107.3	possibly faulted; 22 m of anhydrite included
Fordon 1		5662	1725.8	1595.0	5877	1791.3	1660.6	65.5	
Fordon 2		5432	1655.7	1588.0	5673	1729.1	1661.4	73.5	
Hunmanby 1		5318	1620.9	1540.2	5570	1697.7	1617.0	76.8	
Lockton 2A		1605.0	1605.0	1364.8	1637.0	1637.0	1396.8	32.0	
Lockton 3		4922	1500.2	1377.5	5002	1524.6	1401.9	24.4	
Lockton 4		5348	1630.1	#VALUE!	5440	1658.1	#VALUE!	#VALUE!	
Lockton 5		5400	1645.9	1414.4	5566	1696.5	1465.0	50.6	
Lockton 7		5242	1597.8	1372.7	5395	1644.4	1419.4	46.6	
Lockton 8		5424	1653.2	1403.9	5568	1697.1	1447.8	43.9	
Lockton East No. 1		1449	1449.0	1365.7	1507	1507.0	1423.7	58.0	
Newton Mulgrave 1		1355.75	1355.8	1137.8	1386.2	1386.2	1168.3	30.5	
Robin Hoods Bay/Fison 1		3635	1107.9	1046.1	3820	1164.3	1102.5	56.4	
S1		3814	1162.5	1093.8	3909	1191.5	1122.8	29.0	
S3			No Data	No Data		No Data	No Data	No Data	
S5			No Data	No Data		No Data	No Data	No Data	
S6		4106	1251.5	1099.1	>4116	No Data	No Data	No Data	
S10			No Data	No Data		No Data	No Data	No Data	
S11			No Data	No Data		No Data	No Data	No Data	
S13		4034	1229.6	1134.3	>4037	No Data	No Data	No Data	
S20		3808	1160.7	1075.9	3891	1186.0	1101.2	25.3	
Stoupe Beck 1		1122	1122.0	1068.8	1175.2	1175.2	1122.0	53.2	
WP1			No Data	No Data		No Data	No Data	No Data	
WP2			No Data	No Data		No Data	No Data	No Data	
WP3			No Data	No Data		No Data	No Data	No Data	
Wykeham No 1		5205.0	1586.5	1364.6	5347.0	1629.8	1407.9	43.3	
YP1			No Data	No Data		No Data	No Data	No Data	
YP2			No Data	No Data		No Data	No Data	No Data	
YP3			No Data	No Data		No Data	No Data	No Data	
YP4			No Data	No Data		No Data	No Data	No Data	
YP5			No Data	No Data		No Data	No Data	No Data	
YP6			No Data	No Data		No Data	No Data	No Data	
YP7			No Data	No Data		No Data	No Data	No Data	
YP8			No Data	No Data		No Data	No Data	No Data	
YP 10		4299	1310.3	1310.3	4308	1313.1	1313.1	2.7	(TD)
YP 10 DIVERSION			No Data	No Data		No Data	No Data	No Data	
YP 11			No Data	No Data		No Data	No Data	No Data	
YP12			No Data	No Data		No Data	No Data	No Data	
YP13			No Data	No Data		No Data	No Data	No Data	
YP14		4550	1386.8	1250.1	4719	1438.4	1301.6	51.5	
FISONS 4			No Data	No Data		No Data	No Data	No Data	
FISONS 2			No Data	No Data		No Data	No Data	No Data	
FISONS 3			No Data	No Data		No Data	No Data	No Data	
41/14-1		4651.0	1417.6	1383.2	4884.0	1488.6	1454.2	71.0	
41/18-1		3652.0	1113.1	1081.7	3841	1170.7	1139.3	57.6	
41/24A-1		3715.0	1132.3	1099.1	3964.0	1208.2	1175.0	75.9	
41/24A-2		1124.0	1124.0	1089.0	1200.0	1200.0	1165.0	76.0	
41/25-A1		4128.0	1258.2	1223.8	4271.0	1301.8	1267.4	43.6	

Well Number or name	Grauer Saltzton (GS)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1			No Data	No Data		No Data	No Data	No Data	
A2			No Data	No Data		No Data	No Data	No Data	
A3			No Data	No Data		No Data	No Data	No Data	
A4			No Data	No Data		No Data	No Data	No Data	
A5			No Data	No Data		No Data	No Data	No Data	
A8			No Data	No Data		No Data	No Data	No Data	
A9			No Data	No Data		No Data	No Data	No Data	
A10			No Data	No Data		No Data	No Data	No Data	
A12			No Data	No Data		No Data	No Data	No Data	
A13			No Data	No Data		No Data	No Data	No Data	
A17			No Data	No Data		No Data	No Data	No Data	
A18			No Data	No Data		No Data	No Data	No Data	
A19			No Data	No Data		No Data	No Data	No Data	
A20			No Data	No Data		No Data	No Data	No Data	
Cloughton A		4754	1449.0	1274.4	4757	1449.9	1275.3	0.9	
Egton High Moor 1			No Data	No Data		No Data	No Data	0.0	not recognized
Eskdale 2			No Data	No Data		No Data	No Data	No Data	
Eskdale 3			No Data	No Data		No Data	No Data	No Data	
Eskdale 4			No Data	No Data		No Data	No Data	No Data	
Eskdale 5			No Data	No Data		No Data	No Data	No Data	
Eskdale 6			No Data	No Data		No Data	No Data	No Data	
Eskdale 7			No Data	No Data		No Data	No Data	No Data	
Eskdale 8			No Data	No Data		No Data	No Data	No Data	
Eskdale 11			No Data	No Data		No Data	No Data	No Data	
Eskdale 12			No Data	No Data		No Data	No Data	0.0	not recorded
Fordon 1			No Data	No Data		No Data	No Data	No Data	
Fordon 2		5673	1729.1	1661.4	5677	1730.3	1662.7	1.2	
Hunmanby 1		5570	1697.7	1617.0	5580	1700.8	1620.0	3.0	
Lockton 2A			No Data	No Data		No Data	No Data	0.0	absent
Lockton 3		5002	1524.6	1401.9	5068	1544.7	1422.0	20.1	shaly dolomite
Lockton 4			No Data	No Data		No Data	No Data	No Data	
Lockton 5		5566	1696.5	1465.0	5588	1703.2	1471.7	6.7	
Lockton 7			No Data	No Data		No Data	No Data	No Data	
Lockton 8		5568	1697.1	1447.8	5580	1700.8	1451.5	3.7	
Lockton East No. 1		1507	1507.0	1423.7	1510	1510.0	1426.7	3.0	
Newton Mulgrave 1			No Data	No Data		No Data	No Data	0.0	not recognized
Robin Hoods Bay/Fison 1			No Data	No Data		No Data	No Data	0.0	not recognized
S1		3814	1162.5	1093.8	3909	1191.5	1122.8	29.0	
S3			No Data	No Data		No Data	No Data	No Data	
S5			No Data	No Data		No Data	No Data	No Data	
S6			No Data	No Data		No Data	No Data	No Data	
S10			No Data	No Data		No Data	No Data	No Data	
S11			No Data	No Data		No Data	No Data	No Data	
S13			No Data	No Data		No Data	No Data	No Data	
S20			No Data	No Data		No Data	No Data	No Data	weakly developed
Stoupe Beck 1		1175.2	1175.2	1122.0	1176.9	1176.9	1123.7	1.7	
WP1			No Data	No Data		No Data	No Data	No Data	
WP2			No Data	No Data		No Data	No Data	No Data	
WP3			No Data	No Data		No Data	No Data	No Data	
Wykeham No 1		5347.0	1629.8	1407.9	5368.0	1636.2	1414.3	6.4	
YP1			No Data	No Data		No Data	No Data	No Data	
YP2			No Data	No Data		No Data	No Data	No Data	
YP3			No Data	No Data		No Data	No Data	No Data	
YP4			No Data	No Data		No Data	No Data	No Data	
YP5			No Data	No Data		No Data	No Data	No Data	
YP6			No Data	No Data		No Data	No Data	No Data	
YP7			No Data	No Data		No Data	No Data	No Data	
YP8			No Data	No Data		No Data	No Data	No Data	
YP 10			No Data	No Data		No Data	No Data	No Data	
YP 10 DIVERSION			No Data	No Data		No Data	No Data	No Data	
YP 11			No Data	No Data		No Data	No Data	No Data	
YP12			No Data	No Data		No Data	No Data	No Data	
YP13			No Data	No Data		No Data	No Data	No Data	
YP14		4719	1438.4	1301.6	4723	1439.6	1302.8	1.2	
FISONS 4			No Data	No Data		No Data	No Data	No Data	
FISONS 2			No Data	No Data		No Data	No Data	No Data	
FISONS 3			No Data	No Data		No Data	No Data	No Data	
41/14-1		4884.0	1488.6	1454.2	4891.0	1490.8	1456.3	2.1	
41/18-1		3841.0	1170.7	1139.3	3844	1171.7	1140.3	0.9	
41/24A-1		3964.0	1208.2	1175.0	3968.0	1209.4	1176.2	1.2	
41/24A-2		1200.0	1200.0	1165.0	1201.0	1201.0	1166.0	1.0	
41/25-A1		4271.0	1301.8	1267.4	4275.0	1303.0	1268.6	1.2	

Well Number or name	Fordon Evaporites (FE)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1			No Data	No Data		No Data	No Data	No Data	
A2			No Data	No Data		No Data	No Data	No Data	
A3			No Data	No Data		No Data	No Data	No Data	
A4			No Data	No Data		No Data	No Data	No Data	
A5			No Data	No Data		No Data	No Data	No Data	
A8			No Data	No Data		No Data	No Data	No Data	
A9			No Data	No Data		No Data	No Data	No Data	
A10			No Data	No Data		No Data	No Data	No Data	
A12			No Data	No Data		No Data	No Data	No Data	
A13			No Data	No Data		No Data	No Data	No Data	
A17			No Data	No Data		No Data	No Data	No Data	
A18			No Data	No Data		No Data	No Data	No Data	
A19			No Data	No Data		No Data	No Data	No Data	
A20			No Data	No Data		No Data	No Data	No Data	
Cloughton A		4757	1449.9	1275.3	5563	1695.6	1521.0	245.7	very lo. gr. spike at 1459-1462
Egton High Moor 1		4102	1250.3	950.6	4222	1286.9	987.2	36.6	no K indicated on gamma log
Eskdale 2		4315	1315.2	1192.4	4773	1454.8	1332.0	139.6	
Eskdale 3		4383	1335.9	1322.6	5464	1665.4	1652.1	329.5	
Eskdale 4			No Data	No Data		No Data	No Data	No Data	
Eskdale 5		4234	1290.5	1222.2	4672	1424.0	1355.7	133.5	
Eskdale 6			No Data	No Data		No Data	No Data	No Data	
Eskdale 7			No Data	No Data		No Data	No Data	No Data	
Eskdale 8			No Data	No Data		No Data	No Data	No Data	
Eskdale 11			No Data	No Data		No Data	No Data	No Data	
Eskdale 12		4402	1341.7	1236.6	4878	1486.8	1381.7	145.1	possibly faulted
Fordon 1		5877	1791.3	1660.6	6934	2113.5	1982.7	322.2	
Fordon 2		5677	1730.3	1662.7	6602	2012.3	1944.6	281.9	poss. lo. gr. unid. K salts 1856-1880
Hunmanby 1		5580	1700.8	1620.0	6830	2081.8	2001.0	381.0	lo. gr. ?carn. 1761-1780; and 1804-1810
Lockton 2A		1665.0	1665.0	1424.8	1733.0	1733.0	1492.8	68.0	halite and anhydrite from top to 1686
Lockton 3		5068	1544.7	1422.0	5096	1553.3	1430.6	8.5	K 2.3 spike at 5070' K 2.2, low grade, 105 API
Lockton 4		5440	1658.1	#VALUE!	5700	1737.4	#VALUE!	#VALUE!	
Lockton 5		5588	1703.2	1471.7	6048	1843.4	1611.9	140.2	K 2.3, low grade, 120 API, 5607' - 5612'; k2.2 VERY LOW GRADE, 50 API, 5696 - 5724'; SYLVITE
Lockton 7		5395	1644.4	1419.4	5777	1760.8	1535.8	116.4	
Lockton 8		5580	1700.8	1451.5	5960	1816.6	1567.3	115.8	caved hole
Lockton East No. 1		1510	1510.0	1426.7	1658	1658.0	1574.7	148.0	
Newton Mulgrave 1		1386.2	1386.2	1168.3	1723.9	1723.9	1506.0	337.7	
Robin Hoods Bay/Fison 1		3820	1164.3	1102.5	4735	1443.2	1381.4	278.9	low. gr. gamma spike at K2.3
S1		3916	1193.6	1124.9	4240	1292.4	1223.7	98.8	
S3			No Data	No Data		No Data	No Data	No Data	
S5			No Data	No Data		No Data	No Data	No Data	
S6			No Data	No Data		No Data	No Data	No Data	
S10			No Data	No Data		No Data	No Data	No Data	
S11			No Data	No Data		No Data	No Data	No Data	
S13			No Data	No Data		No Data	No Data	No Data	
S20		3891	1186.0	1101.2	>3947	No Data	No Data	No Data	
Stoupe Beck 1		1176.9	1176.9	1123.7	1492.9	1492.9	1439.7	316.0	claystone at K2.2 level
WP1			No Data	No Data		No Data	No Data	No Data	
WP2			No Data	No Data		No Data	No Data	No Data	
WP3			No Data	No Data		No Data	No Data	No Data	
Wykeham No 1		5368.0	1636.2	1414.3	5766.0	1757.5	1535.6	121.3	K 2.3 (?sylvite), API, 1637 - 1639; k2.2 barely visible, 1661 - 1665; halite and anhydrite from top to 1660, halite to 1682
YP1			No Data	No Data		No Data	No Data	No Data	
YP2			No Data	No Data		No Data	No Data	No Data	
YP3			No Data	No Data		No Data	No Data	No Data	
YP4			No Data	No Data		No Data	No Data	No Data	
YP5			No Data	No Data		No Data	No Data	No Data	
YP6			No Data	No Data		No Data	No Data	No Data	
YP7			No Data	No Data		No Data	No Data	No Data	
YP8			No Data	No Data		No Data	No Data	No Data	
YP 10			No Data	No Data		No Data	No Data	No Data	
YP 10 DIVERSION			No Data	No Data		No Data	No Data	No Data	
YP 11			No Data	No Data		No Data	No Data	No Data	
YP12			No Data	No Data		No Data	No Data	No Data	
YP13			No Data	No Data		No Data	No Data	No Data	
YP14		4723	1439.6	1302.8	5492	1674.0	1537.2	234.4	very lo. gr. gamma spikes around K2.2 and K2.3
FISONS 4			No Data	No Data		No Data	No Data	No Data	
FISONS 2			No Data	No Data		No Data	No Data	No Data	
FISONS 3			No Data	No Data		No Data	No Data	No Data	
41/14-1		4891.0	1490.8	1456.3	6092.0	1856.8	1822.4	366.1	carn. 1689-1693 lo.gr.
41/18-1		3844.0	1171.7	1140.3	4940	1505.7	1474.3	334.1	K2.3 ? carnallite 3900-3908';k2.2 ? carnallite, in 2 bands ca. 4400-4460
41/24A-1		3968.0	1209.4	1176.2	5443.0	1659.0	1625.8	449.6	carn. bands at top? washout at K2.2 position
41/24A-2		1201.0	1201.0	1166.0	1678.0	1678.0	1643.0	477.0	carn. 1215-1230; 1410-1418; 1440-1490
41/25-A1		4275.0	1303.0	1268.6	5410.0	1649.0	1614.5	345.9	alternating beds of anhydr. from top to 1336 and 1455-1479, anhydrite from 1644-base

Well Number or name	Polyhalite	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1			No Data	No Data		No Data	No Data	No Data	
A2			No Data	No Data		No Data	No Data	No Data	
A3			No Data	No Data		No Data	No Data	No Data	
A4			No Data	No Data		No Data	No Data	No Data	
A5			No Data	No Data		No Data	No Data	No Data	
A8			No Data	No Data		No Data	No Data	No Data	
A9			No Data	No Data		No Data	No Data	No Data	
A10			No Data	No Data		No Data	No Data	No Data	
A12			No Data	No Data		No Data	No Data	No Data	
A13			No Data	No Data		No Data	No Data	No Data	
A17			No Data	No Data		No Data	No Data	No Data	
A18			No Data	No Data		No Data	No Data	No Data	
A19			No Data	No Data		No Data	No Data	No Data	
A20			No Data	No Data		No Data	No Data	No Data	
Cloughton A		5200	1585.0	1410.3	5490	1673.4	1498.7	88.4	high grade section 1619-1673; ?carn.vein @ 1666 m
Egton High Moor 1			No Data	No Data		No Data	No Data	0.0	not indicated
Eskdale 2		4440	1353.3	1230.5	4525	1379.2	1256.4	25.9	According to Stewart & Fleck, core is massive polyhalite 1364-1378 m
Eskdale 3		4722	1439.3	1426.0	5171	1576.1	1562.8	136.9	
Eskdale 4			No Data	No Data		No Data	No Data	No Data	
Eskdale 5		4363	1329.8	1261.5	4387	1337.2	1268.9	7.3	
Eskdale 6			No Data	No Data		No Data	No Data	No Data	
Eskdale 7			No Data	No Data		No Data	No Data	No Data	
Eskdale 8			No Data	No Data		No Data	No Data	No Data	
Eskdale 11			No Data	No Data		No Data	No Data	No Data	
Eskdale 12		4504	1372.8	1267.7	4536	1382.6	1277.4	9.8	recorded as polyhalite
Fordon 1		6350	1935.5	1804.7	6805	2074.2	1943.4	138.7	hi grade section 2016-2074 m
Fordon 2		6107	1861.4	1793.7	6468	1971.4	1903.8	110.0	hi grade 1881-1971 m; max 250 API; ?sylvite or langbeinite?
Hunmanby 1		6420	1956.8	1876.0	6780	2066.5	1985.8	109.7	high grade 2013-2066 m w. traces carnallite; gamma 180-210 (cased 4½" hole)
Lockton 2A		1681.0	1681.0	1440.8	1719.0	1719.0	1478.8	38.0	main bed 1717-1719, 170 API
Lockton 3		5323	1622.5	1499.8	5426	1653.8	1531.2	31.4	
Lockton 4			No Data	No Data		No Data	No Data	No Data	
Lockton 5		5826	1775.8	1544.3	5906	1800.1	1568.7	24.4	mostly ca 140-150 API. "high" grade; and second lower grade horizon 5962 - 5998'
Lockton 7		5530	1685.5	1460.5	5556	1693.5	1468.4	7.9	
Lockton 8		5669	1727.9	1478.6	5912	1802.0	1552.7	74.1	1728-1730.5 max gamma 125 API; 1793-1802 max gamma 132 API
Lockton East No. 1		1567	1567.0	1483.7	1632	1632.0	1548.7	65.0	present as thin beds throughout, high grade
Newton Mulgrave 1			No Data	No Data		No Data	No Data	No Data	not recorded, but probably present
Robin Hoods Bay/Fison 1			No Data	No Data		No Data	No Data	No Data	not recorded, but probably present
S1		4021	1225.6	1156.9	4070	1240.5	1171.9	14.9	consistent gamma 130; sonic 59; hi grade
S3			No Data	No Data		No Data	No Data	No Data	
S5			No Data	No Data		No Data	No Data	No Data	
S6			No Data	No Data		No Data	No Data	No Data	
S10			No Data	No Data		No Data	No Data	No Data	
S11			No Data	No Data		No Data	No Data	No Data	
S13			No Data	No Data		No Data	No Data	No Data	
S20			No Data	No Data		No Data	No Data	No Data	
Stoupe Beck 1		1375	1375.0	1321.8	1478.5	1478.5	1425.3	103.5	hi grade section 1415-1469 gamma 240 API-high for polyhalite SG 2.8-exact for polyhalite neutron 15%-exact for polyhalite
WP1			No Data	No Data		No Data	No Data	No Data	
WP2			No Data	No Data		No Data	No Data	No Data	
WP3			No Data	No Data		No Data	No Data	No Data	
Wykeham No 1		5520.0	1682.5	1460.6	5564.0	1695.9	1474.0	13.4	100 - 170 API; halite with polyhalite
YP1			No Data	No Data		No Data	No Data	No Data	
YP2			No Data	No Data		No Data	No Data	No Data	
YP3			No Data	No Data		No Data	No Data	No Data	
YP4			No Data	No Data		No Data	No Data	No Data	
YP5			No Data	No Data		No Data	No Data	No Data	
YP6			No Data	No Data		No Data	No Data	No Data	
YP7			No Data	No Data		No Data	No Data	No Data	
YP8			No Data	No Data		No Data	No Data	No Data	
YP 10			No Data	No Data		No Data	No Data	No Data	
YP 10 DIVERSION			No Data	No Data		No Data	No Data	No Data	
YP 11			No Data	No Data		No Data	No Data	No Data	
YP12			No Data	No Data		No Data	No Data	No Data	
YP13			No Data	No Data		No Data	No Data	No Data	
YP14		5086	1550.2	1413.5	5492	1674.0	1537.2	123.7	high gr. 1583-1649; gamma spiky 170 API
FISONS 4			No Data	No Data		No Data	No Data	No Data	
FISONS 2			No Data	No Data		No Data	No Data	No Data	
FISONS 3			No Data	No Data		No Data	No Data	No Data	
41/14-1		5800.0	1767.8	1733.4	6060.0	1847.1	1812.6	79.2	hi. gr. 1807-1833 (gamma 180, SG 2.75, 14-24 N)
41/18-1		4714.0	1436.8	1405.4	4890	1490.5	1459.1	53.6	high grade 150 API 4744-4836'?
41/24A-1		5067.0	1544.4	1511.2	5376.0	1638.6	1605.4	94.2	hi gr. 1588-1639, gamma 60-130
41/24A-2		1577.0	1577.0	1542.0	1661.0	1661.0	1626.0	84.0	banded hi. gr. 1597-1655 (gamma 150, SG 2.75)
41/25-A1		4860.0	1481.3	1446.9	5397.0	1645.0	1610.6	163.7	main bed 1584-1643, max. gamma 170/180 API

Well Number or name	Kirkham Abbey Formation =Hartlepool & Roker Dol/Conc Lmst=Ca2 (KAF)	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1			No Data	No Data		No Data	No Data	No Data	
A2			No Data	No Data		No Data	No Data	No Data	
A3			No Data	No Data		No Data	No Data	No Data	
A4			No Data	No Data		No Data	No Data	No Data	
A5			No Data	No Data		No Data	No Data	No Data	
A8			No Data	No Data		No Data	No Data	No Data	
A9			No Data	No Data		No Data	No Data	No Data	
A10			No Data	No Data		No Data	No Data	No Data	
A12			No Data	No Data		No Data	No Data	No Data	
A13			No Data	No Data		No Data	No Data	No Data	
A17			No Data	No Data		No Data	No Data	No Data	
A18			No Data	No Data		No Data	No Data	No Data	
A19			No Data	No Data		No Data	No Data	No Data	
A20			No Data	No Data		No Data	No Data	No Data	
Cloughton A		5490	1673.4	1498.7	5836	1778.8	1604.2	105.5	
Egton High Moor 1		4222	1286.9	987.2	4494	1369.8	1070.1	82.9	
Eskdale 2		4773	1454.8	1332.0	>5040	No Data	No Data	No Data	
Eskdale 3		5171	1576.1	1562.8	>5500	No Data	No Data	No Data	
Eskdale 4			No Data	No Data		No Data	No Data	No Data	
Eskdale 5		4672	1424.0	1355.7	>5037	No Data	No Data	No Data	
Eskdale 6			No Data	No Data		No Data	No Data	No Data	
Eskdale 7			No Data	No Data		No Data	No Data	No Data	
Eskdale 8			No Data	No Data		No Data	No Data	No Data	
Eskdale 11			No Data	No Data		No Data	No Data	No Data	
Eskdale 12		4878	1486.8	1381.7	5272	1606.9	1501.7	120.1	
Fordon 1		6934	2113.5	1982.7	7020	2139.7	2008.9	26.2	base approximate
Fordon 2		6602	2012.3	1944.6	6818	2078.1	2010.4	65.8	
Hunmanby 1		6830	2081.8	2001.0	7124	2171.4	2090.6	89.6	
Lockton 2A		1733.0	1733.0	1492.8	1932.0	1932.0	1691.8	199.0	
Lockton 3		5426	1653.8	1531.2	6130	1868.4	1745.7	214.6	
Lockton 4		5700	1737.4	#VALUE!	6270	1911.1	#VALUE!	#VALUE!	
Lockton 5		6048	1843.4	1611.9	6205	1891.3	1659.8	47.9	
Lockton 7		5777	1760.8	1535.8	6750	2057.4	1832.4	296.6	
Lockton 8		5912	1802.0	1552.7		No Data	No Data	No Data	
Lockton East No. 1		1658	1658.0	1574.7	1770	1770.0	1686.7	112.0	
Newton Mulgrave 1		1723.9	1723.9	1506.0	1745.9	1745.9	1528.0	22.0	
Robin Hoods Bay/Fison 1		4735	1443.2	1381.4	4995	1522.5	1460.7	79.2	
S1		4240	1292.4	1223.7	4610	1405.1	1336.5	112.8	
S3			No Data	No Data		No Data	No Data	No Data	
S5			No Data	No Data		No Data	No Data	No Data	
S6			No Data	No Data		No Data	No Data	No Data	
S10			No Data	No Data		No Data	No Data	No Data	
S11			No Data	No Data		No Data	No Data	No Data	
S13			No Data	No Data		No Data	No Data	No Data	
S20			No Data	No Data		No Data	No Data	No Data	
Stoupe Beck 1		1492.9	1492.9	1439.7	1576	1576.0	1522.8	83.1	
WP1			No Data	No Data		No Data	No Data	No Data	
WP2			No Data	No Data		No Data	No Data	No Data	
WP3			No Data	No Data		No Data	No Data	No Data	
Wykeham No 1		5564.0	1695.9	1474.0	6301.0	1920.5	1698.6	224.6	
YP1			No Data	No Data		No Data	No Data	No Data	
YP2			No Data	No Data		No Data	No Data	No Data	
YP3			No Data	No Data		No Data	No Data	No Data	
YP4			No Data	No Data		No Data	No Data	No Data	
YP5			No Data	No Data		No Data	No Data	No Data	
YP6			No Data	No Data		No Data	No Data	No Data	
YP7			No Data	No Data		No Data	No Data	No Data	
YP8			No Data	No Data		No Data	No Data	No Data	
YP 10			No Data	No Data		No Data	No Data	No Data	
YP 10 DIVERSION			No Data	No Data		No Data	No Data	No Data	
YP 11			No Data	No Data		No Data	No Data	No Data	
YP12			No Data	No Data		No Data	No Data	No Data	
YP13			No Data	No Data		No Data	No Data	No Data	
YP14		5492	1674.0	1537.2	>5524	No Data	No Data	No Data	
FISONS 4			No Data	No Data		No Data	No Data	No Data	
FISONS 2			No Data	No Data		No Data	No Data	No Data	
FISONS 3			No Data	No Data		No Data	No Data	No Data	
41/14-1		6092.0	1856.8	1822.4	6257.0	1907.1	1872.7	50.3	
41/18-1		4940	1505.7	1474.3	5236	1595.9	1564.5	90.2	
41/24A-1		5376.0	1638.6	1605.4	5660.0	1725.2	1691.9	86.6	base unsure
41/24A-2		1678.0	1678.0	1643.0	1738.0	1738.0	1703.0	60.0	
41/25-A1		5410.0	1649.0	1614.5	5550.0	1691.6	1657.2	42.7	

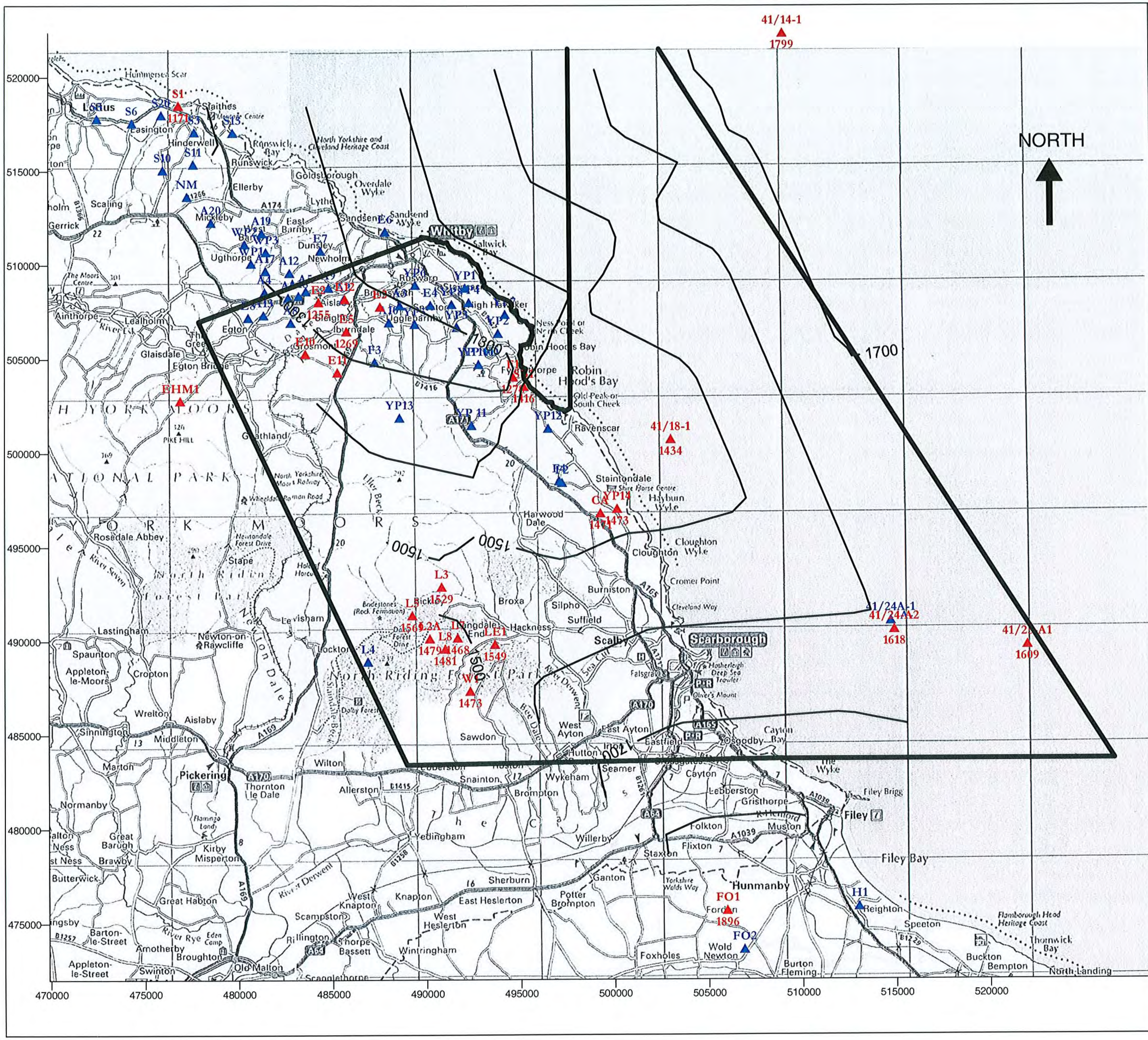
Well Number or name	Hayton Anhydrite=A1	Top (data)	Top (m)	Top (mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1			No Data	No Data		No Data	No Data	No Data	
A2			No Data	No Data		No Data	No Data	No Data	
A3			No Data	No Data		No Data	No Data	No Data	
A4			No Data	No Data		No Data	No Data	No Data	
A5			No Data	No Data		No Data	No Data	No Data	
A8			No Data	No Data		No Data	No Data	No Data	
A9			No Data	No Data		No Data	No Data	No Data	
A10			No Data	No Data		No Data	No Data	No Data	
A12			No Data	No Data		No Data	No Data	No Data	
A13			No Data	No Data		No Data	No Data	No Data	
A17			No Data	No Data		No Data	No Data	No Data	
A18			No Data	No Data		No Data	No Data	No Data	
A19			No Data	No Data		No Data	No Data	No Data	
A20			No Data	No Data		No Data	No Data	No Data	
Cloughton A		5836	1778.8	1604.2	5909	1801.1	1626.4	22.3	
Egton High Moor 1		4494	1369.8	1070.1	5072	1545.9	1246.3	176.2	
Eskdale 2			No Data	No Data		No Data	No Data	No Data	
Eskdale 3			No Data	No Data		No Data	No Data	No Data	
Eskdale 4			No Data	No Data		No Data	No Data	No Data	
Eskdale 5			No Data	No Data		No Data	No Data	No Data	
Eskdale 6			No Data	No Data		No Data	No Data	No Data	
Eskdale 7			No Data	No Data		No Data	No Data	No Data	
Eskdale 8			No Data	No Data		No Data	No Data	No Data	
Eskdale 11			No Data	No Data		No Data	No Data	No Data	
Eskdale 12		5272	1606.9	1501.7	5362	1634.3	1529.2	27.4	bands anhyd. and dol.
Fordon 1		7020	2139.7	2008.9	7080	2158.0	2027.2	18.3	approximate
Fordon 2		6818	2078.1	2010.4	6870	2094.0	2026.3	15.8	
Hunmanby 1			No Data	No Data		No Data	No Data	No Data	not recognized
Lockton 2A		1932	1932.0	1691.8	1961	1961.0	1720.8	29.0	
Lockton 3		6130	1868.4	1745.7	6212	1893.4	1770.7	25.0	top contact uncertain
Lockton 4		6270	1911.1	#VALUE!	6470	1972.1	#VALUE!	#VALUE!	
Lockton 5			No Data	No Data		No Data	No Data	No Data	
Lockton 7		6750	2057.4	1832.4	6843	2085.7	1860.7	28.3	
Lockton 8			No Data	No Data		No Data	No Data	No Data	
Lockton East No. 1		1770	1770.0	1686.7		No Data	No Data	No Data	base not known
Newton Mulgrave 1		1723.9	1723.9	1506.0	1745.9	1745.9	1528.0	22.0	
Robin Hoods Bay/Fison 1		4995	1522.5	1460.7	5085	1549.9	1488.1	27.4	
S1		4610	1405.1	1336.5	4850	1478.3	1409.6	73.2	estimated from gamma/sonic logs
S3			No Data	No Data		No Data	No Data	No Data	
S5			No Data	No Data		No Data	No Data	No Data	
S6			No Data	No Data		No Data	No Data	No Data	
S10			No Data	No Data		No Data	No Data	No Data	
S11			No Data	No Data		No Data	No Data	No Data	
S13			No Data	No Data		No Data	No Data	No Data	
S20			No Data	No Data		No Data	No Data	No Data	
Stoupe Beck 1		1576	1576.0	1522.8	1602	1602.0	1548.8	26.0	banded
WP1			No Data	No Data		No Data	No Data	No Data	
WP2			No Data	No Data		No Data	No Data	No Data	
WP3			No Data	No Data		No Data	No Data	No Data	
Wykeham No 1		6301	1920.5	1698.6	6403	1951.6	1729.7	31.1	
YP1			No Data	No Data		No Data	No Data	No Data	
YP2			No Data	No Data		No Data	No Data	No Data	
YP3			No Data	No Data		No Data	No Data	No Data	
YP4			No Data	No Data		No Data	No Data	No Data	
YP5			No Data	No Data		No Data	No Data	No Data	
YP6			No Data	No Data		No Data	No Data	No Data	
YP7			No Data	No Data		No Data	No Data	No Data	
YP8			No Data	No Data		No Data	No Data	No Data	
YP 10			No Data	No Data		No Data	No Data	No Data	
YP 10 DIVERSION			No Data	No Data		No Data	No Data	No Data	
YP 11			No Data	No Data		No Data	No Data	No Data	
YP12			No Data	No Data		No Data	No Data	No Data	
YP13			No Data	No Data		No Data	No Data	No Data	
YP14			No Data	No Data		No Data	No Data	No Data	
FISONS 4			No Data	No Data		No Data	No Data	No Data	
FISONS 2			No Data	No Data		No Data	No Data	No Data	
FISONS 3			No Data	No Data		No Data	No Data	No Data	
41/14-1		6257	1907.1	1872.7	6332	1930.0	1895.6	22.9	anhydr. + dol.
41/18-1		5236	1595.9	1564.5	5247	1599.3	1567.9	3.4	limestone interbeds
41/24A-1		5660	1725.2	1691.9	5690	1734.3	1701.1	9.1	anhydr. patches
41/24A-2		1738	1738.0	1703.0	1758	1758.0	1723.0	20.0	anhydr. patches
41/25-A1		5550	1691.6	1657.2	5619	1712.7	1678.2	21.0	

Well Number or name	Cadeby Formation=Ca1	Top (data)	Top (m)	Top (level mBOD)	Base (data)	Base (m)	Base (mBOD)	Thickness (m)	Notes
A1			No Data	No Data		No Data	No Data	No Data	
A2			No Data	No Data		No Data	No Data	No Data	
A3			No Data	No Data		No Data	No Data	No Data	
A4			No Data	No Data		No Data	No Data	No Data	
A5			No Data	No Data		No Data	No Data	No Data	
A8			No Data	No Data		No Data	No Data	No Data	
A9			No Data	No Data		No Data	No Data	No Data	
A10			No Data	No Data		No Data	No Data	No Data	
A12			No Data	No Data		No Data	No Data	No Data	
A13			No Data	No Data		No Data	No Data	No Data	
A17			No Data	No Data		No Data	No Data	No Data	
A18			No Data	No Data		No Data	No Data	No Data	
A19			No Data	No Data		No Data	No Data	No Data	
A20			No Data	No Data		No Data	No Data	No Data	
Cloughton A		5909	1801.1	1626.4	>5904	No Data	No Data	No Data	
Egton High Moor 1		5072	1545.9	1246.3	5223	1592.0	1292.3	46.0	
Eskdale 2			No Data	No Data		No Data	No Data	No Data	
Eskdale 3			No Data	No Data		No Data	No Data	No Data	
Eskdale 4			No Data	No Data		No Data	No Data	No Data	
Eskdale 5			No Data	No Data		No Data	No Data	No Data	
Eskdale 6			No Data	No Data		No Data	No Data	No Data	
Eskdale 7			No Data	No Data		No Data	No Data	No Data	
Eskdale 8			No Data	No Data		No Data	No Data	No Data	
Eskdale 11			No Data	No Data		No Data	No Data	No Data	
Eskdale 12		5362	1634.3	1529.2	5512	1680.1	1574.9	45.7	
Fordon 1		7080	2158.0	2027.2	7115	2168.7	2037.9	10.7	
Fordon 2		6870	2094.0	2026.3	6940	2115.3	2047.6	21.3	
Hunmanby 1		7124	2171.4	2090.6	7199	2194.3	2113.5	22.9	(no MS or Basal Sand?)
Lockton 2A		1961	1961.0	1720.8	No Data	No Data	No Data	No Data	
Lockton 3		6212	1893.4	1770.7	6290	1917.2	1794.5	23.8	
Lockton 4		6470	1972.1	#VALUE!	6546	1995.2	#VALUE!	#VALUE!	
Lockton 5			No Data	No Data		No Data	No Data	No Data	
Lockton 7		6843	2085.7	1860.7	6916	2108.0	1883.0	22.3	
Lockton 8			No Data	No Data		No Data	No Data	No Data	
Lockton East No. 1			No Data	No Data		No Data	No Data	No Data	
Newton Mulgrave 1		1723.9	1723.9	1506.0	1745.9	1745.9	1528.0	22.0	
Robin Hoods Bay/Fison 1		5085	1549.9	1488.1	5173	1576.7	1514.9	26.8	
S1		4610	1405.1	1336.5	4850	1478.3	1409.6	73.2	
S3			No Data	No Data		No Data	No Data	No Data	
S5			No Data	No Data		No Data	No Data	No Data	
S6			No Data	No Data		No Data	No Data	No Data	
S10			No Data	No Data		No Data	No Data	No Data	
S11			No Data	No Data		No Data	No Data	No Data	
S13			No Data	No Data		No Data	No Data	No Data	
S20			No Data	No Data		No Data	No Data	No Data	
Stoupe Beck 1		1602	1602.0	1548.8	1619.5	1619.5	1566.3	17.5	
WP1			No Data	No Data		No Data	No Data	No Data	
WP2			No Data	No Data		No Data	No Data	No Data	
WP3			No Data	No Data		No Data	No Data	No Data	
Wykeham No 1		6403	1951.6	1729.7	6466.0	1970.8	1748.9	19.2	
YP1			No Data	No Data		No Data	No Data	No Data	
YP2			No Data	No Data		No Data	No Data	No Data	
YP3			No Data	No Data		No Data	No Data	No Data	
YP4			No Data	No Data		No Data	No Data	No Data	
YP5			No Data	No Data		No Data	No Data	No Data	
YP6			No Data	No Data		No Data	No Data	No Data	
YP7			No Data	No Data		No Data	No Data	No Data	
YP8			No Data	No Data		No Data	No Data	No Data	
YP 10			No Data	No Data		No Data	No Data	No Data	
YP 10 DIVERSION			No Data	No Data		No Data	No Data	No Data	
YP 11			No Data	No Data		No Data	No Data	No Data	
YP12			No Data	No Data		No Data	No Data	No Data	
YP13			No Data	No Data		No Data	No Data	No Data	
YP14			No Data	No Data		No Data	No Data	No Data	
FISONS 4			No Data	No Data		No Data	No Data	No Data	
FISONS 2			No Data	No Data		No Data	No Data	No Data	
FISONS 3			No Data	No Data		No Data	No Data	No Data	
41/14-1		6332	1930.0	1895.6	6367.0	1940.7	1906.2	10.7	
41/18-1		5247	1599.3	1567.9	5290	1612.4	1581.0	13.1	
41/24A-1		5690	1734.3	1701.1	5750.0	1752.6	1719.4	18.3	
41/24A-2		1758	1758.0	1723.0	1768.0	1768.0	1733.0	10.0	
41/25-A1		5619	1712.7	1678.2	5650.0	1722.1	1687.7	9.4	cored

Well Number or name	Top of Carboniferous (BoP)	Depth (data)	Depth (m)	Depth (mBOD)	Na4 plus A4	Thickness (m)	Note	Na3 plus A3	Thickness (m)	Note
A1			No Data	No Data		51.2			No Data	TD in halite
A2			No Data	No Data		35.5			No Data	
A3			No Data	No Data		81.2			No Data	TD in halite
A4			No Data	No Data		38.1			57.0	
A5			No Data	No Data		54.9			No Data	TD in halite
A8			No Data	No Data		45.4			No Data	TD in halite
A9			No Data	No Data		57.8			No Data	TD in halite
A10			No Data	No Data		52.9			No Data	TD in halite
A12			No Data	No Data		70.7			No Data	TD in halite
A13			No Data	No Data		34.4			64.1	
A17			No Data	No Data		No Data	faulted out		No Data	faulted
A18			No Data	No Data		6.2			0.0	
A19			No Data	No Data		43.9			No Data	TD in halite
A20			No Data	No Data		36.6			No Data	TD in halite
Cloughton A			No Data	No Data		36.9			41.5	
Egton High Moor 1		5223	1592.0	1292.3		36.9			45.4	
Eskdale 2			No Data	No Data		62.5			99.7	
Eskdale 3			No Data	No Data		47.2			116.7	
Eskdale 4			No Data	No Data		43.3			72.8	
Eskdale 5			No Data	No Data		49.7			70.4	
Eskdale 6			No Data	No Data		62.8			No Data	TD in anhydrite
Eskdale 7			No Data	No Data		46.9			67.1	
Eskdale 8			No Data	No Data		34.4			48.7	
Eskdale 11			No Data	No Data		58.5			67.7	
Eskdale 12		5542	1689.2	1584.0		31.1			39.3	
Fordon 1		7135	2174.7	2044.0		47.9			49.1	
Fordon 2		6940	2115.3	2047.6		52.7			38.7	
Hunmanby 1		7199	2194.3	2113.5		52.7			23.2	
Lockton 2A			No Data	No Data		23.5	halite only		55.0	halite only
Lockton 3		6296	1919.0	1796.3		112.5			56.1	
Lockton 4			No Data	No Data		0.0			0.0	
Lockton 5			No Data	No Data		43.3			51.5	
Lockton 7		6925	2110.7	1885.7		20.7	halite only		49.7	
Lockton 8			No Data	No Data		54.9			56.1	
Lockton East No. 1			No Data	No Data		44.0			37.0	
Newton Mulgrave 1		1745.9	1745.9	1528.0		35.9			68.3	
Robin Hoods Bay/Fison 1		5196	1583.7	1521.9		53.0			58.8	
S1		4914	1497.8	1429.1		51.8			68.9	
S3			No Data	No Data		47.9			No Data	TD in anhydrite
S5			No Data	No Data		32.6			No Data	TD in anhydrite
S6			No Data	No Data		41.5			65.2	
S10			No Data	No Data		39.3			No Data	TD in anhydrite
S11			No Data	No Data		37.5			No Data	TD in halite
S13			No Data	No Data		29.9			69.2	
S20			No Data	No Data		38.4			59.7	
Stoupe Beck 1		1620.5	1620.5	1567.3		56.6			60.4	
WP1			No Data	No Data		98.1			0.0	sylvite 18.8 m @ 26% KCl; incl. Halite band 1465-1469 TD in Halite
WP2			No Data	No Data		35.0			No Data	TP in anhydrite
WP3			No Data	No Data		41.6			No Data	TD in halite
Wykeham No 1		6486.0	1976.9	1755.0		41.5			57.3	Gamma, sonic, density and caliper logs; concern whether gamma log is under reading in sylvite
YP1			No Data	No Data		6.0			0.0	
YP2			No Data	No Data		51.2			0.0	
YP3			No Data	No Data		9.9			0.0	
YP4			No Data	No Data		47.0			0.0	
YP5			No Data	No Data		8.8			0.0	
YP6			No Data	No Data		4.7			0.0	
YP7			No Data	No Data		53.6			0.0	
YP8			No Data	No Data		53.3			No Data	
YP 10			No Data	No Data		50.6			No Data	
YP 10 DIVERSION			No Data	No Data		50.0			No Data	
YP 11			No Data	No Data		43.6			No Data	
YP12			No Data	No Data		50.6			No Data	
YP13			No Data	No Data		#VALUE!			0.0	
YP14			No Data	No Data		43.3			56.7	
FISONS 4			No Data	No Data		40.4			37.2	
FISONS 2			No Data	No Data		49.8			0.0	
FISONS 3			No Data	No Data		51.7			0.0	
41/14-1		6477.0	1974.2	1939.7		65.5			60.0	
41/18-1		5307	1617.6	1586.2		57.9			48.8	
41/24A-1		5752.0	1753.2	1720.0		64.0			25.3	
41/24A-2		1797.0	1797.0	1762.0		55.5			22.0	
41/25-A1		5744.0	1750.8	1716.3		100.0			43.3	

A P P E N D I X 2

DATABASE PLOTS FOR SELECTED HORIZONS



NOTES

▲ ALL BOREHOLES ANALYSED

▲ THOSE BOREHOLES INTERSECTING POLYHALITE HORIZON

NOTE - CONTOURS DISREGARD FAULTING AND ARE ONLY ILLUSTRATIVE OF STRUCTURE

CLIENT

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Environmental and Geological Consultants

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TECHNICAL REPORT
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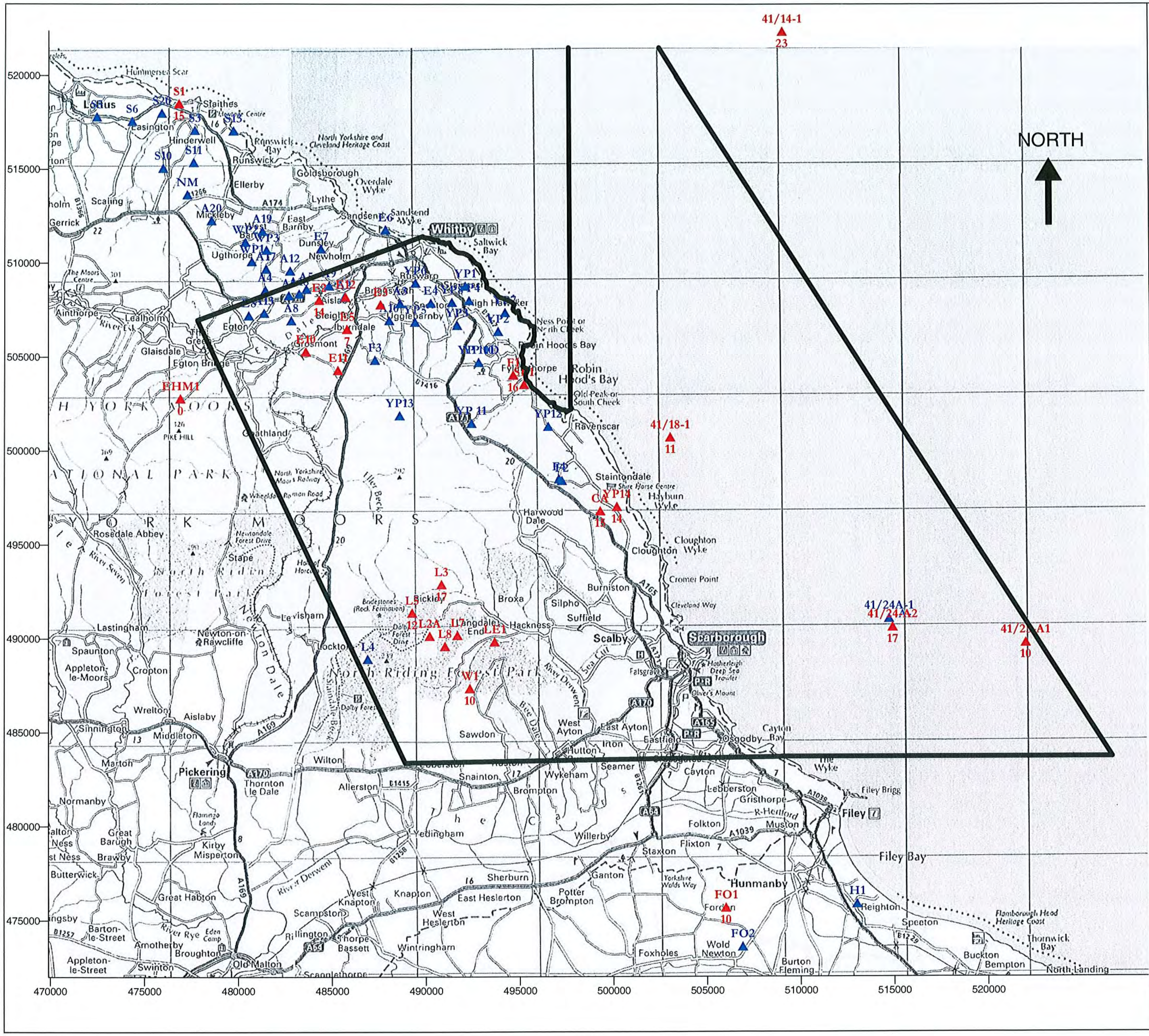
PROJECT FORTY

DRAWING TITLE

FIGURE A2.1
CONTOURS ON BASE OF POLYHALITE HORIZON (mBOD)

STATUS		
DRAWN BY	DESIGNED BY	DATE
SCALE APPROX 1:200,000	DRG. No.	REV.



NOTES

- ▲ ALL BOREHOLES ANALYSED
- ▲ THOSE BOREHOLES INTERSECTING POLYHALITE HORIZON

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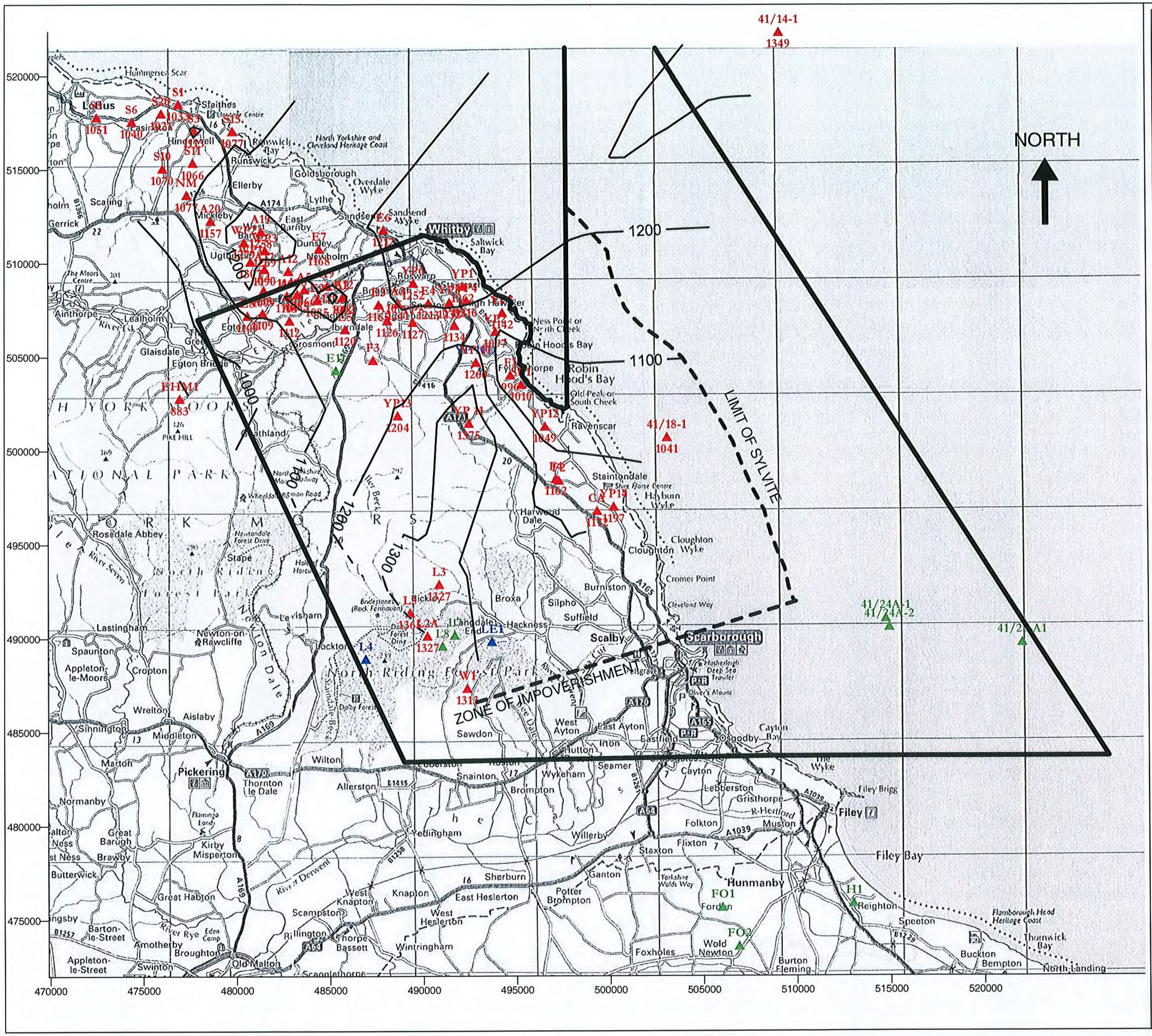
FIGURE A2.2
THICKNESS OF POLYHALITE (m)

STATUS

DRAWN BY	DESIGNED BY	DATE

SCALE	DRG. No.	REV.
APPROX 1:200,000		



NOTES

- ▲ NO DATA AVAILABLE (blue)
- ▲ BOULBY POTASH PRESENT - DEPTHS IN mBOD (red)
- ▲ BOULBY POTASH NOT PRESENT (green)

NOTE - CONTOURS DISREGARD FAULTING AND ARE ONLY ILLUSTRATIVE OF STRUCTURE

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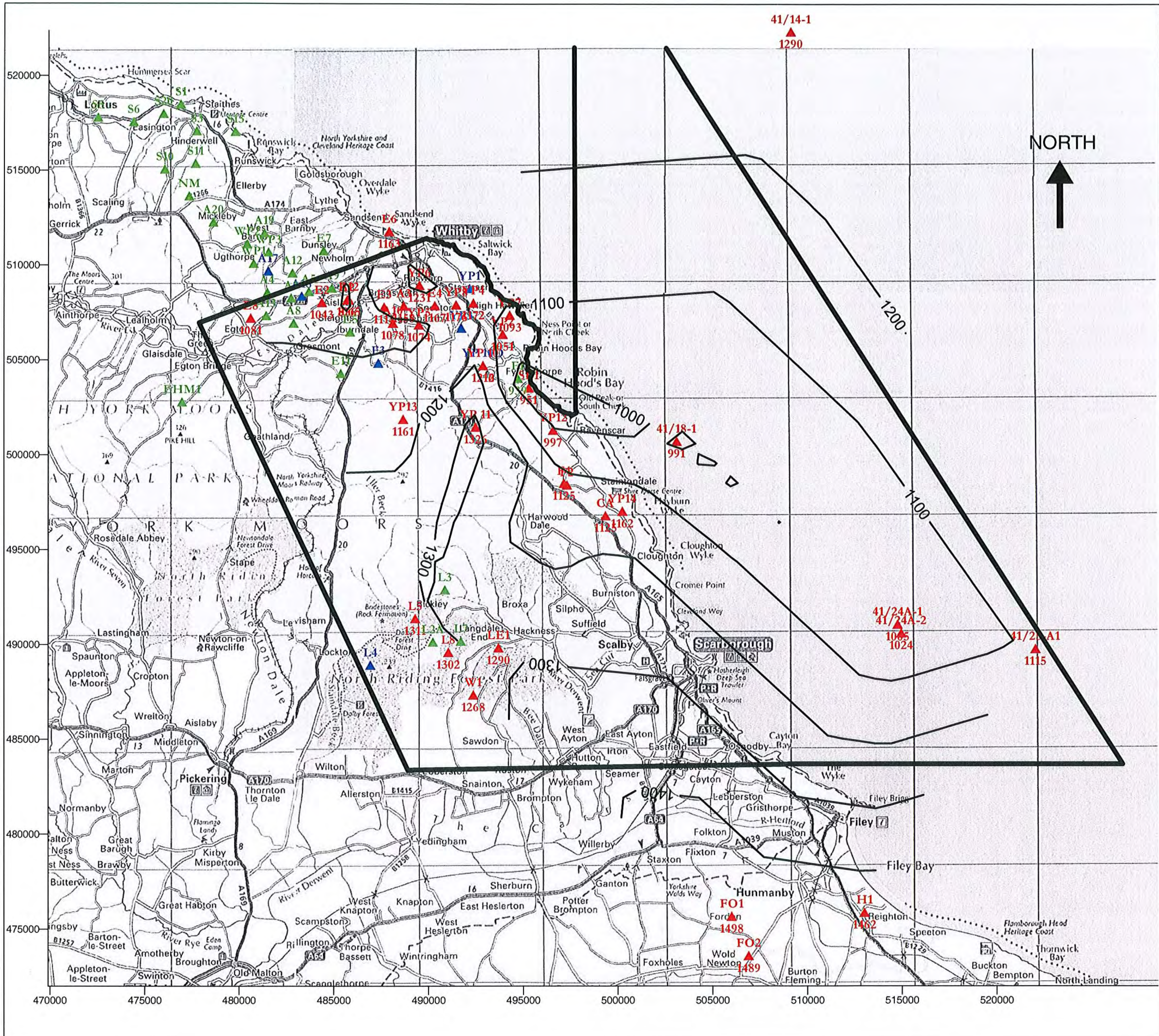
FIGURE A2.3
CONTOURS ON BASE OF BOULBY POTASH HORIZON (mBOD)

STATUS

DRAWN BY	DESIGNED BY	DATE

SCALE	DRG. No.	REV.
APPROX 1:200,000		



NOTES

- NO DATA AVAILABLE
- SNEATON POTASH PRESENT - DEPTHS IN mBOD
- SNEATON POTASH NOT PRESENT

NOTE - CONTOURS DISREGARD FAULTING AND ARE ONLY ILLUSTRATIVE OF STRUCTURE

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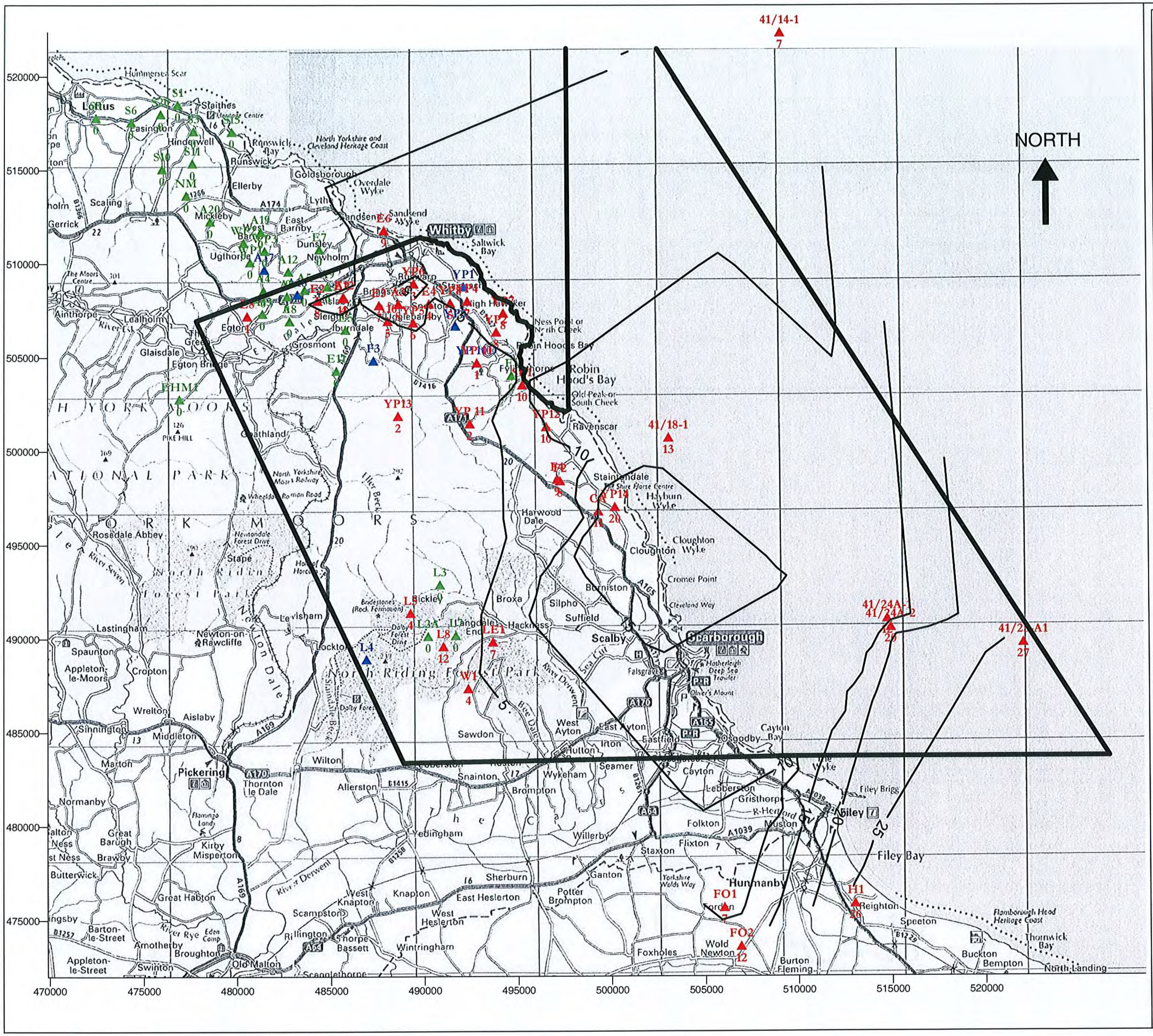
FIGURE A2.4
CONTOURS ON BASE OF SNEATON POTASH HORIZON (mBOD)

STATUS		
DRAWN BY	DESIGNED BY	DATE
SCALE APPROX 1:200,000	DRG. No.	REV.



NOTES

▲ NO DATA AVAILABLE

▲ SNEATON POTASH PRESENT - THICKNESS IN m

▲ SNEATON POTASH NOT PRESENT

NOTE - ISOPACHS DISREGARD FAULTING AND ARE ONLY ILLUSTRATIVE OF STRUCTURE

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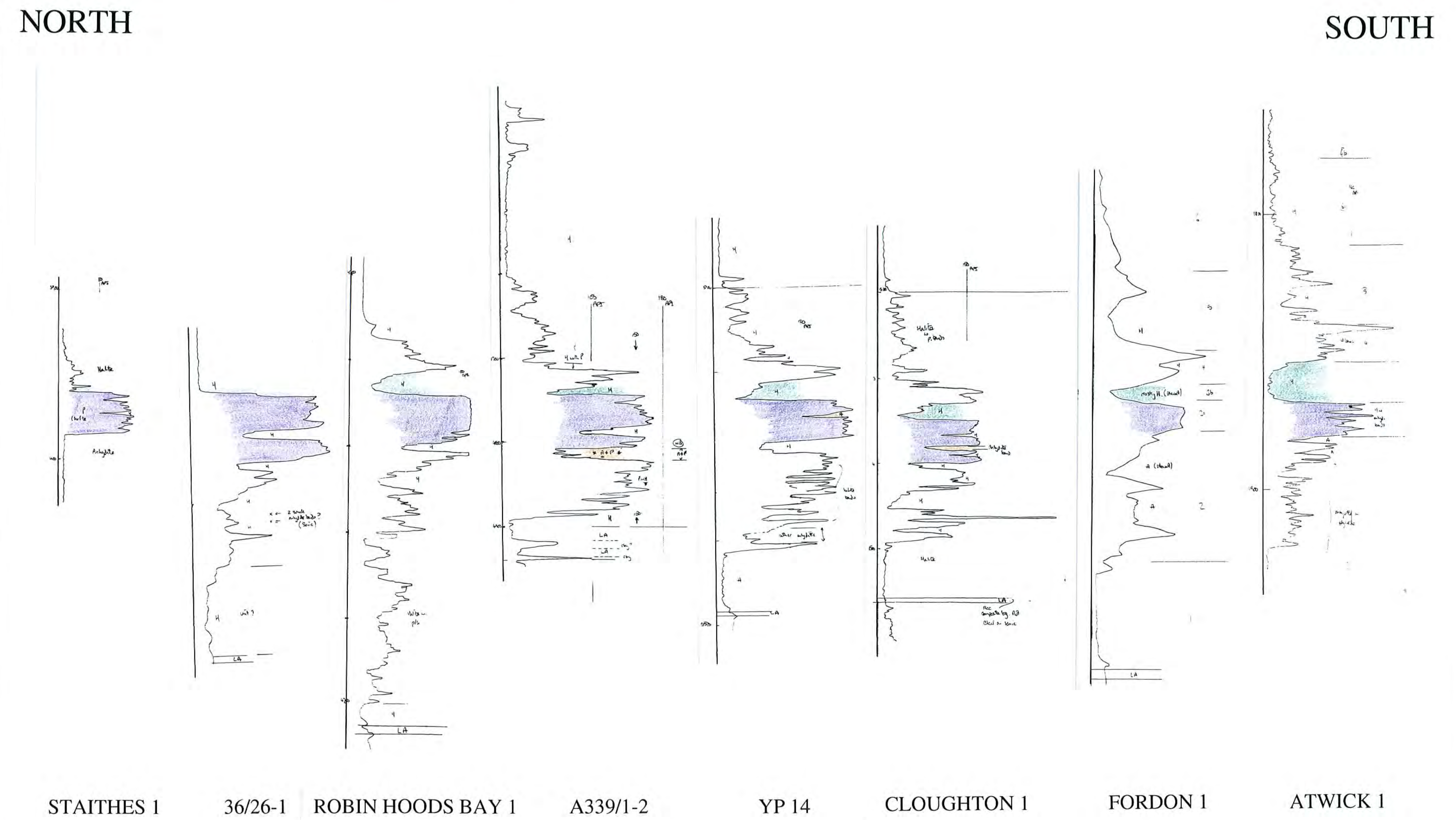
FIGURE A2.5
THICKNESS OF SNEATON POTASH(m)

STATUS

DRAWN BY	DESIGNED BY	DATE
SCALE APPROX 1:200,000	DRG. No.	REV.

APPENDIX 3

TYPICAL GAMMA TRACES OF Z2 POLYHALITE ZONE



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10/01/2011

SCALE

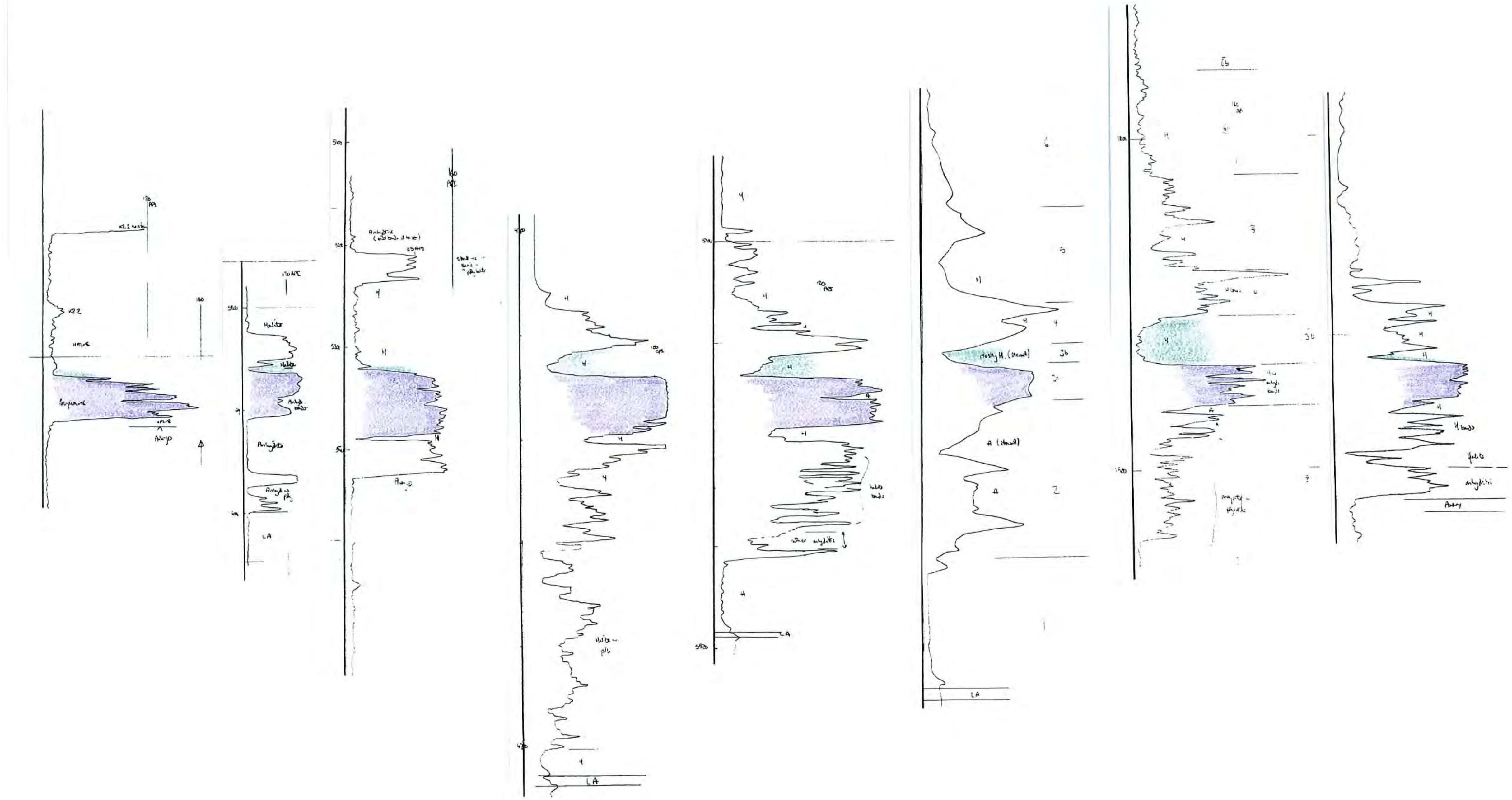
NTS

DRAWING TITLE - FIGURE A3.1

GAMMA RAY LOGS OF POLYHALITE INTERSECTIONS: ARRANGED NORTH - SOUTH

WEST

EAST

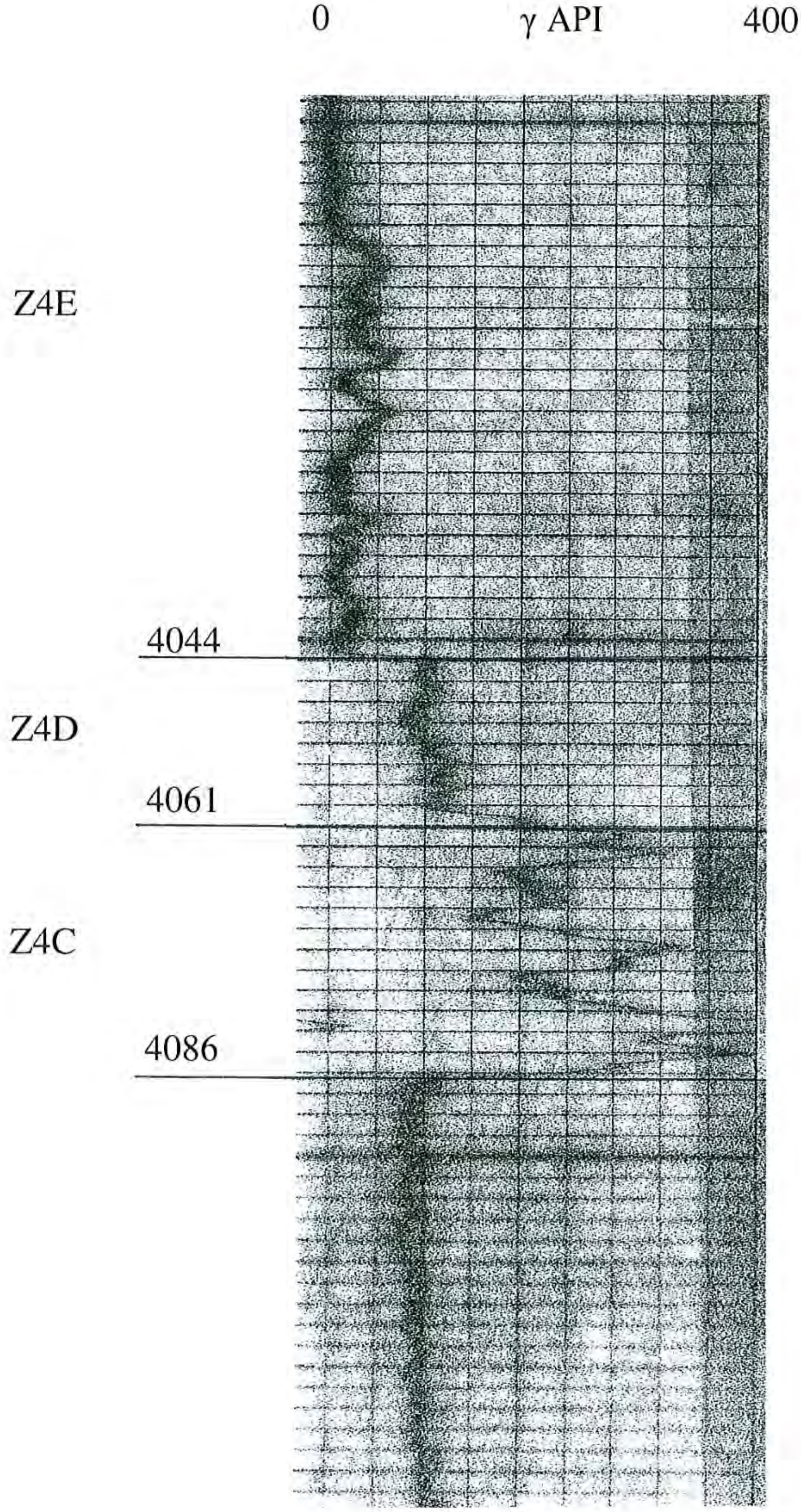


WYKEHAM 1 LOCKTON 5 LOCKTON 3 ROBIN HOODS BAY 1 YP 14 FORDON 1 ATWICK 1 41/25a-1

FWS CONSULTANTS LTD *Environmental and Geological Consultants* Merrington House, Merrington Lane Industrial Estate, Spennymoor, Co Durham. DL16 7UT Tel: 01388 420633 Fax: 01388 819705 www.fwsconsultants.com	JOB TITLE TECHNICAL REPORT PROJECT STATUS – JANUARY 2011 PROJECT 40	CLIENT YORK POTASH LTD	DATE 10/01/2011 SCALE NTS	DRAWING TITLE - FIGURE A3.2 GAMMA RAY LOGS OF POLYHALITE INTERSECTIONS: ARRANGED WEST - EAST

APPENDIX 4

TYPICAL WIRELINE RESPONSES IN Z3 AND Z4 SYLVINITES



γ scale 0 to 400 API units, depth in feet

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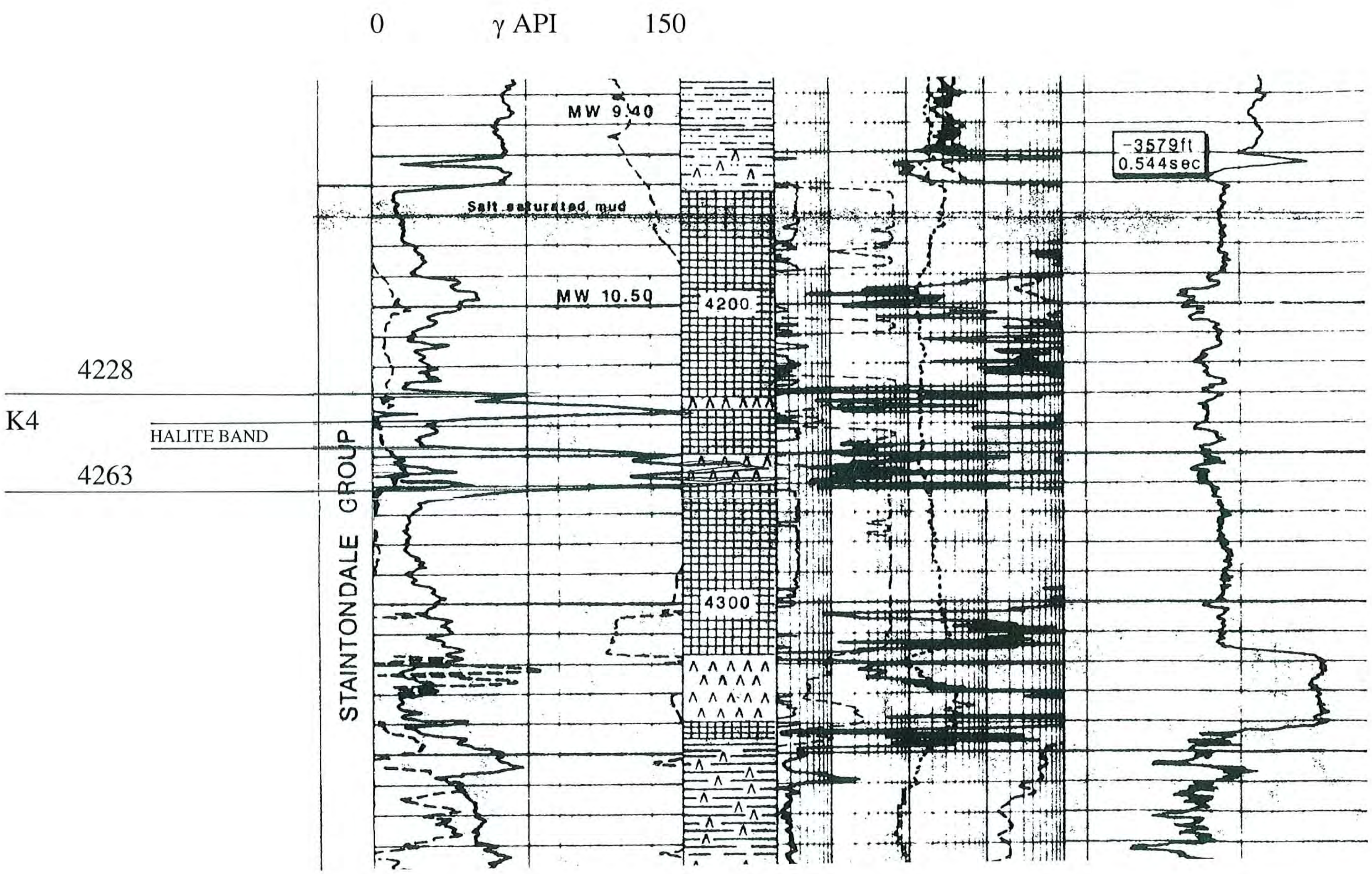
JOB TITLE TECHNICAL REPORT PROJECT STATUS – JANUARY 2011 PROJECT 40	DRAWING TITLE - FIGURE A4.1 A3 WELL LOG THROUGH K4 SNEATON POTASH
CLIENT YORK POTASH LTD	SCALE: NA — DATE: 10/01/2011



γ scale 0 to 150 API units, depth in feet

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DRAWING TITLE - FIGURE A4.2

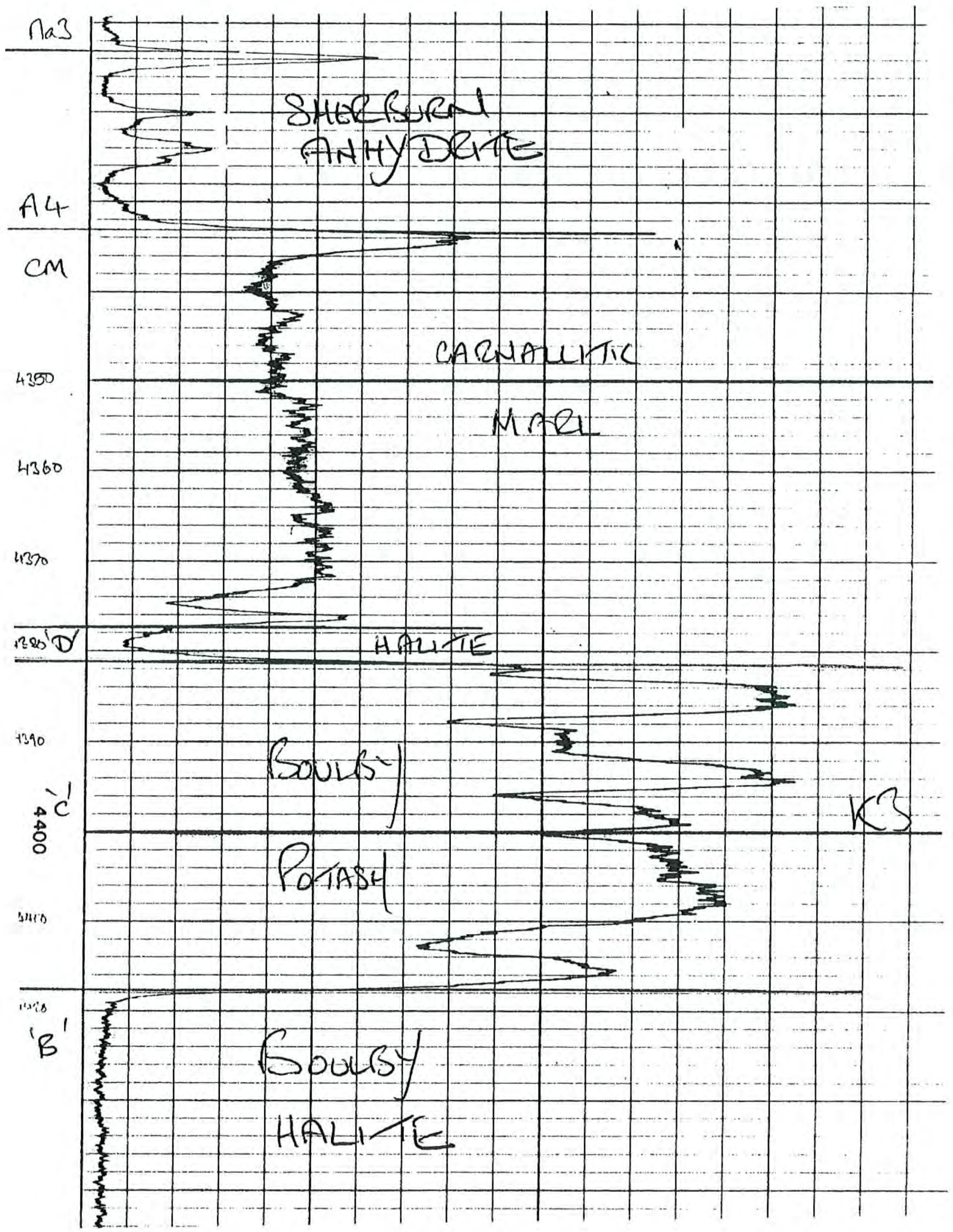
CLOUGHTON 'A' WELL LOG
THROUGH K4 SNEATON POTASH

SCALE

NA

DATE

10/01/2011



γ scale 0 to 544 API units, depth in feet

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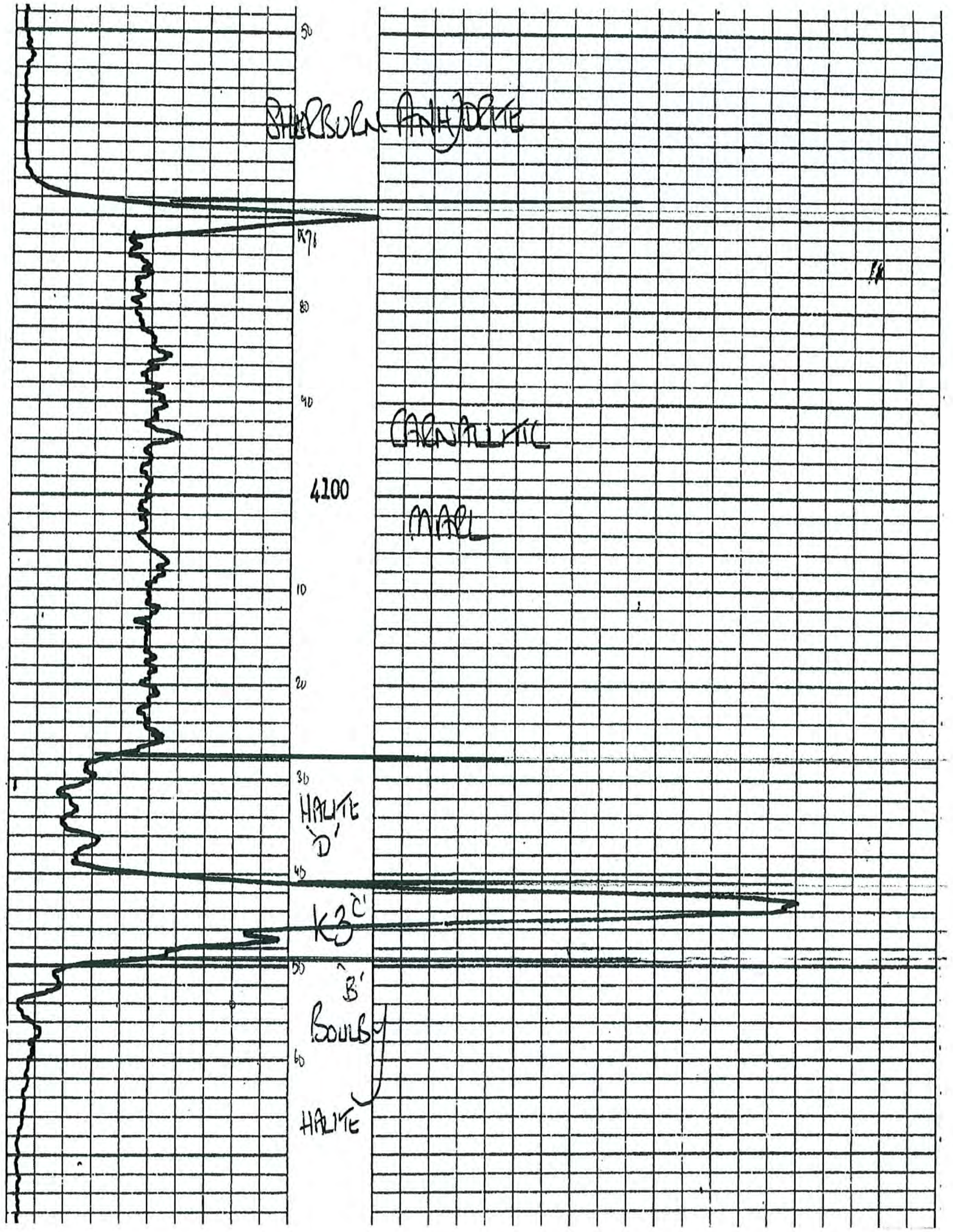
DRAWING TITLE - FIGURE A4.3

BOULBY POTASH GAMMA RAY SIGNATURE ARMOUR 1 (11.6 m @ 61% KCl) – TYPICAL OF THICK SEAM, HIGH GRADE

SCALE	DATE
NA	10/01/2011



γ scale 0 to 600 CPS units, depth in feet

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DRAWING TITLE - FIGURE A4.4

BOULBY POTASH GAMMA RAY SIGNATURE YP 10 – TYPICAL OF THIN SEAM, HIGH GRADE

SCALE	DATE
NA	10/01/2011

APPENDIX 5

QUALIFIED PERSONS AND AREAS OF RESPONSIBILITY

APPENDIX: 5

QUALIFIED PERSONS AND AREAS OF RESPONSIBILITY

The principal author of this report is Dr Frederick W Smith FIMMM., CEng, CSci. He has been supported by Eur. Ing. Peter Woods, MIMMM., CEng. (collaboration on Target Tonnage estimates).

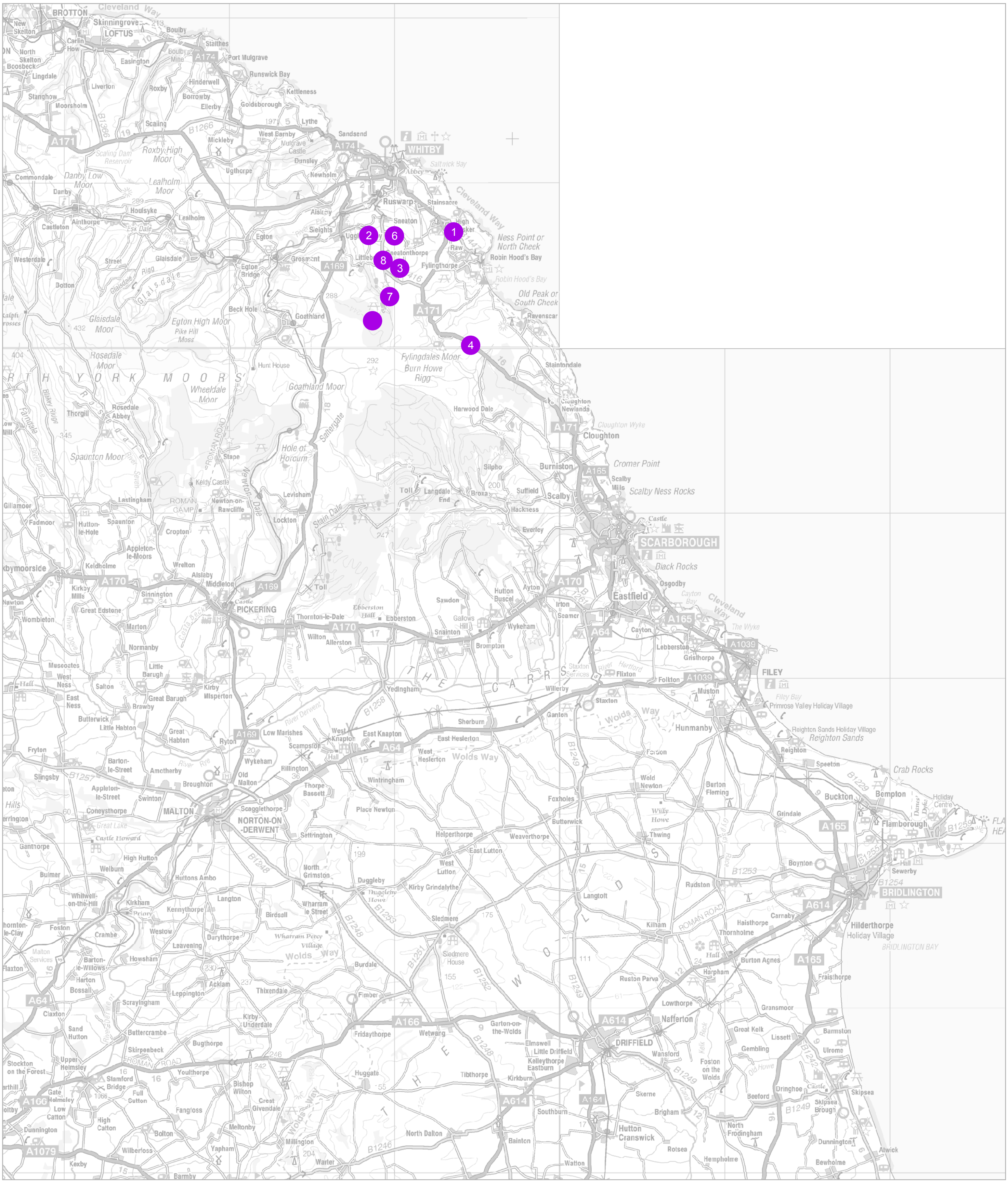
Dr Smith and Peter Woods have been involved with the Project since February 2010, and are fully familiar with (indeed have been closely involved in) the identification of land and mineral owners, and the subsequent negotiation of Agreements over the Contract Areas, in addition to carrying out the geological research and some technical assessment.

Peter Woods, is a potash exploration and mining consultant and an associate of FWS Consultants Ltd. He was Chief Geologist for Cleveland Potash Ltd between 1967 and 1981. This spanned the main phases of borehole and seismic exploration, the Boulby shaft sinking, and the early years of mining (during which the main features of the seam were defined and appropriate mining methods identified). He was responsible for the introduction of the longhole horizontal drilling technique for exploration of the seam and identification of mineable areas. He has authored several, peer-reviewed papers, in the Transactions of the Institution of Mining, Metallurgy, and Economic Geology for example, about the Boulby Potash deposit. Since working for CPL he has gained experience of other potash deposits in Russia, Thailand and Saudi Arabia. His principal input to this report has been discussion of the geology of the Boulby Potash, its lateral variability, the significance of the existing borehole intersections in the York AOI, derivation of the exploration target tonnages for the Boulby Seam, and to the exploration strategy; as well as an overview of the report in its entirety. Peter Woods also has extensive experience of mineral and diamond exploration internationally.

Dr Smith is the Principal of FWS Consultants Ltd (FWSC), a consulting practice that he formed in 1977. Prior to that he had worked within ICI Mond Division for whom he researched and reported on halite resources in North Yorkshire and Cheshire, and regularly visited Boulby Mine in its early years of mining. He has subsequently reported on the Zechstein and Triassic (Röt) evaporites in the Yorkshire Province for potential for leached or mined caverns for storage of gas or for radioactive waste, on the Permian limestones for base metal potential, and the Cleveland Basin as a whole for gas potential. Clients for these projects have included Geostore Ltd, Conoco Phillips, NIREX, Consolidated Goldfields, Amax, and Calor. He also carried out a major study (partly in association with Dr D B Smith), in 1999, of the Zechstein Potash Deposits throughout the Southern North Sea Basin. His experience elsewhere has been largely concerned with industrial minerals, coal, oil and gas exploration, and coal mining, in the UK and overseas. He is currently Vice President of the North of England Institute of Mining and Mechanical Engineers.

Appendix 10

Mapped YPL Borehole Locations



Key

YPL Borehole Locations

YPL Boreholes

1. SM1
2. SM2
3. SM3
4. SM4
5. SM6
6. SM7
7. SM9
8. SM11

Nathaniel Lichfield & Partners
Planning. Design. Economics.

Project	Minehead Alternative Site Assessment
Title	YPL Borehole Locations
Client	York Potash Limited
Date	11.09.2014
Scale	-
Drawn by	CS
Drg. No	GIS50303/04-21

N

GIS Reference: S:\LE5027 - York Potash Minehead\LE50303-0 - York Potash Minehead - YPL Borehole Locations - 11.09.201 .mxd

Appendix 11

FWS Report – Supplementary Geological Report (April 2013)

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SUPPLEMENTARY GEOLOGICAL REPORT WITH RESPECT TO MINEHEAD LOCATION WITHIN NORTH YORK MOORS NATIONAL PARK

CLIENT:

York Potash Ltd
7-10 Manor Court
Manor Garth
SCARBOROUGH
YO11 3TU

1433/April 2013

CONTENTS

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EXECUTIVE SUMMARY

1 The Zechstein deposits contain the only commercially valuable potash resources known in the British Isles. They come onshore – at mineable depth – over a relatively small area of North Yorkshire.

2 The polyhalite deposit in the Zechstein Fordon Evaporites is unique, and has global significance in terms of size and grade. The area in which it occurs at mineable depth is almost entirely within the North York Moors National Park.

3 The current geological model, based on legacy boreholes, recent boreholes, and several phases of acquisition, reprocessing and modelling of legacy and new seismic data, has been presented; and various milestones and decision points in York Potash's polyhalite exploration programme noted.

4 Exploration has shown that high grade polyhalite is present in two different seams that locally overlap in a narrow zone. Most of York's onshore Area of Interest (AOI) is underlain by the Shelf Seam, and the coastal strip and offshore AOI is underlain by Basin Seam.

5 Although similar in grade and thickness, the Shelf Seam is preferred to the other because of the relative absence of halite (both as an impurity, and because of rock strength in a deep mining situation) – and the larger target it presents. The Shelf Seam is York's target.

6 Provings of the Shelf Seam in the area from Boulby southwards to York boreholes SM6, 9 and 9A show that the Shelf Seam is relatively predictable and consistently mineable thickness and grade.

7 Boreholes SM6, 9 and 9A, and legacy Lockton boreholes, in the area further south, show the Shelf Seam prone to splitting, thinning, and low grades; and where the seam roof is often a bed of weak rock salt. Whilst existence of areas of mineable seam in the south of the AOI cannot be discounted, they are unlikely or, at least, will be difficult to locate and prove with sufficiently high level of confidence to warrant investment in a mine. The focus for definition of a mineable resource has fallen inevitably, therefore, on the northern part of the AOI where the Shelf Seam is best and most predictably developed.

8 Within the northern area, seismic and geological modelling has defined a large block (ca. 35 km^2) of thick, high grade, Shelf Seam polyhalite with relatively low fault frequency, bounded by the westerly seam nip-out, the Donovan and Whitby Faults, and the southwards onset of seam deterioration (that coincides, too, with a fault swarm). This constitutes York's conceptual Mining Block. Independent geological auditors are developing a Resource Model within this Mining Block, that is sufficiently robust to support the necessary investment.

9 A minehead site has been identified at Dove's Nest, within the Mining Block, at a fault-free location that allows underground development in all directions, and thereby facilitates maximum recovery of the resource, maximizes mine-life, and minimizes risk of mine stoppages due to localized conditions unforeseen from surface drilling.

10 As part of the site selection process, with respect particularly to the Major Development Test (MDT), four alternative sites have been considered outside the Park (and hence outside the relatively fault-free area of thick high grade polyhalite). Each has been

reviewed geologically. Each has significant problems that can be summarized as follows:-

a) Whitby Enclave
   - Certainty of faults affecting shaft-sinking and mining.
   - Small accessible Shelf Seam resource, bounded by major fault obstacles or mineral ownership boundary.
   - Unacceptable risk of geological problems and very few options for mine development away from unforeseen trouble areas.

b) Whitby Industrial Estate
   - High risk of faults affecting shaft-sinking and mining.
   - Little or no workable Shelf Seam resource.
   - Small area (only say 2 to 3 km^2) of potentially workable, undisturbed, Basin Seam defined by mineral rights, physical or fault boundaries.
   - Unacceptable risk of geological problems with almost no options for mine development away from unforeseen trouble areas.

c) Cloughton Surrounds
   - Proximity of a major graben fault structure and enhanced risk of minor faults such as low angle shears in low strength layers impacting shaft-sinking.
   - Location exactly at the conjectured eastward limit of Shelf Seam, and within the southern part of the AOI, where the seam is unpredictable and prone to splitting.
   - Location within a roughly 3 km wide zone of Basin Seam that nips-out to the west, and is faulted out to the east – and is also affected (unpredictably) by salt flow adjacent to the Peak Fault Trough. In other words, a small area of potential resource.
   - Bounded to the south by a fault zone.
   - Risk of an igneous dyke cutting the minehead site.
   - Second deepest option (equivalent to virgin rock-temperatures in the order of 54ºC).
   - Unacceptable risk of geological problems, with few options for development away from unforeseen trouble areas; and severe difficulty in exploring the region in sufficient detail to define a robust Resource Model.

d) Vale of Pickering
   - Abundant and severe faulting;
   - Straddles the conjectured western nip-out of the Shelf Seam.
   - Lies in the southern part of the AOI, where Lockton-like unpredictable seam conditions prevail.
   - Proximity to the Corallian aquifer.
   - Unacceptable risk of geological problems with few options to develop away from unforeseen trouble areas.
   - Deepest part of the AOI (i.e. highest costs and rock temperatures).

For these reasons, principally, the four identified out-of-Park options have been rated as geologically unsuitable as minehead sites from which to develop the polyhalite resources. In fact, in each case, we consider it would be impossible to explore and to prove an adequate Resource Model to attract the required investment.

SUPPLEMENTARY GEOLOGICAL REPORT WITH RESPECT TO MINEHEAD LOCATION WITHIN NORTH YORK MOORS NATIONAL PARK

1 INTRODUCTION AND GEOLOGICAL SETTING

1.1 The Fordon Evaporite deposits appear to host the largest resource, by far, of polyhalite in the World. This is a complex potassium-magnesium-calcium sulphate mineral, so contains other plant nutrients in addition to potassium. Although the potassium content of pure polyhalite is lower than in the usual potash ore mineral – sylvite – the additional elements, and their presence as sulphate rather than chloride, redress the balance to a large extent. In addition, the high strength of polyhalite (behaving more like a brittle 'rock', than sylvite does), means that it can be mined more safely, and with a higher percentage of extraction, than one could mine other potash salts at the depths contemplated in Yorkshire.

1.2 The Fordons are part of the Permian 'Zechstein' evaporite sequence, that underlies most of the North Sea, and parts of Northern Europe (Figure 1). The entire sequence can total over a kilometre's thickness of evaporite salts, and is subdivided into several discrete 'cycles' or formations (Figure 2). The Fordon Evaporites are the second oldest cycle (Z2). Potash salts occur in three Zechstein cycles in the UK – but polyhalite is confined to the Fordons, where it occurs in a reasonably well-defined belt say 350 km long, by say 50 km wide. The bulk of this remarkable resource lies offshore beneath the North Sea and out of reach, but it comes onshore UK between Boulby in the north and about Humberside in the south – extending at most about 15 km inland. **The Zechstein evaporites are the <u>only</u> commercial source of potash in the British Isles**, and the only producer is Boulby Mine, in the North York Moors National Park, that has mined sylvite ores from the third Zechstein cycle evaporites, since the early 1970s.

1.3 Figure 3 shows the variation of overall thickness of the Fordon Evaporites. They infilled a vast basinal feature that was originally a sub-Sea Level desert bowl, resembling the Dead Sea Rift Valley, or the Qattara Depression of North Africa, that flooded due to global sea level changes (the Permian being a period of ice ages – with significant sea level fluctuation), and underwent intense evaporation. The margin of the flooded basin was not a straight line, but a rugged coastline with inflexions, wadhis, promontories and offshore islands. The main basin was 300 m or so in depth, and at times the sea level rose to such an extent that it flooded the surrounding hinterland for tens of kilometres, where shallow water (geologically known as – 'shelf' or 'platform') evaporites (mostly anhydrite) and lagoonal limestones were deposited. The rugged basin margin itself – the ancient scarp connecting the shelf hinterland with the basinal deep – is variously known as the basin 'ramp' or 'slope'.

1.4 At the outset of the York project, the Fordon evaporite sequence was well known from the basinal area alone. This is where the minerals had accumulated, mostly, in quite deep water. There is a well-established stratigraphy, defined first by Stewart in 1963 and extended by Colter & Reed in 1980. It can be correlated readily from Atwick in the south, to Whitby in the north, and in hydrocarbon wells for up to 50 km offshore, thus showing that palaeo-conditions within the deep-water basin were reasonably consistent.

A thick, high grade, polyhalite seam lies towards the base of the basinal Fordons – in Colter & Reed's Mineral Units 2 to 4. More details are provided later in this report.

1.5 The basinal facies deposits extend only a short way onshore in Yorkshire. By pure coincidence the old Fordon basin margin was not far removed from the modern coastline. Boreholes drilled onshore, originally for gas exploration, and now for potash exploration, clarify how the Z2 evaporites change in thickness and mineralogy as they are traced west from the deep-water basin, across the old Fordon basin ramp, and into the shallow water shelf and lagoonal deposits of the former Permian hinterland. Another polyhalite seam is found within these shallow water deposits. Stewart believed it correlated with the seam in the basin – but York's boreholes have shown very clearly that the two seams are separate and, at SM2, can even overlap.

Thus, there are two potentially mineable polyhalite seams that locally overlap, but generally occupy separate areas.

1.6 Figure 4 is a schematic of the current geological model that describes the relationship between the two polyhalite seams.

The lower, or Basin Seam, (as seen in onshore boreholes SM1*, Robin Hood's Bay, Stoupe Beck, Cloughton 'A' and YP14; and many more offshore wells) extends westwards until it nips out against the old Fordon basin margin, or ramp.

The upper, or Shelf Seam, is well developed west of the ramp – beyond which it can be traced for up to 7 km further inland before it peters out. It also extends eastwards across the ramp and for a short distance (maybe 1 km east of the ramp-toe) into the basin. The precise nature of its eastern termination is not known. There is an apparently equivalent horizon further east, in the basin, where several metres thickness of low grade kainite (a potassium-magnesium sulphate), kieserite (magnesium sulphate) and sylvite (potassium chloride) often occur in a halite matrix. It is tempting to correlate the two and suggest that the shelf polyhalite passes laterally into this diffuse zone of K-Mg salts, but the details are simply unknown at present.

We have defined, therefore, three depositional zones. The true Fordon Basin, where only the Basin Seam is found in a predominantly halite sequence; the true Fordon Shelf, where only the Shelf Seam is found, in a condensed, predominantly anhydritic, sequence; and a Transition Zone, where the Shelf Seam is also found, and is often thicker than on the true Shelf – and where there is locally overlap with the Basin Seam (Figure 4).

1.7 Figure 5 shows typical borehole sections through the Fordon Evaporite Formation in these three zones and demonstrates the changes in overall thickness and in the mineralogical make-up. Assay data are in Appendix 1. The sections use the contact with the Grauer Salzton, a thin black shale at the base of the Brotherton Formation, as a datum. It is believed to have been deposited across an almost flat seabed – the Fordon Basin relief having been infilled by the Z2 evaporites.

1.8 It is also possible to create notional west to east sections through the legacy and York boreholes, to illustrate again the difference between the three zones – using our borehole database (though note that the boreholes do not fall exactly on west-east lines, they have been projected). The boreholes are plotted roughly in correct sequence, west to east (with respect to position relative to the ramp), but not on any horizontal scale. Borehole locations are shown in Appendix 2.

FOOTNOTE: * Boreholes pre-fixed SM were drilled by York Potash Ltd (Sirius Minerals) and very detailed logs and assays are available, on request. Other boreholes are the so-called "legacy" wells, for which records are of variable age and quality – but, again, the originals and FWSC interpretations are available.

1.9 Figure 6 runs west to east through Eskdale and the main area of York's exploration. The Shelf Polyhalite is absent at Egton High Moor, in the far west; can be traced easily through the old Eskdale wells (despite variable quality of the records), into the Transition Zone proved by York at SM2 where there is localized seam overlap (also suspected at E3), and others where the Basin Seam is absent (e.g. SM3, 7 and 11); and then into the basin at SM1 and Robin Hood's Bay (F1, SB1, and 41/18-1).

1.10 Figure 7 runs west to east through the Lockton Gasfield and Cloughton, and then offshore to 41/18-1. The Shelf Seam is absent in L4, in the far west. It can be traced through the Lockton Series wells where, unlike Eskdale, it is often present as multiple seams – condensing to a single well-developed seam in W1, LE1 and L3. There are no wells proving a Transition Zone – but we have no reason to doubt it exists. Then the boreholes at Cloughton 'A' and YP14 etc prove typical basinal evaporite sequences.

1.11 The break-up of the Shelf Seam appears to be a real southwards regional trend.

Legacy boreholes around Boulby show that only a single, shelf, polyhalite seam is present in the 'far' north. The same situation persists through Eskdale and the main group of York boreholes (SM2, 3, 7 and 11) – though localized anhydrite bands can be present and may presage the southward break-up of the seam.

York boreholes SM6 and SM9, drilled at the southern edge of their recent exploration programme, and at the closest point to the Lockton holes, show a fragmented seam that resembles the Lockton situation.

1.12 Figure 8 shows two sections north to south through the Shelf and locally the Transition Zone, from Boulby to Lockton and demonstrates graphically this southwards fragmentation of the seam at SM6 and 9/9A. We cannot be sure there are no coherent areas of workable polyhalite in the south, but it is clear that – for reasons still not understood – **the better area of Shelf Seam lies north of SM4.**

1.13 The Basin Seam is less well explored in detail. It is a composite seam, within which we can identify beds (usually three in number) of high grade polyhalite separated by thick beds (up to 5 m) of halite (rock salt). The seam continues throughout the region at broadly similar thickness and make-up (in terms of recognizable pattern of banding), but the seam quality data are poor and unreliable. Only SM1, at Robin Hood's Bay has been assayed from core samples. Polyhalite grade elsewhere has been assessed from old archive wireline logs, or analysis of well-cuttings – neither method being reliable. Figure 9 compares the wireline gamma logs of three wells around Robin Hood's Bay (the gamma readings reflecting the potassium content of the rock). The presence of high grade polyhalite is not in doubt – but each high grade bed is banded with halite and occasionally anhydrite. These minor bands vary in thickness and persistence, and much more detailed work is needed to define consistently mineable horizons. **This issue, plus the presence of in-seam halite as an undesirable gangue, and as a weak and unstable roof and floor of the seam, makes the Basin Seam a second order target in comparison with the more consistent Shelf Seam, where halite is relatively rare, and the roof is generally formed from thick anhydrite*. In other words, mining conditions should be considerably better (and more predictable) in the Shelf Seam, as well as being relatively shallower.**

FOOTNOTE: * Halite is weak and deforms plastically in mineworkings at these depths, whereas anhydrite is much harder, more brittle, and should behave more akin to polyhalite in the roof, floor, and pillars of a mineworking.

1.14 Our current best estimates of the position of the Fordon basin-margin ramp and the limits of each polyhalite seam are shown on Figure 10. This has been compiled from a review and modelling of seismic data (nearly 2500 km of legacy seismic lines, plus ca. 50 km of new 2D seismic lines), tied in to drilling, that provide isopachs on the Fordon sequence, and thus enable us to define approximately the zone of thickening across the ramp (and hence the locations of the crest and toe of the ramp itself). The westward nip-out of the Shelf Seam (Figure 10) is reasonably known at three points (Lockton, Eskdale and Boulby). The eastward limit of Shelf Seam (Figure 10) is a judgement, based partly on geological interpretation, and partly on four seismic (inversion) sections where it can be seen particularly clearly. Both 'limits' are subject to amendment following further exploration. The best method to locate (and characterize) accurately the seam limits is considered to be by underground exploration – development headings and long horizontal drillholes with seam deflections (as practiced at Boulby Mine), rather than costly surface drillholes, each of which sterilizes ore in permanent protection pillars. (N.B. Every surface borehole is surveyed accurately, and completely cemented and sealed. But such is the risk posed by water accidentally getting down the abandoned borehole, from the high pressure Sherwood Sandstone aquifer, that a protection zone or pillar - where mining is not permitted - must be drawn around each borehole. Thus each exploratory borehole drilled from surface sterilizes mineral resources and interferes with future mining, as well as performing the essential task of proving the mineral resource. This paradox is not associated with underground drilling, since aquifers are avoided).

1.15 The discussion so far has been focused on the original disposition of the polyhalite seams and our ability now to model with growing confidence the polyhalite and host Fordon sequence, as deposited in different parts of the AOI. That original disposition has been modified of course by subsequent tectonic events; and the regional dip and fault pattern determine where the seams lie now, and how easily they can be mined. Hence the structural geological model is as important – for defining areas of potentially mineable minerals – as the depositional model.

1.16 Depth below surface is an important consideration with respect to shaft sinking and then the annual energy cost of haulage of ore to surface. It is also relevant to rock pressures and stability of workings, and to the virgin rock temperature (that increases at 1ºC per 38 m in this area) – and hence cost of ventilation and likely need for refrigeration. The virgin rock temperature at 1600 m is likely to be in the order of 52ºC. This is close to the maximum encountered in deep mining, world-wide; and so becomes a material consideration with respect to mine location. Even small changes in overburden thickness, at such critical depths, can have significant cost effects for ventilation and refrigeration requirements.

2 MINEHEAD LOCATION – THE MAJOR DEVELOPMENT TEST

2.1 York Potash prepared a report (24 August 2012) relating to the minehead location and argued the need for its proposed minehead to be inside the National Park, and that – within the Park – Dove's Nest (the 'base case') meets geological and mining requirements.

2.2 AMEC commented on the York report in October 2012, and again in March 2013. A meeting between York, NYMNP, AMEC and FWSC on 19 March 2013 clarified the issues, and this report has been drafted specifically to address the geology-related points discussed at that meeting (and, where still relevant, in the previous AMEC reviews and report). **The key issue, of course, being the second part of the Major**

Development Test (MDT) that requires an assessment of "the cost of, and scope for, developing elsewhere outside the designated area, or meeting the need for it some other way". The regional geology is a key factor with respect to cost and scope. Polyhalite occurs beneath a large area – some of which lies outside the Park boundaries – but the geology (depth, grade, and thickness), mineability (depth; nature of banding or gangue mineral; roof, pillar and floor stability; consistent conditions; and degree of tectonic disturbance) and viability (all preceding factors, plus the size of the available reliably mineable resource, over which to defray the investment cost) are not the same throughout.

2.3 Another particular relevant consideration that, in a sense, touches all three above, is the ability to 'prove' a mineable resource. There is no disagreement about the existence of a mineral province here of global importance. By remarkable good luck it comes onshore in the UK over a sufficient area to allow mining, and the deposit is unprecedented in terms of size, thickness and grade of the mineral. The great depth will, however, result in high costs and unusual engineering challenges, and this is coupled with the fact that polyhalite has never been mined before except for very recent developments at Boulby Mine.

Exploration normally proceeds in well-defined stages; seeking to identify firstly a mineral 'Target', then a 'Resource' and finally a 'Reserve' after all feasibility studies and permits are complete. These terms are strictly defined by international standards and – for miners and investors – their meaning is far more precise than in common parlance. Furthermore, 'Resources' and 'Reserves' are subdivided into different levels of confidence (e.g. Inferred, Indicated, and Measured Resources). This procedure too is tightly controlled, and is carried out by independent third party auditors who need to satisfy themselves about tonnages, grades, mineability etc. Mining projects must meet certain site-specific levels of confidence about the resources/reserves and are valued only on their 'Indicated' and 'Measured' Resource (and Reserve) tonnages. The purpose of exploration, having established a geological model, is to focus upon that area with greatest potential to achieve the necessary confidence threshold – ideally the biggest area of high grade, thick seam, at shallowest depth, with fewest faults, and – most particularly – where conditions appear most consistent and risk of unforeseen geological/mining problems are least! Naturally it is impossible to satisfy all, but the ability to reduce geological risk – by having a large area, and flexibility over a mining programme, such that a lifetime of >20 years can be reasonably assured – is critical. **In other words, it is not just the Company's view of the geological factors that influences mine location, but <u>the ability to demonstrate</u> to third party auditors (upon whom investors rely) that the deposit is safely and economically mineable, and that the level of geological risk (with respect to a mineral like polyhalite, never previously mined large scale) is acceptable.** Investors abhor uncertainties, and projects of this scale must focus on the lowest risk options if they are ever to gain funding.

3 YORK POTASH AREA OF INTEREST AND DEVELOPMENT OF THE EXPLORATION PROGRAMME

3.1 The York Area of Interest (AOI) was defined by an FWSC desk study at the outset of the exploration programme, and related to the whole area in which we believed – in 2010 – that there could be mineable polyhalite. The boundaries reflect the state of knowledge at that time. The eastern boundary extends offshore to a limit that is now defined by the Crown Estates mineral agreement (FWSC's Exploration Target limit was 11 km offshore – that coincided more or less with the distance that coal was mined offshore Durham and Northumberland). It is a conceptual limit not affecting this report. The western limit is where we believe the seams peter out. The northern limit of the AOI coincided more or less with the southern boundary of Cleveland Potash Ltd's mineral rights; and the southern limit coincided, more or less, with the Vale of Pickering where the evaporites are deep, and geologically disturbed (as will be discussed again, below). Drawing 1 shows the AOI.

3.2 Mineral rights were secured by York as far as possible throughout the whole AOI prior to exploration – since, obviously, it was unclear where we would be led by subsequent studies and drilling.

3.3 Since the preliminary desk study (that defined an "Exploration Target" of up to 9 billion tonnes of polyhalite-bearing material in the whole AOI), the geological structure has been defined in much better detail, through the acquisition, reprocessing and modelling of 2500 km of legacy seismic lines. The drilling programme transformed also our geological model, early on, especially with the results from the second borehole (SM2) – that showed the presence of <u>two</u> seams, as described earlier. This understanding refocused exploration to the Shelf Seam – which was clearly the better of the two for mining purposes. It transpired that Boulby Mine was already developing in the Shelf Seam (the only option available to them) and that added confidence that "it can be done".

3.4 The Basin Seam remains a significant potential resource. SM1 has shown it is excellent grade and thickness (Appendix 1) but, as described in Paragraph 1.13:-

a) It is some 100 m or so deeper than the Shelf Seam (an important consideration when near the limit for VRT);

b) It is banded with halite (so in terms of strength of mine pillars etc is less reliable);

c) It has a halite roof and floor (so polyhalite would need to be left to support the roof and floor);

d) As a result of the presence of thick halite (above and below), there may be more disruption by halokinesis (plastic flow), especially in the vicinity of faults.

There is little doubt that methods of working the Basin Seam will be developed in time – since it represents such a huge resource of global significance (taking the offshore area into consideration) – but as a start-up mining project it comes a poor second to developing the Shelf Seam that:-

a) Is shallower;

b) Is banded mostly with anhydrite (if at all) – a rock that behaves like polyhalite;

c) Generally has a massive and stable anhydrite roof (though the floor is banded with halite in the Transition Zone);

d) Appears to behave as a brittle, competent rock in the vicinity of faults and thus is more predictable;

e) Has a much larger onshore footprint – thereby greater opportunity to explore and prove an adequate tonnage of Indicated Resources.

Thus the Shelf Seam became York's primary target.

3.5 Figure 6 shows borehole results for the Shelf Seam, including legacy logs, from Eskdale to Lockton and the tendency to fragmentation that has already been discussed – Para 1.11. The areal extent of this 'Lockton' seam condition was unknown until York's exploration drilling had progressed southwards as far as boreholes SM4, SM6 and then SM9. They showed:-

SM4 – significant thinning of the high grade Shelf Seam in the Transition Zone.

SM6 – major thinning, splitting, and deterioration in grade of the Shelf Seam in the Shelf Zone.

SM9 – break-up of the seam into four leaves, plus major deterioration in grade (see the results for the deflection – Appendix 1), and unacceptable variability between mother-hole and deflection (i.e. unpredictable over short distances).

Consequently the conclusion has been drawn that the relatively predictable and high grade single Shelf Seam situation at Boulby and Eskdale deteriorates southwards at around SM4, 6 and 9; and beyond here - to Lockton - it is less predictable, prone to splitting, and commonly lower grade. Furthermore, the seam roof in the shelf region, south of SM6, is commonly halite.

A further complication – the significance of which is still not understood – is that SM6 and SM9 both contain a significant amount of kalistrontite. This is a very unusual strontium-potassium mineral, interbedded with the polyhalite, and for which there is currently no means of separation – nor commercial value. At present it has to be regarded as a potentially unwelcome contaminant, of unknown extent.

There remain, of course, areas in the south of the AOI where the Shelf Seam has not been tested by drilling – and where, with patient and detailed exploration, resources of workable polyhalite might be defined. In time this work may be carried out – though, as explained earlier, it is better and far more cost-effective, to do it by underground exploratory and development carefully and patiently probing southwards from an already established mine. If we were to predict currently the chances of success of a surface exploratory borehole north of SM9, say, it would be >80% - whereas the chances south of SM9 must be much less than 50:50 (for a workable Shelf Seam intersection) on our present model.

Thus the northern part of York's AOI has become York's primary target, for exploration of the Shelf Seam.

3.6 The primary target area within the northern part of the AOI can be defined further by several significant geological features that present obstacles to mining. These are shown on Figure 11 and are:-

- The southern impoverishment/break-up;
- The Donovan Fault Zone;
- The westerly seam nip-out;
- The Whitby Fault Zone;

- The Cleveland Dyke.

3.7 The southern impoverishment, or seam break-up, has been discussed above.

3.8 The Donovan Fault Zone, recognized and named by Whitby Potash in the 1960s, has in the order of 100 m throw, and is also associated with monoclinal folding and splinter or offshoot faults. A typical seismic section is shown in Figure 12. Boreholes SM7, 7A and 7B penetrated a splinter reverse fault, that has 30-35 m vertical (over-thrust) displacement. The Donovan fault system was probably triggered in the Triassic, was certainly active during the late Jurassic, and Lower Cretaceous, and was probably reactivated in the mid-Tertiary. Polyhalite seam mineralogy and grade appear unchanged in the vicinity of faults, but the disposition (dip, vertical displacement etc) is obviously affected. Furthermore, the presence of faults introduces the potential for gas and water migration from overlying and underlying strata. The principal aquifer of concern is the overlying Sherwood Sandstone, and principal gas risk is from the underlying Kirkham Abbey Formation (formerly exploited for gas at Eskdale and Lockton) – though all the limestones have been known to contain brines and/or gas somewhere in the English Zechstein. None is entirely risk-free. Boulby Mine has experienced serious water inflows from the Sherwood, and gas, from the Kirkham Abbey Formation. Such risks can be explored, assessed and quantified safely by underground probing from established mineworkings, but not by surface exploration.

3.9 The Whitby Fault Zone is a complex north-south structure. It reaches surface with a relatively minor vertical displacement, but at depth it appears to increase in magnitude; and Hemingway considered it likely to have a large wrench (sideslip) component. A typical seismic section is shown in Figure 13.

3.10 The western Shelf Seam nip-out is conjectured from legacy wells, and is only approximate on Figures 10 and 11. The seam is expected to thin progressively westwards – but since this was a shallow-water, almost lagoonal, geological environment, the exact line is likely to be irregular, and will be proved by underground development.

3.11 The Cleveland Dyke is shown on Figure 11. It too presents an obstacle to mining – both as a potential pathway for water and gas (through any open joints in the Dyke), and as a zone of potential gas pockets in the adjacent evaporite mineral (such effects – gas bursts – being associated with dykes in German potash mines). It can be traced for nearly 400 km from the Tertiary Igneous Centres around Mull, but dies at surface on Blea Hill, just east of Newton House Plantation. Magnetic surveys suggest that it might continue to the southeast at depth, without breaking surface, but its full extent is unknown.

3.12 The two fault zones and the dyke present formidable obstacles to mining – but, with patient study and underground probing, by development drivages and drillholes, methods of safely traversing them may be discovered from an already operational and secure mine. This would be a long-term exploration/development objective, in order to maximize recovery of the available mineral resources and to extend the mine life.

4 SPECIFIC OPTIONS FOR MINEHEAD LOCATIONS

4.1 Preliminary discussions between York and NYMNP identified three sites of potential interest outside the Park boundary and, for completeness, York added a fourth. They are:-

- Whitby Enclave
- Whitby Industrial Estate
- Cloughton Surrounds
- Vale of Pickering

The York August 2012 report discussed the pros and cons of these sites. AMEC has asked (inter alia) for the geological arguments to be developed in greater detail – and for greater clarity in some of the drawings. This section aims to provide that – with reference to the preceding geological narrative.

4.2 The principal arguments that will be developed relate to:-

a) **Shaft-sinking issues** – it is nonsensical to site shafts in a badly faulted or geologically disturbed area where alternatives exist. Costs and safety (to sinkers and to the long-term life of the mine) are the obvious problems. We understood that HSE has confirmed to York its opposition to deep shaft sinking through known faulted ground.

b) **Presence of – or access to – a mineral seam that can be worked safely and profitably** (adequate thickness, grade, and mineable conditions – such as roof and floor). For reasons already discussed, in reality, this means access to thick, high-grade, Shelf Seam.

c) **Scale** – Indicated Resources (as verified by independent auditors) of sufficient tonnage etc are needed to justify investment over a reasonable mine lifetime. This introduces the ability to define – from surface – a large enough area with consistent and relatively predictable conditions, free of significant obstacles (major faults, dykes, nip-outs). For reasons already discussed, York has been led to focus on the northern area of the AOI, where these conditions are satisfied.

d) **Depth below surface** – with respect to winding costs and to virgin rock temperature (VRT). The energy costs associated with depth, considered over the mine lifetime, and tonnage to be raised, and volumes of ventilation air, are material factors. The northern area of the AOI is, broadly, more likely to provide the shallowest options.

e) **Gasfields** – the known gasfields of Eskdale and Lockton are areas that should be avoided at this stage, for concerns over the enhanced risk of gas leakage into mineworkings from the underlying Kirkham Abbey Formation.

f) **Centre of gravity with respect to potentially mineable resources**. This needs further explanation. It does not relate to location relative to the AOI as a whole. The distance that any mine can develop away from its shafts is finite. One can argue as to what it is, exactly, but not in principle. Furthermore, the issue is more critical for a very deep and hot mine, than for a shallow mine. Given the high cost and unavoidable impact of minehead and shaft development, it is clear that (given a choice) the optimum location is the one that would facilitate the longest possible mine-life (and hence be the one with largest body of readily accessible reserves). It follows then that a mine located in the centre of a large resource will have a considerably longer life expectancy – being able to develop radially outwards to the maximum possible extent in all 360º points of the compass – than one located at the side of the resource block (limited development over 180º) or, worse still, one in a corner of a resource block with only very limited (90º say) options for development. It is not, however, simply an issue of the enhanced resource tonnage potentially recoverable over the mine lifetime. The ability to develop a mine in several directions also provides security against unforeseen mining problems, grade issues etc. that might otherwise close a mine that was dependent on a single development district alone. There are many examples of this around the world. One that is close to home, at Whitby, was the early discovery of the high pressure, in-seam, gas out-bursts in a particular district at Boulby Mine in the 1970s (with tragic consequences). Fortunately the mine had the option of developing and mining in a totally different area while the problem was investigated and solutions implemented. Without those alternative production districts, the mine could have closed. These are qualitative arguments, but very relevant with respect to the size of development and scale of investment considered here. **Risks must be minimized.** There is conversely, of course, a problem with putting a minehead in the centre of the workable deposit – insofar as resources are sterilized in the shaft support pillar; but, given the circumstances here, this is of far smaller import than the adverse impacts of sinking off the mineral deposit.

5 WHITBY ENCLAVE

5.1 Drawing 2 summarizes the salient geological features requested by AMEC; and Drawing 1 shows the Enclave in relation to the regional structural elements.

5.2 Our geological model, based upon Fordon isopachs from the seismic reinterpretation, shows only Shelf Seam present at this locality.

5.3 Therefore, Drawing 2 shows contours on the base of Shelf Seam, as metres BOD. There is an element of uncertainty, probably in the order of 30 m (vertical) in these depths (and contours on subsequent drawings).

5.4 Two E-W faults (represented at surface by the Lealholm Fault Zone) cut the enclave; both throwing north down by variable amounts. Both are seen, on seismic sections, at the top and the bottom of the Fordon sequence, so there is no doubt they displace the polyhalite seam. Given their location, relative to Sleights village and the River Esk, and the likely hade of the fault planes, **it is inevitable that shafts sunk here would have to contend with faulted ground.**

5.5 The faults would also affect the shaft pillar, and underground developments around the shaft bottom would have to change level to remain in polyhalite (which in this area is expected to be ca. 20 to 30 m thickness).

5.6 The northern edge of the Enclave follows more or less the northern boundary of York's mineral agreements. Mine development could only be southwards and not to all points of the compass. **In other words, the life expectancy of a mine here would**

be significantly less than a more centrally situated mine and the risks from unforeseen geological or mining problems would be higher.

5.7 In fact the only resource readily accessible to a mine sunk in the Enclave is the block north of the big Donovan Fault Zone and west of the Whitby Fault Zone. This is a strip 1 to 2 km width, tapering, and ca. 4 km long. As discussed above (Para. 3.8), the Fault Zones may not be an insurmountable obstacle to development further afield – but it would be almost impossible to prove, by surface drilling, a safe traverse; and it would be reckless to sink a mine in the Enclave on the assumption that a safe traverse would be found in future.

5.8 In summary, the geological problems associated with Whitby Enclave are:-

a) Faulted ground affecting shaft-sinking and shaft pillars.

b) Little, if any, significant resource of Shelf Seam polyhalite (maximum area 1 to 2 km (tapering) wide by ca. 4 km long), bounded by faults or mineral rights.

c) Extremely limited opportunity to open multiple mining districts, and thereby minimize risks of unforeseen problems.

5.9 For all these reasons it is considered that the Enclave cannot be considered a safe or viable site from which to exploit the resource.

6 WHITBY INDUSTRIAL ESTATE

6.1 Drawing 3 summarizes the salient geological features requested by AMEC, and Drawing 1 shows the regional structural elements.

6.2 In this case, our model suggests that **the Shelf Seam is present as an isolated block**, about 1 km^2, detached from the rest of the Transition Zone by ca. 1 km of strike slip displacement on the NNW-SSE Whitby Fault Zone (see Figure 10). Its thickness and grade are uncertain since this location is near the conjectured eastwards limit of shelf polyhalite. It may be thick, but is must also be deteriorating (e.g. by interfingering with halite - see Figure 4). There is a strong probability that the Basin Seam is present ca. 100 m deeper and, though unproven here, is likely to be similar in thickness to SM1 (see Appendix 1).

6.3 Drawing 3 shows, west of the Whitby Fault Zone (WFZ), the tail end of the E-W Lealholm Faults. These cannot be traced with certainty across the wrench fault. The seismic model does show faults with similar directions and throw, on the east side, but there is in fact a whole cluster of faults on the east of the WFZ and in the Industrial Estate Block. The intersection of the E-W fault system, with the N-S fault system, each with different histories of movement and multiple phases of reactivation – one being predominantly normal faulting and the other predominantly wrench faulting - is inevitably an area of structural complexity that would certainly write-off any question of shaft-sinking in that part of the property SW of the A171 and would raise serious concern over the area east of the factories. **The frequency of faults in and around the Estate suggests it would be difficult to sink two shafts there that would avoid disturbed ground.**

6.4 Figure 13 shows a seismic section over the WFZ, demonstrating its complexity and the high degree of disturbance associated with it.

6.5 The ESE-WNW trending faults heading through Stainsacre and Hawsker affected the Basin Seam in SM1, where bedding dips of up to 80º were seen in the core, and significant halite flow had occurred.

6.6 The areas of the unproved outlier of Shelf Seam, and of the underlying Basin Seam accessible from shafts, were it possible to sink them, at the Industrial Estate are relatively small – being hemmed in by Whitby itself, the edge of York's mineral rights (and a currently undefined coastal cliff protection zone), and the aforementioned faults. It would amount to somewhere between 2 and 3 km^2 of apparently fault-free, potential mineral resource. **This would be insufficient to sustain a mine.**

6.7 The geological problems associated with Whitby Industrial Estate can be summarized as:-

a) High risk of disturbed ground affecting shafts.

b) Little significant Shelf Seam resource (conjectured outlier close to its eastwards nip-out).

c) Basin Seam present, but only limited resource (2 to 3 km^2) accessible within fault compartment.

d) Extremely limited long-term development options – south and southwest only – necessitating driving through complex Fault Zones that cannot be characterized safely by surface exploration. None of the faults is necessarily a permanent obstacle. As argued earlier, detailed and patient probing and exploration from an established underground operation may be able to identify a safe traverse – e.g. via roads entirely in halite – but this is not possible by surface exploration and it would be reckless to sink a mine surrounded by such faulting in the expectation of being able to negotiate a safe penetration to larger resource blocks beyond.

6.8 **For all these reasons it is considered that the Industrial Estate is not a viable site from which to attempt to exploit the Company's mineral resources.**

7 CLOUGHTON SURROUNDS

7.1 Drawing 4 shows the relevant geological features, incorporating the most recent (January 2013) seismic inversion models.

7.2 Our geological model (Figure 10) shows only the Basin Seam present with reasonable confidence at this locality. The nearest provings are at Cloughton 'A' and YP14 (Figure 10), where legacy wireline logs show that the seam is well-developed (although we have no assay data). There is no reason to suspect that different conditions apply to the Cloughton block. The conjectured position of the toe of the basin margin ramp, and westward nip-out of the Basin Seam does, however, coincide more or less with the western Cloughton Boundary (see Figure 10 and Drawing 4). So, whilst we are reasonably confident that the Basin Seam exists here, it is close to its expected western limit.

7.3 The conjectured edge of the Shelf Seam lies more or less on the eastern Cloughton boundary, assuming that a Transition Zone exists here that is similar to the Eskdale situation. There is no reason to suspect otherwise – though it remains unproven.

7.4 There is a higher degree of uncertainty about the position of the Ramp (and consequently the precise limits of both seams) here, than elsewhere. The reason will be explained below (Para. 7.9) following the discussion on the Peak Fault, and the associated salt flow.

7.5 **The key issue with respect to the Shelf Seam is, however, less concerned with the exact nip-out position, but with the southward trend towards unpredictability and seam break-up** – described in Para. 3.5. Two thirds of the Shelf Seam intersections in the southern part of the AOI show split or multiple seams – and a third shows a massive seam. The degree of detail needed to explore and explain this situation from surface drilling, and to identify and prove a large enough consistently mineable resource to the satisfaction of third party auditors, would be prohibitively expensive and not guaranteed success. Moreover, the close spacing of drill-holes needed to provide adequate confidence on seam continuity would result in disproportionate sterilization of resources (and interference with mine layout). For these reasons **we consider that a mine development at Cloughton would have to be justified by, and based upon, the Basin Seam alone.**

7.6 Drawing 4 shows conjectured seam contours on the floor of the normal high grade section (Unit 3a) of the Basin Seam. They range from ca. 1650 to 1670 m BOD.

7.7 The fault pattern discernible at the base of the Fordons, from legacy seismic data, is shown on Drawing 4. Since the Basin Seam is low down in the Fordons, it can be taken as reasonably representative of the fault pattern affecting polyhalite. The two principal structures are:-

a) The western boundary of the major, North-South, Peak Fault Trough.

b) A pair of unnamed East-West faults with displacements of 25 to 50 m.

7.8 The Peak Fault is an intimidating structure. It is known in detail from several generations of seismic data between Scarborough and offshore Runswick Bay (see Milsom & Rawson, 1989, copied in Appendix 3, for a good general description). Hemingway considered it to have a very large wrench displacement (several kilometres) in addition to the vertical displacements, and Milsom & Rawson agree that "some of the sections resemble those imaging flower structures associated with transtensional strike-slip faults". It was certainly reactivated at least three times – contributing to the complexity. It is not defined very well at Cloughton itself because it lies exactly on the coast – and, therefore, falls between onshore seismic survey lines, and offshore survey lines. There is none that runs from sea to land to give us a complete cross section. The drawings in Milsom & Rawson, combined with the partial sections derived from York's reprocessing of legacy lines, show that in simple terms the geometry is a complex graben (fault trough) of roughly 2 to 3 km width, and up to 300 m depth. Milsom & Rawson's Text Figure 2, shows a complete cross section offshore Whitby, and is regarded as representative of the structure. We can draw several deductions that influence future development of the polyhalite resource in the vicinity of, and in particular westwards of, the structure.

a) The boundary faults are shallow dipping – so that their positions in the Sherwood Sandstone aquifer (just above the horizon shown as BS – Bunter Shales – on M and R's Figure 2) – are displaced a kilometre or more laterally from the points where they cut the lower evaporites (i.e. a very shallow hade). A similar situation is shown on Drawing 4 – where modelled fault locations in the Sherwood

Sandstone at Cloughton are ca. 1.2 km west of the position mapped at the top of the Kirkham Abbey Formation.

b) According to Milsom & Rawson, the top Zechstein reflector bends noticeably upwards about 3 km from the boundary faults on either side of the Trough. This bend is sharply reversed entering the graben itself. The seam contours on Drawing 4 show a similar effect at Cloughton. This 3 km wide disturbed zone coincides with thickening of the evaporite sequence (see the bulge between TZ – top Zechstein – and TC – top Carboniferous).

c) The geometry of the trough is clearly, in essence, an extension structure within which there is decoupling within low strength horizons in the Mesozoic (i.e. Triassic and Jurassic) sediments and in the evaporites. Salt has flowed from the central graben to the periphery (where, as described, the cross section clearly shows thickening of the evaporites). This is absolutely typical of salt tectonics. The effect of this salt flow on the condition of the polyhalite seam is simply not known. Whilst we regard the polyhalite bed as a hard and brittle mineral, reacting to stresses by brittle fracture, it has not necessarily always been so. Cores from SM1 show flow folding in the Basin Seam in the proximity of a fault – and demonstrate that, at times in the past, this basinal, halite-hosted, polyhalite has suffered serious plastic deformation. In other words, there is a zone of up to 3 km width (according to Milsom & Rawson, and apparently also identifiable at Cloughton) either side of the Peak Trough, within which halokinetic flow has occurred – with effects on the Basin polyhalite Seam that are currently unpredictable. Conditions improve westwards, but are likely to worsen to the east approaching the Fault. **Not only does the Cloughton block lie within this flow-affected zone, but the entire width of available Basin Seam resource at Cloughton is probably not much more than 3 km – in other words all the available Basin Seam may be affected to some degree by halokinesis. In our view it would be unwise, or reckless, to predicate a mining operation on this 3 km wide zone.** As conceded earlier, the seam might be workable safely and economically within the 3 km disturbed zone, but that could only be proved by patient and careful underground exploration from an already operating mine. The same goes for finding a route to tunnel eastwards through the Peak Trough (here or elsewhere). It is possible that – guided by focused seismic surveying - a safe route (e.g. within the remnant salt) can in the future be found through the Trough; and that must be a long-term exploration objective, to enable comprehensive mining of the offshore resources.

7.9 Returning briefly to the point earlier (Para. 7.4) about the degree of confidence over the exact line of the ramp and, consequently, the nip-outs of the Shelf and Basin Seams). We have explained that the position of the top and bottom of the ramp has been deduced from seismic modelling that gives us an isopach plan of the Fordon Evaporites. The line of the top of the ramp has been picked out the 175 m isopach, and the toe at the 250 m isopach. This ties in well with borehole observations and with recently completed seismic inversions that – in several places – appear to image the eastward limit of thick Shelf Seam. The lines on Figure 10 show our best current interpretation after some smoothing out of confusing detail and small faults. The methodology breaks down somewhat in the vicinity of the Peak Fault – because of the aforementioned salt flow, the artificial thickening of the Fordon Evaporites west of the Trough, and depletion of salt inside the Trough. Those effects show up on Fordon isopach map as linear N-S features paralleling the structure. We have had to project the line of the ramp (and seam nip-outs) straight across this flow-affected zone. Hence, as cautioned earlier, we have less confidence here about positioning the seam nip-outs; but the error is probably no more than a kilometre or so – and does not affect the overall conclusions.

7.10 **The 25 to 50 m east-west fault zone on the southern margin of Cloughton Surrounds presents a barrier to southwards development** – to which the previous arguments apply. It is not necessarily impenetrable – but it would be reckless to plan such a project on the assumption that it can be safely traversed.

7.11 **The Cleveland Dyke can be projected to Cloughton Surrounds** from Blea Hill, its last surface exposure. It is difficult to conceive of an exploration method that could show conclusively the absence of an upwards blind dolerite dyke at depths of say 1.5 km below surface.

7.12 We conclude, a mine developed at Cloughton would have to be justified by a sufficient sized mineable resource in the Basin Seam since the conjectured site lies right on the eastern limit of the Shelf Seam; and the Shelf Seam itself is expected to be similar to Lockton – i.e. less consistent and predictable than further north in the AOI. The area of Basin Seam accessible to such a mine is bounded to the south by a 25 to 50 m fault zone, to the west by the conjectured nip-out against the Fordon Basin ramp, and to the east by the Peak Fault Zone. Furthermore, it lies almost entirely inside a "marginal zone" some 3 km wide against the Peak Fault, within which salt appears to have flowed significantly and the effect of that on the interbedded polyhalite seams is not known – nor can it be proved with certainty by surface drill-holes. **Basin Seam resources can be expected only in the narrow zone extending from Cloughton northwards to Cloughton 'A' and YP14 – and in our view, regardless of the seam consistency, would be insufficient to support the project.**

There is also an issue of shaft-sinking risks and costs, insofar as the very shallow hade of the Peak Faults would take them into the eastern part of Cloughton Surrounds.

Finally, and conclusively, the combination of multiple adverse factors would necessitate an extremely high level of 'proof' before any responsible third party auditors would sign off a mineable resource here. No reasonable programme of surface drilling could provide certainty over (a) where the two seams nip-out; (b) consistent nature of the Shelf Seam (i.e. to prove that it is not like the Lockton holes, SM4, 6 and 9) over a large enough area; (c) the effect of faulting and salt flow on the disposition and mineability of the narrow zone of Basin Seam; (d) the absence of the Dyke; and (e) for safety, the exact location of the N-S faults (some of which may be wrench faults with little seismic expressions) that define the corridor of Basin Seam resources running north to Cloughton 'A'.

7.13 The geological and mining problems at Cloughton can be summarized:-

a) Proximity of a major fault zone and enhanced risk (within the site boundary) of minor faults such as low angle shears in low strength layers, impacting on shaft sinking costs and safety.

b) Location at the conjectured eastern limit of the Shelf Seam, within the southern part of the AOI where the seam is unpredictable, prone to splitting, and sometimes has a halite roof.

c) Access is <u>only</u> available to a 3 km wide zone of Basin Seam that nips out to the west; is likely to be affected (unpredictably) by salt flow adjacent to the Peak Fault Trough; and lies at depth of 1650 m below Sea Level (equivalent to ca. 1750 m below ground level, implying rock temperatures of >54ºC).

d) Bounded to the south by a fault zone.

e) Uncertainty regarding a possible intersection with the Cleveland Dyke.

f) Unacceptable risk of geological problems, with few options for development away from trouble-spots.

g) Severe difficulty in exploring the region adequately, and in sufficient detail (with respect to these multiple issues), to define a robust Resource Model with a large enough tonnage to attract investment.

Thus, with respect to the MDT, Cloughton Surrounds does <u>not</u> provide <u>scope</u> for safe or viable mine development outside the Park.

8 VALE OF PICKERING

8.1 Drawing 5 shows the Vale area, with approximate contours on the base of the Shelf polyhalite Seam and the conjectured western seam nip-out. It also shows the positions of faults interpreted (from seismic modelling) at the top of the Kirkham Abbey Formation and in the Brotherton Formation.

8.2 **The conjectured western limit of the polyhalite seam runs through the block.** There is believed to be no polyhalite west of this line. Seam contours on the eastern part indicate depths of ca. 1625 to 1800 m BOD. The condition of the seam is unknown here, but being so close to the nip-out it is probably relatively thin; and being in the southern part of the AOI (south of Lockton) it is within the area where doubt exists over seam consistency.

8.3 **The structural complexity is also a major issue.** It lies in the Vale of Pickering Fault Zone – which is a structure of such size that it is shown on the Regional 1:250,000 scale geological maps and cross sections (see Figures 5.2 and 5.3 in the August 2012 York Potash Report).

8.4 The area overlies, in part at least, **the protected Corallian aquifer.**

8.5 In **our view the Vale area is not a viable minehead site** for the reasons of:-

a) Location right at the nip-out of the Shelf Seam;

b) Potash mining resource is in the Shelf Seam only, in the area where it appears relatively unpredictable (Lockton situation);

c) Heavy faulting and likely disturbed ground between faults mean that shaft-sinking is likely to encounter problems;

d) The only direction in which to develop is northwards, between the Lockton Gasfield and the Scarborough conurbation;

e) This is the deepest part of the AOI (virgin rock temperature estimated as 52º to 57ºC.

9 DOVE'S NEST – BASE CASE

9.1 Having described the four out-of-Park options and described why they were rejected on geological grounds, and do not provide scope for safe and viable mine development (cf. MDT requirements), it is necessary to describe the Company's proposed site at Dove's Nest, with respect to the same geological constraints.

9.2 Drawing 6 shows the area around Dove's Nest centred approximately on SM11 and 14 (located respectively on the proposed South and North Shafts).

9.3 The Drawing shows again the geological features most relevant to mining. The principal seam of concern is the Shelf polyhalite Seam. The Drawing shows contours on the base of polyhalite, the conjectured western nip-out, and the conjectured eastern nip-out/transformation. It also shows the line of the basin margin ramp (which is now known quite reliably here) and hence the boundary between the true Shelf depositional Zone and the Transition Zone (Figure 4). Legacy Eskdale Boreholes, and the SM boreholes sunk by York Potash, (all shown on Drawing 6) have proved the existence of the polyhalite seam. It is a simple coherent seam, of mineable thickness except where approaching the western nip-out, and going southwards at SM6 and SM9 – where the seam splits and resembles the Lockton situation. The Fordon Evaporite sections of each borehole are shown graphically on Figures 6 (the E-W, 'Eskdale' section) and 7; and details of the assayed borehole cores are given in Appendix 1.

Figure 11 shows the approximate isopachs of the Shelf polyhalite Seam, at an arbitrary grade of ca. 80% polyhalite. It is for illustration only as the absence of reliable grade data for the legacy wells means that a number of assumptions have been made (as well as an allowance for the fault-repeated section in SM7). The approximate line of southwards deterioration is clearly apparent (south of which, we believe, a Lockton-like situation prevails – where the seam is locally split and unworkable, for reasons not currently understood). The nature of the eastward seam termination (shown here as an abrupt line) is not currently understood.

9.4 An area where thick Basin Seam is present about 100 m below the Shelf Seam is shown in the vicinity of SM2 and E3 (please refer to Figure 4 that offers an interpretation of this situation).

9.5 Drawing 6 also shows these faults that can be identified from the seismic modelling at the top of the Kirkham Abbey Formation and at the Brotherton Limestone. Those faults that affect each datum have clearly displaced the entire Fordon sequence and must affect the polyhalite seam. Those seen only at the top or the bottom datum must sole out within the evaporites and may not affect the polyhalite. They are of lesser significance, and are generally recognisable only over short distances.

The Donovan Fault system is clearly visible; as is the NNW-SSE Whitby Fault System – already discussed with respect to the Whitby Enclave and Whitby Industrial Estate. These present, currently, the boundaries to the identifiable and potentially mineable resource.

9.6 The line of the Cleveland Dyke is also shown - and, as described earlier (Para. 3.11) presents a boundary to mining southwards.

9.7 These limits to the potentially mineable Shelf Seam – the western nip-out, the Donovan Fault, the Whitby Fault, and then the southwards "impoverishment" or transition from Eskdale to Lockton conditions (and which coincides, by chance, with a swarm of East-West Faults) together define the first phase Mining Block for the proposed minehead at Dove's Nest.

9.8 The proposed shaft location (see SM11 and 14) is relatively central to this block. The body of the block is relatively fault free, and such faults that can be identified are short and can be worked around.

9.9 Recently completed SM11 proves the Shelf Seam at 1547 m below surface, which is significantly shallower than at Cloughton or Pickering.

9.10 The total area of the conceptual Mining Block is approximately 35 km^2. The company's exploration programme is focused now within this area – and independent auditor SRK is producing a resource model based on the borehole results. Because of the very strict rules that apply to formal Resource definition, the SRK Resource Model occupies part only of the Phase 1 Mining Block defined here on our Geological Model but, as is normally the case for mining projects, in time and with underground development, the resource will be explored, evaluated and wherever possible, recovered to the natural limits. Furthermore, as described above, the various geological boundaries and obstacles can – with time – be probed carefully from the operational mine to identify safe penetrations, so that outlying resources (e.g. the triangular-shaped block north of the Donovan Fault, and areas of Basin Seam) may also be developed and mined from a central minehead at Dove's Nest.

9.11 In summary, the geological circumstances that make this the most viable and safest option for minehead site are as follows:-

a) **Unconstrained access to a relatively unfaulted, structurally simple, mining block** of ca. 35 km of Shelf Seam of workable thickness and high grade, with stable anhydrite roof and pillar conditions. No faults at the minehead itself.

b) **Unaffected by known igneous dyke activity.**

c) **Relatively shallow depth.**

d) **Central location with respect to the mining block,** so that development districts can be opened in all directions; and risks of production stoppages, due to unforeseen problems, are reduced significantly.

e) **Relatively straightforward to explore in sufficient detail** to allow independent auditors to generate a robust Resource Model, and thereby raise finance for the scheme.

10 SUMMARY AND CONCLUSION

10.1 The current geological model, based on legacy boreholes, recent boreholes, and several phases of acquisition, reprocessing and modelling of legacy and new seismic data, has been presented; and various milestones and decision points in the exploration programme noted.

10.2 The AOI represents the entire area within which polyhalite is believed to be present and potentially available (via mineral agreements) to York Potash.

10.3 Exploration has shown that high grade polyhalite is present in two different seams that appear to overlap – from time to time anyway – in a narrow zone. Most of the onshore AOI is underlain by the Shelf Seam, and the coastal strip and offshore AOI is underlain by Basin Seam.

10.4 Although similar in grade and thickness, the Shelf Seam is preferred to the other because of the relative absence of halite (both as an impurity, and because of rock strength in a deep mining situation) – and the larger target it presents.

10.5 Provings of the Shelf Seam from Boulby south to about Falling Foss – Fylingthorpe, find a seam that is relatively predictable and consistent. South of that line, we see that York's exploratory boreholes SM6, 9 and 9A, and the widespread legacy holes at Lockton, show split seams that are sometimes unworkably thin and low grade, and are not easily correlated. Whilst existence of large areas of consistent seam to the south cannot be discounted, they are unlikely or, at least, difficult to locate and prove with a high level of confidence. The focus for definition of a mineable resource has fallen, therefore, on the northern part of the AOI.

10.6 Seismic and geological modelling has defined a large block (ca. 35 km^2) of thick, high grade, Shelf Seam polyhalite at relatively shallow depth, with relatively low fault frequency, bounded by the western nip-out, the Donovan and Whitby Faults, and the southwards onset of seam deterioration (that coincides, too, with a fault swarm). This constitutes York's first conceptual Mining Block. Independent geological auditors are developing a Resource Model within this block, that is sufficiently robust to support the necessary investment.

10.7 A minehead site has been identified at Dove's Nest, within the Mining Block, at a fault-free location that allows underground development in all directions, and thereby facilitates maximum recovery of the resource, maximizes mine-life, and minimizes risk of mine stoppages due to localized conditions unforeseen from surface drilling.

10.8 Four alternative sites have been considered outside the Park (and hence outside the relatively fault-free area of thick high grade polyhalite), and have been reviewed geologically. Each has significant problems as follows:-

a) Whitby Enclave
   - Certainty of faults affecting shaft-sinking and mining.
   - Small accessible Shelf Seam resource, bounded by major obstacles or mineral ownership.
   - Unacceptable risk of geological problems and very few options for development away from unforeseen trouble areas.

b) Whitby Industrial Estate
   - High risk of faults affecting shaft-sinking and mining.
   - Little or no workable Shelf Seam resource.

- Small area (say 2 to 3 km^2) of potentially workable, undisturbed, Basin Seam defined by mineral rights, physical or fault boundaries.
- Unacceptable risk of geological problems with almost no options for development away from unforeseen trouble areas.

c) Cloughton Surrounds
- Proximity of a major fault structure and enhanced risk of minor faults such as low angle shears in low strength layers.
- Location exactly at the conjectured eastward limit of Shelf Seam, and within the southern part of the AOI, where the seam is unpredictable and prone to splitting.
- Location within a roughly 3 km wide zone of Basin Seam that nips-out to the west, and is faulted out to the east – and is also likely to be affected (unpredictably) by salt flow adjacent to the Peak Fault Trough.
- Bounded to the south by a fault zone.
- Basin Seam lies at ca. 1750 m below surface – implying virgin rock temperature of >54ºC.
- Unacceptable risk of geological problems with few options of development away from unforeseen trouble areas; and severe difficulty in exploring the region on sufficient detail to define a robust Resource Model.

d) Vale of Pickering
- Abundant and severe faulting;
- Straddles the conjectured western nip-out of the Shelf Seam.
- Lies in the southern part of the AOI, where Lockton-like unpredictable seam conditions prevail.
- Proximity to the Corallian aquifer.
- Unacceptable risk of geological problems with few options to develop away from unforeseen trouble areas.
- Deepest part of the AOI (i.e. highest costs and rock temperatures).

For these reasons, principally, the four options have rated as geologically unsuitable with respect to the MDT, and viable out-of-Park alternatives to the proposed minehead site at Dove's Nest. In fact, <u>in each case</u>, we consider it would be impossible to explore and to prove an adequate Resource Model to attract the required investment.

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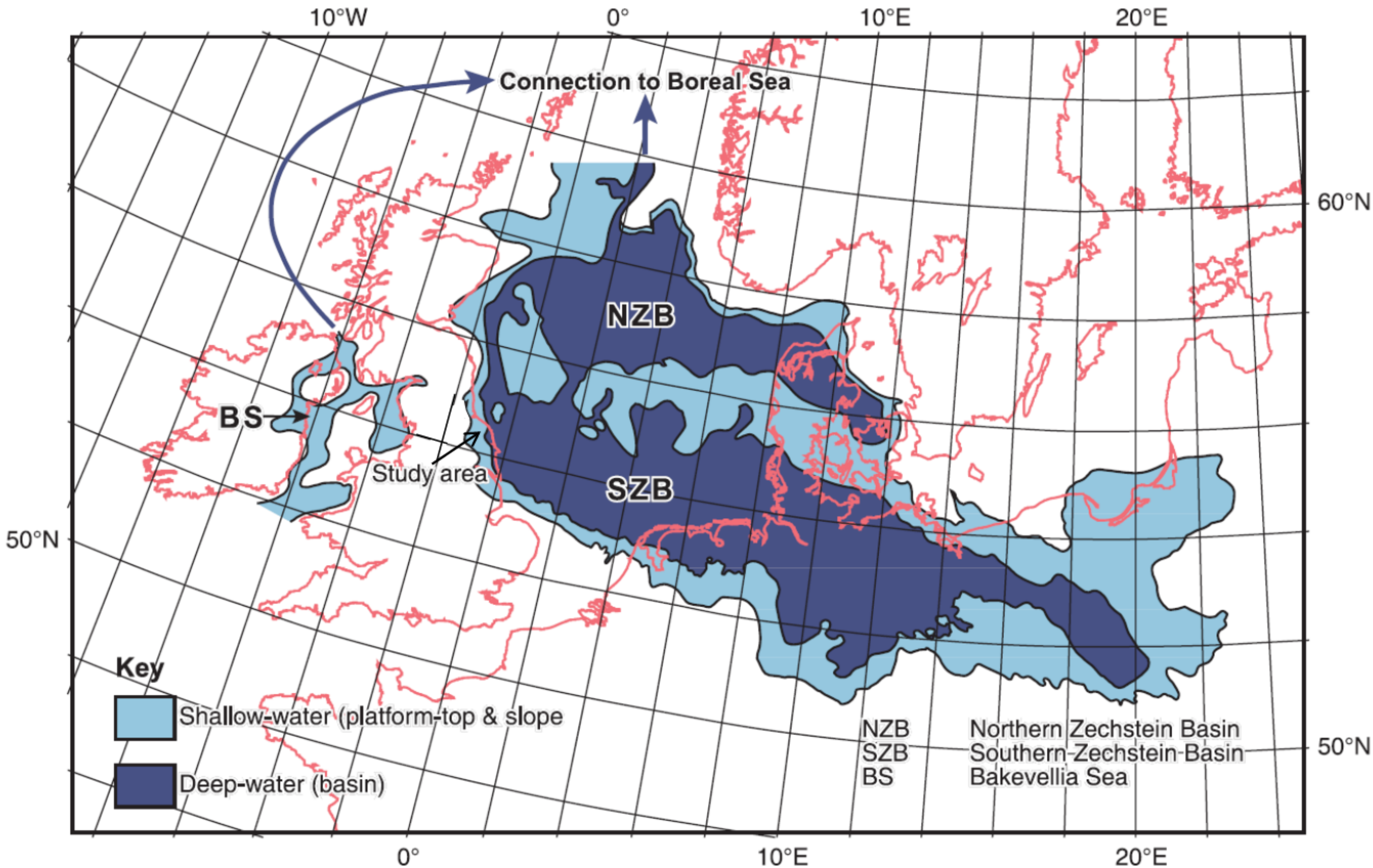
12 April 2013



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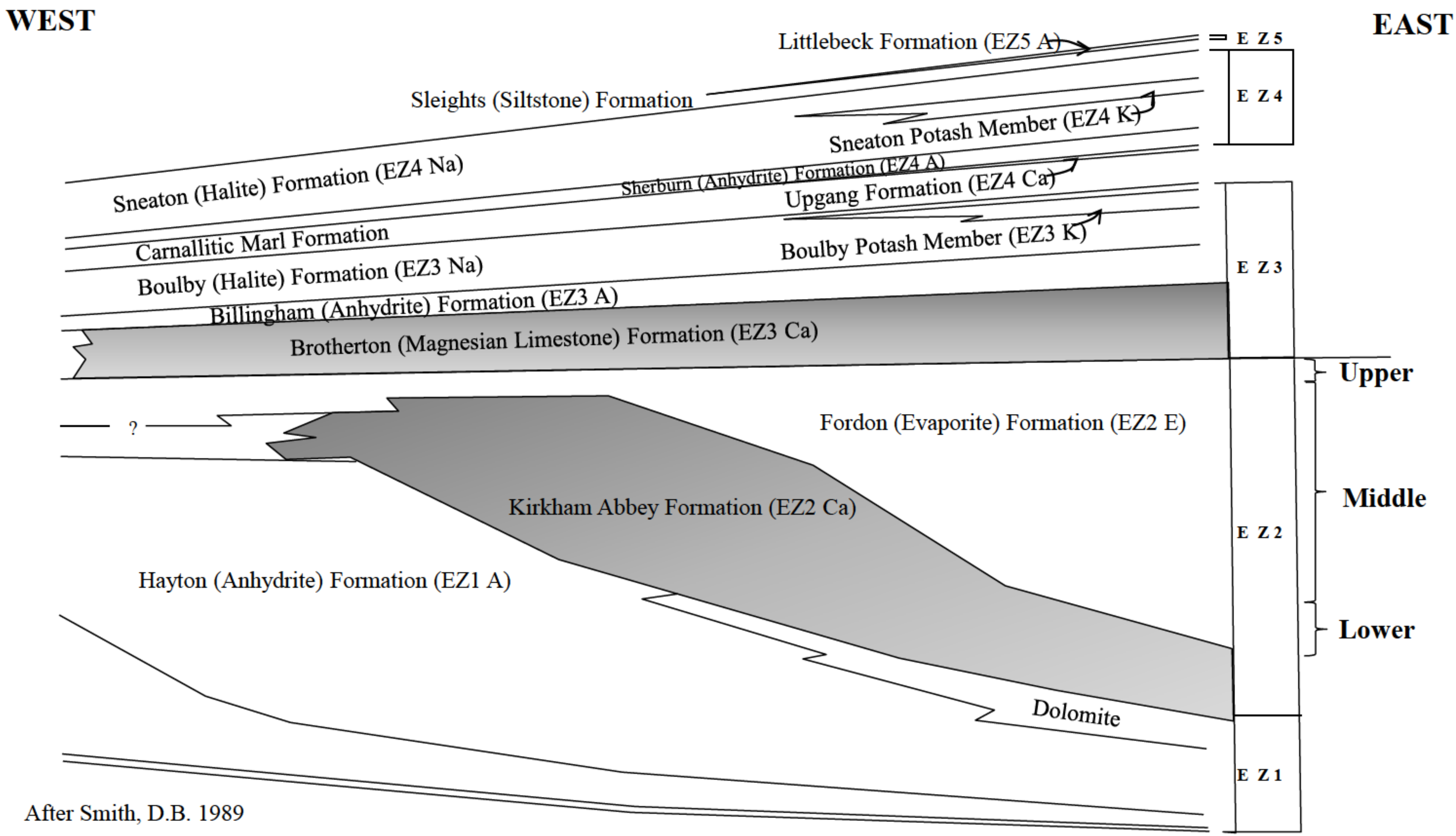
DRAWING TITLE FIGURE 1 EXTENT OF ZECHSTEIN BASIN FROM MAWSON & TUCKER, 2009		SCALE: NTS / DRAWN BY: CBELL / DATE: 25/03/2013	



DRAWING NUMBER 1433/MHJ/02	JOB TITLE YORK POTASH PROJECT	CLIENT YORK POTASH LTD	FWS CONSULTANTS LTD Environmental and Geological Consultants Merrington House, Merrington Lane Industrial Estate, Spennymoor, Co Durham. DL16 7UT Tel 01388 420633 Fax 01388 819705 www.fwsconsultants.com
DRAWING TITLE FIGURE 2 ZECHSTEIN STRATIGRAPHY, NORTH EAST ENGLAND		SCALE: NTS / DRAWN BY: CBELL / DATE: 25/03/2013	

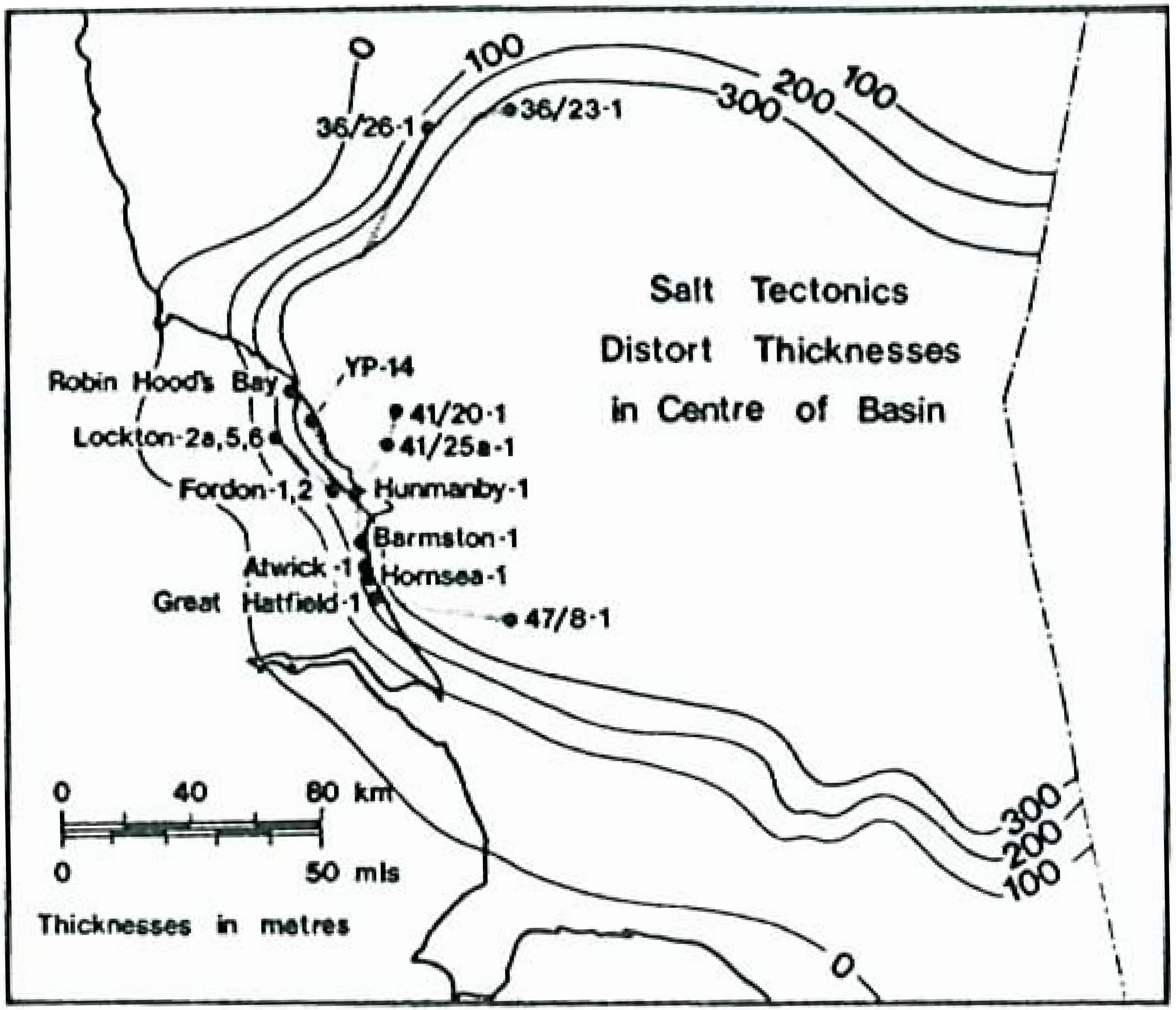


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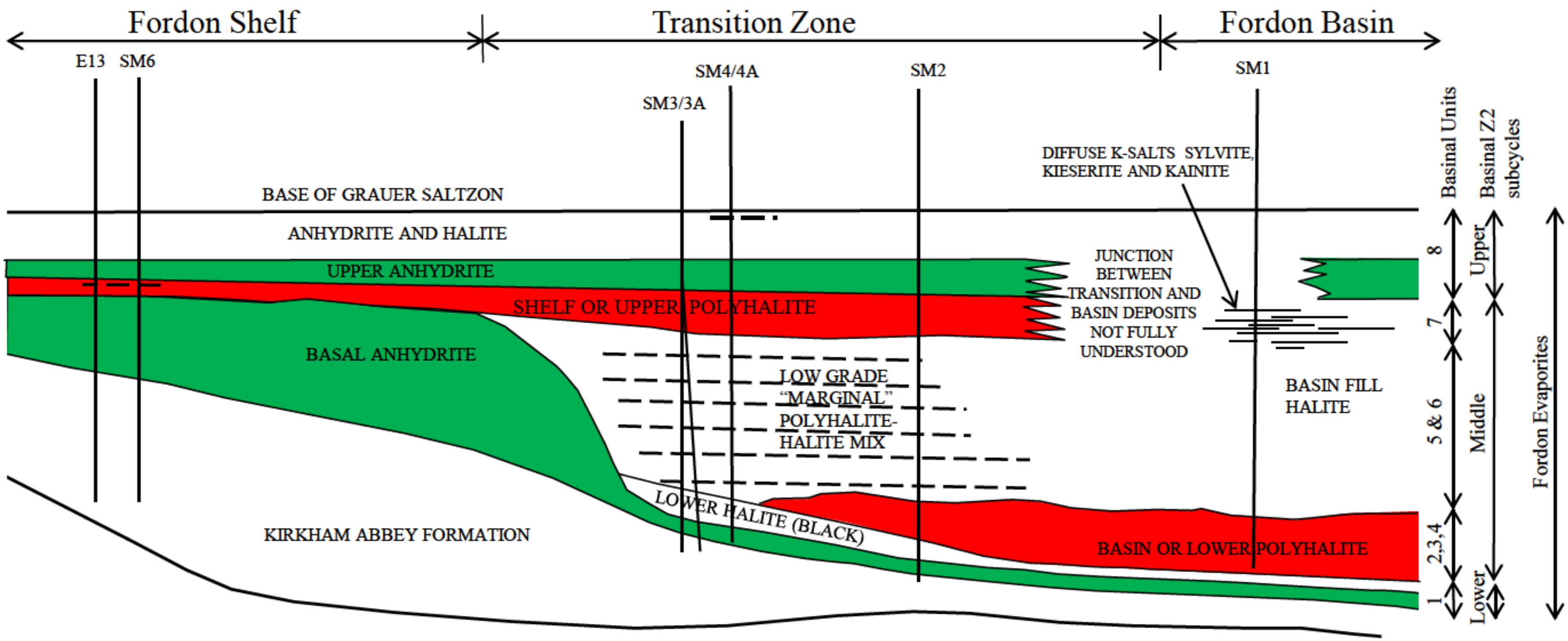
FIGURE 3
THICKNESS OF FORDON EVAPORITES
FROM COLTER AND REED, 1980

STATUS

DRAWN BY	DESIGNED BY	DATE
NA		25/03/13

SCALE	DRG No	REV
AS SHOWN	1433/MHJ/03	



DRAWING NUMBER	JOB TITLE	CLIENT		
1433/MHJ/04	YORK POTASH PROJECT	YORK POTASH LTD		
DRAWING TITLE FIGURE 4 SCHEMATIC SECTION ACROSS FORDON EVAPORITE BASIN MARGIN		SCALE NTS	DRAWN BY CBELL	DATE 25/03/2013

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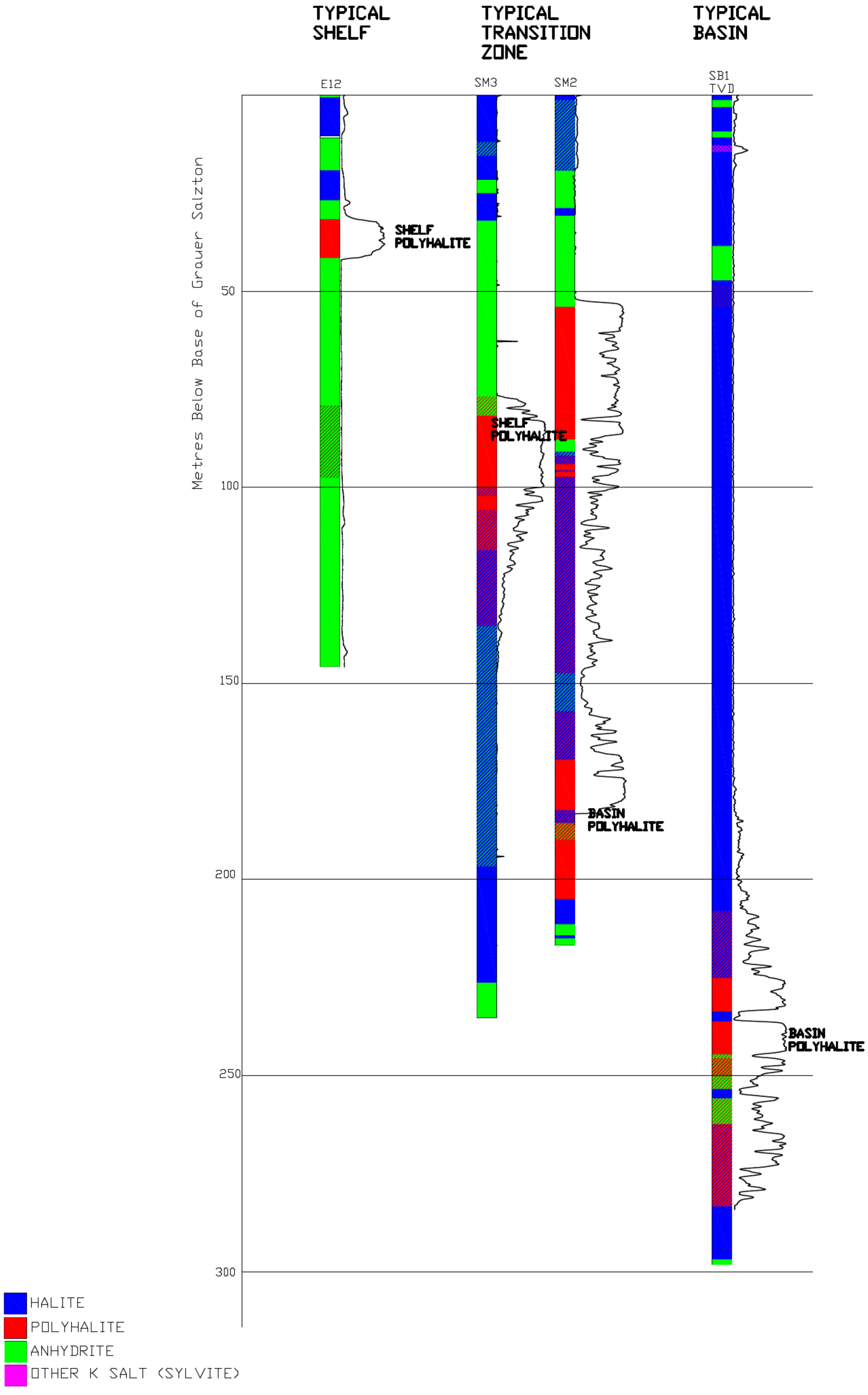

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1433/MHJ/05	YORK POTASH PROJECT	YORK POTASH LTD

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FIGURE 5
TYPICAL SECTIONS IN EACH ZONE

SCALE	DRAWN BY	DATE
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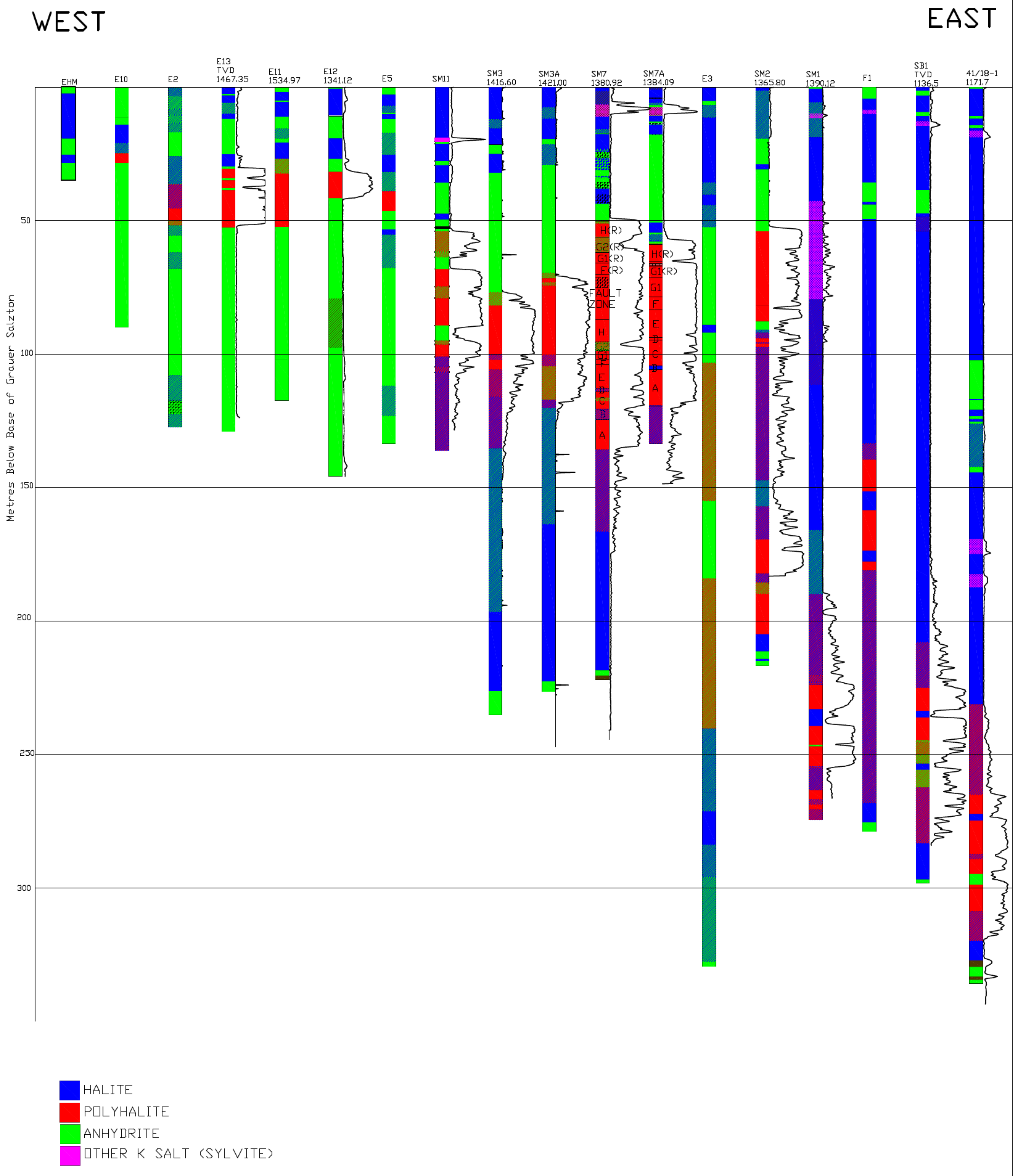

DRAWING NUMBER	JOB TITLE	CLIENT	
1433/MHJ/06	YORK POTASH PROJECT	YORK POTASH LTD	

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FIGURE 6
WEST-EAST SECTION OF FORDON EVAPORITES: NORTHERN AREA (ESKDALE) BOREHOLES

SCALE	DRAWN BY	DATE
VERTICAL AS SHOWN HORIZONTAL NOT TO SCALE	CBELL	25/03/13

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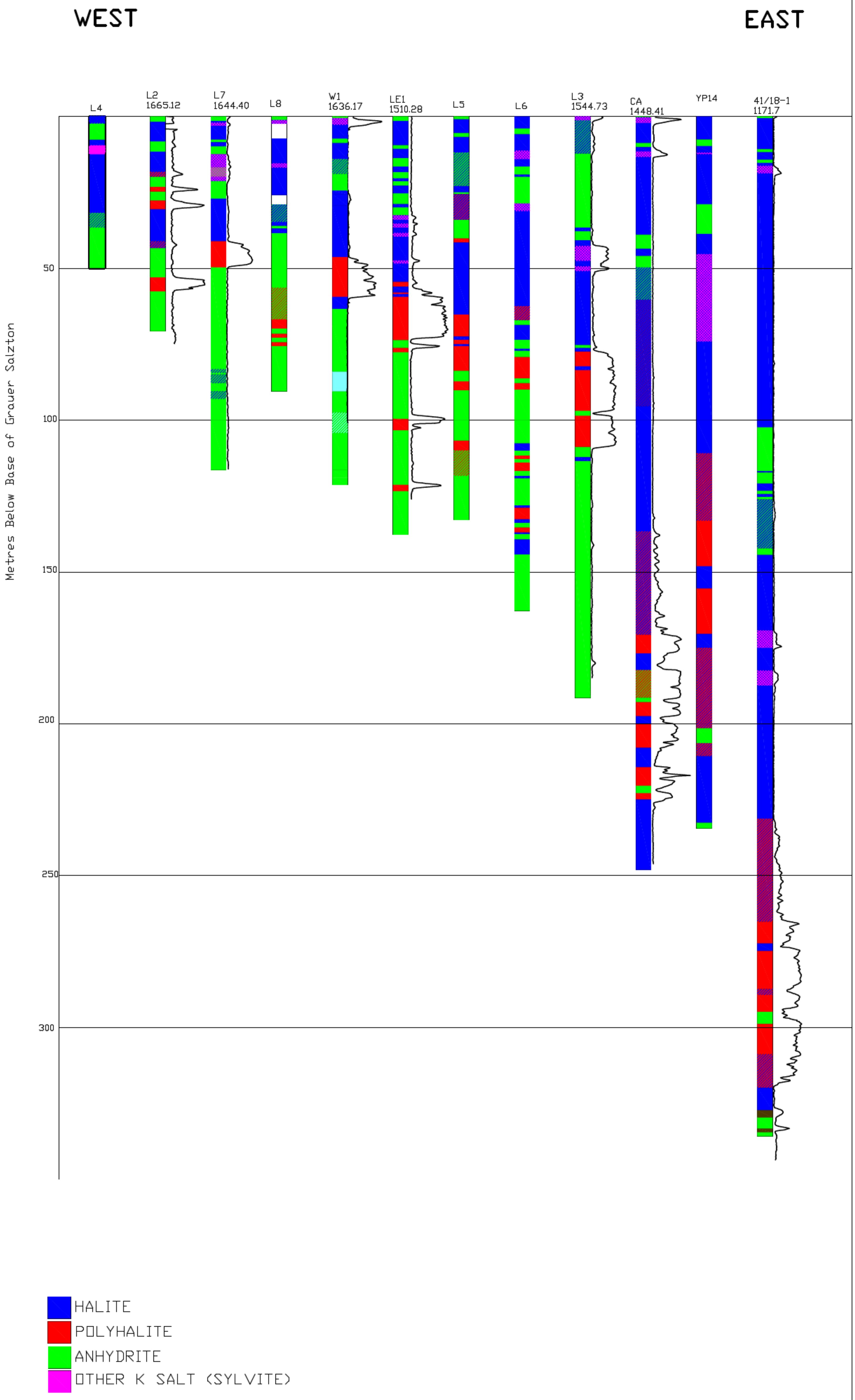
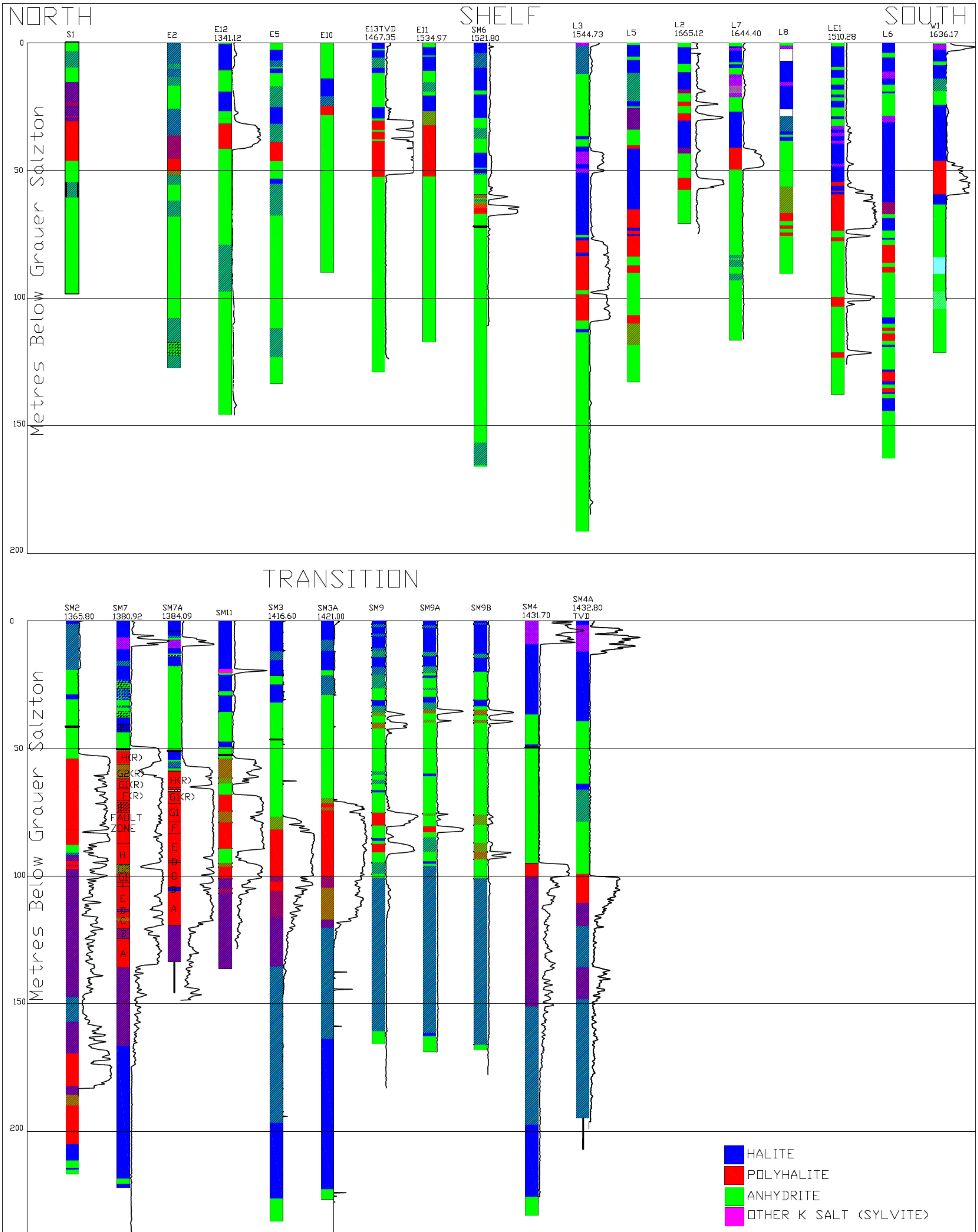


DRAWING NUMBER 1433/MHJ/07	JOB TITLE YORK POTASH PROJECT	CLIENT YORK POTASH LTD	FWS CONSULTANTS LTD Environmental and Geological Consultants Merrington House, Merrington Lane Industrial Estate, Spennymoor, Co Durham, DL16 7UT Tel: 01388 420633 Fax: 01388 819750 www.fwsconsultants.com
DRAWING TITLE FIGURE 7 WEST-EAST SECTION OF FORDON EVAPORITES: SOUTHERN AREA (LOCKTON) BOREHOLES		SCALE VERTICAL AS SHOWN HORIZONTAL NOT TO SCALE	DRAWN BY CBELL DATE 25/03/13



DRAWING NUMBER	JOB TITLE	CLIENT	
1433/MHJ/08	YORK POTASH PROJECT	YORK POTASH LTD	FWS CONSULTANTS LTD *Environmental and Geological Consultants*

DRAWING TITLE
FIGURE 8
NORTH-SOUTH SECTIONS OF FORDON EVAPORITES:
SHELF AND TRANSITION BOREHOLES

SCALE	DRAWN BY	DATE
VERTICAL AS SHOWN HORIZONTAL NOT TO SCALE	CBELL	25/03/13

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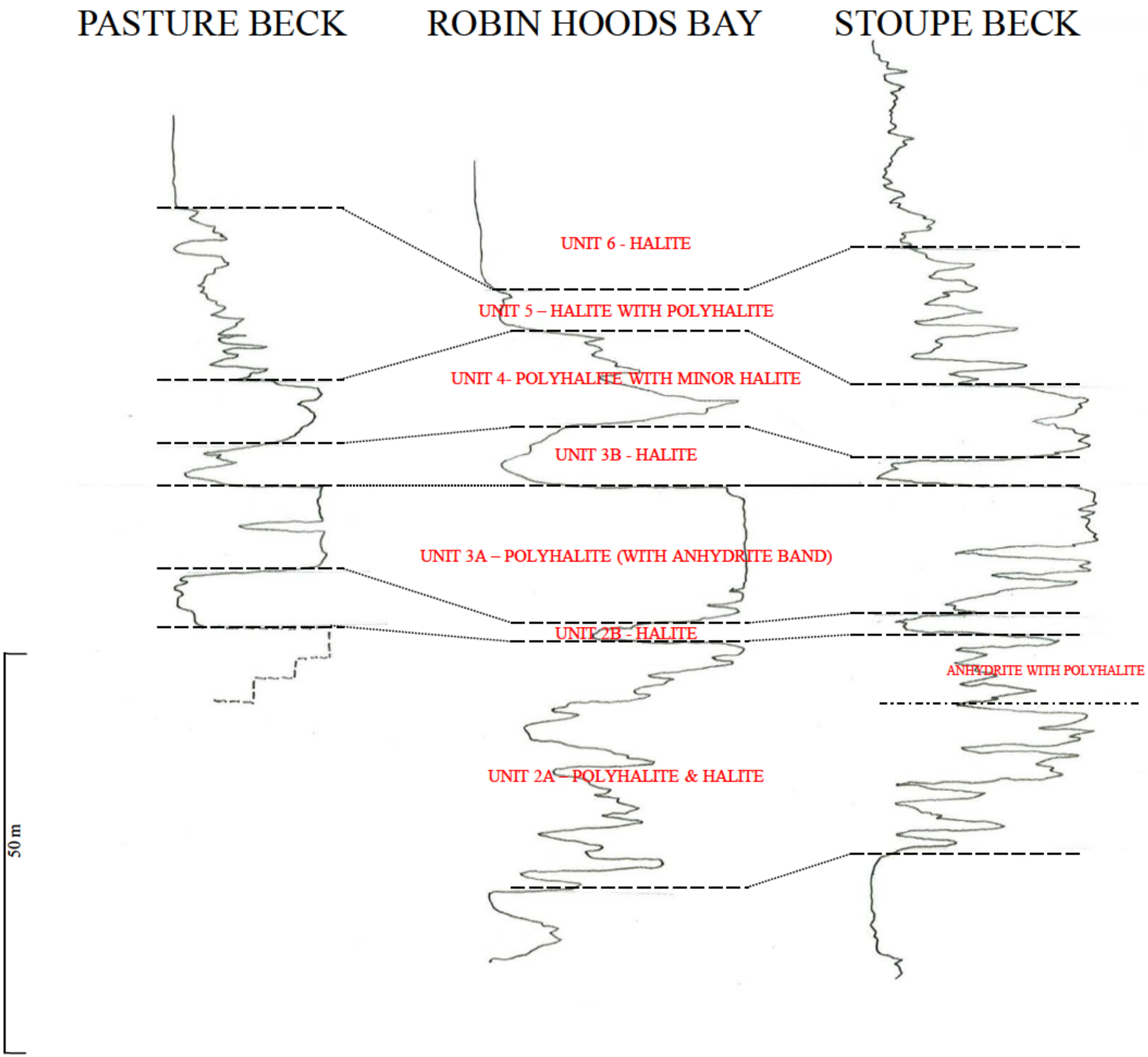

NOTES

Stoupe Beck gamma log has been corrected for deviation

Pasture Beck gamma log has been corrected for dip

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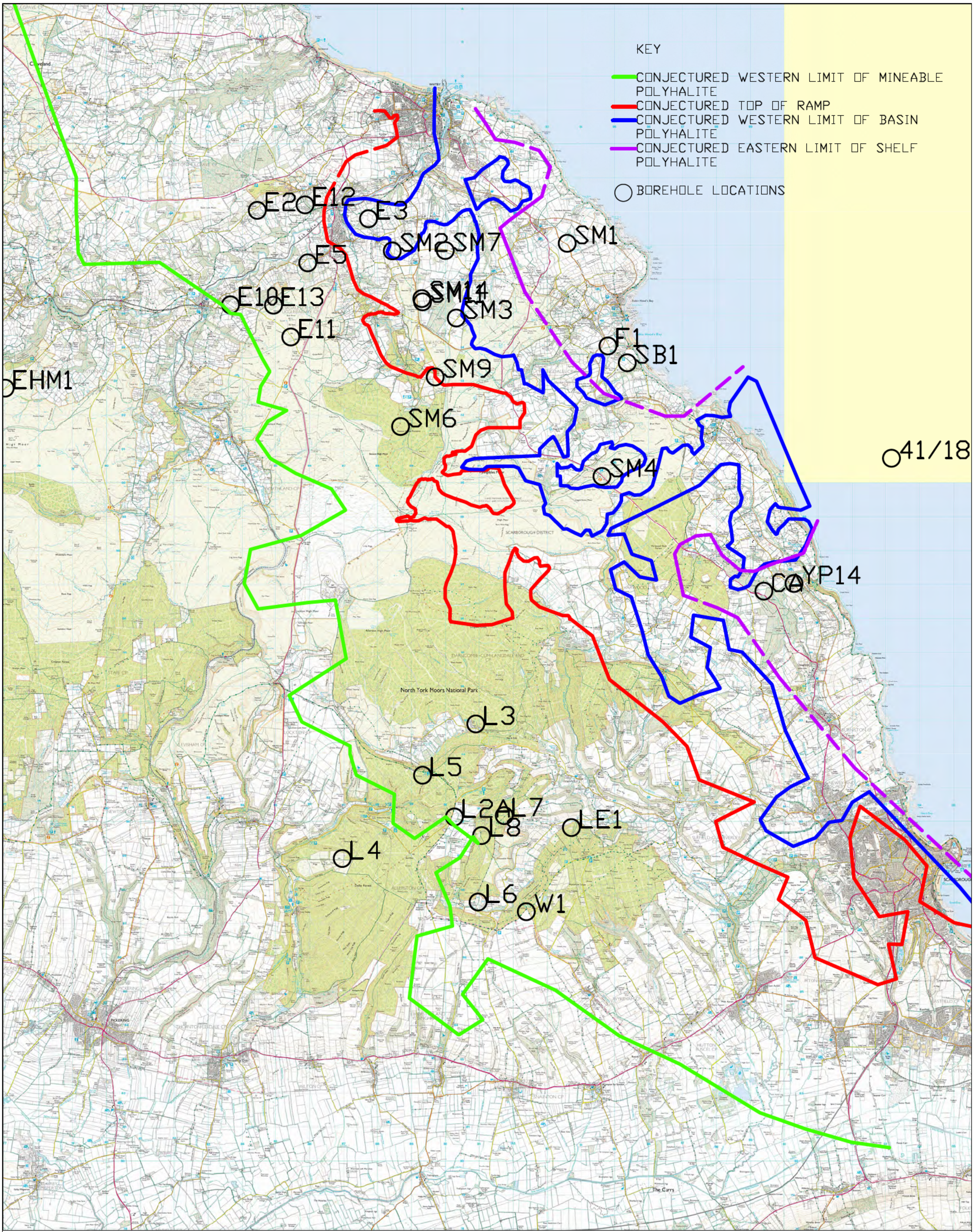
DRAWING TITLE - FIGURE 9
COMPARISON OF POLYHALITE INTERSECTION IN PASTURE BECK WITH ROBIN HOODS BAY AND STOUPE BECK AS SHOWN BY GAMMA LOGS

STATUS

DRAWN BY	DESIGNED BY	DATE
CB		FEB 2012

SCALE	DRG. No	REV.
NTS	1433/MHJ/09	



DRAWING NUMBER 1433/MHJ/10	JOB TITLE YORK POTASH PROJECT	CLIENT YORK POTASH LTD	FWS CONSULTANTS LTD Environmental and Geological Consultants
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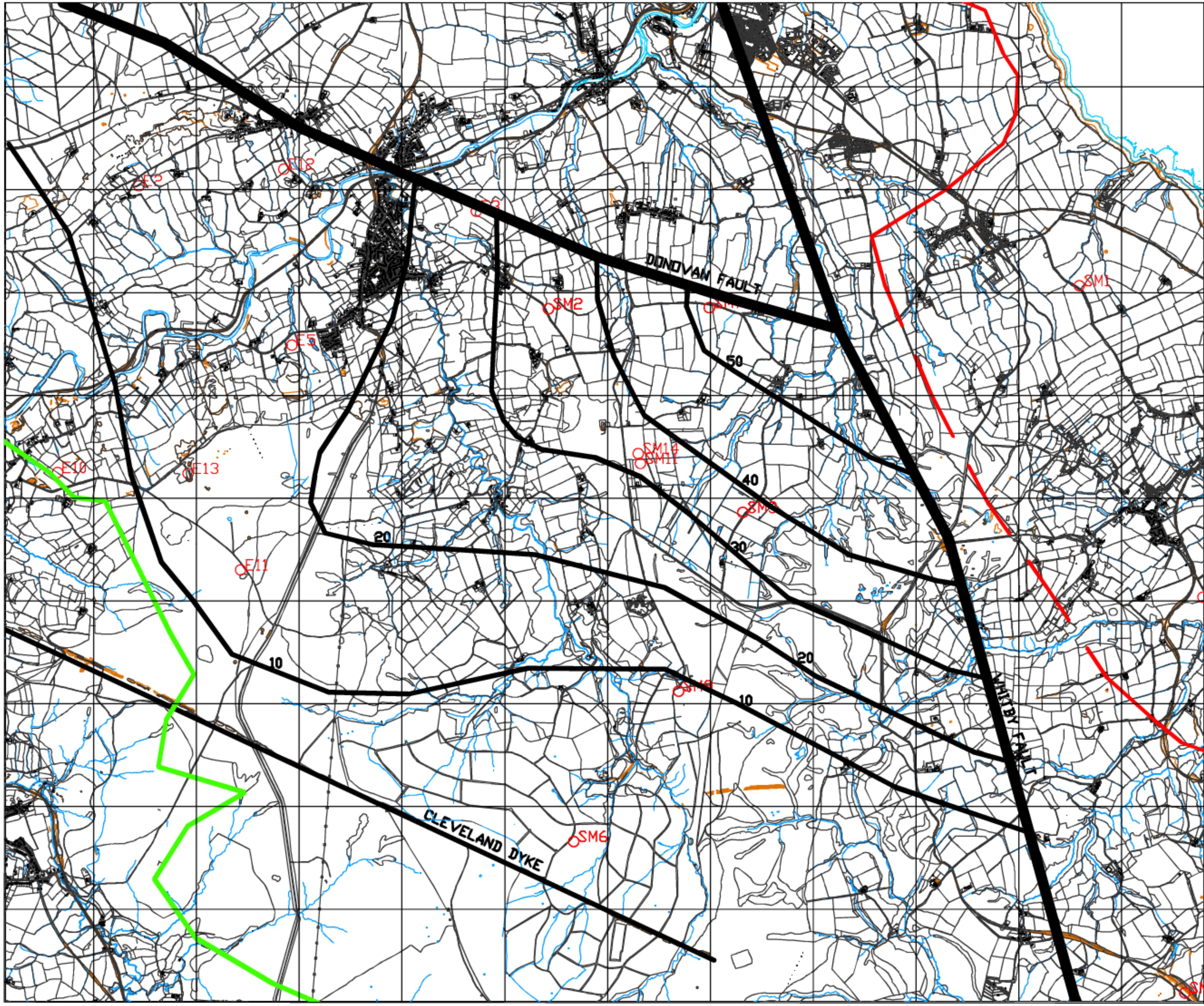

NOTES

ISOPACH OF POLYHALITE (m) (SHELF SEAM)

SIMPLIFIED STRUCTURAL FEATURES

EASTERN LIMIT OF SHELF POLYHALITE

WESTERN LIMIT OF MINEABLE SHELF POLYHALITE

DRAWING NUMBER

1433/MHJ/11

DRAWING TITLE

FIGURE 11
BASIC GEOLOGICAL ELEMENTS FOR NORTHERN PART OF AOI

JOB TITLE

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SCALE	DRAWN BY	DATE
1:25,000 @ A2 1:50,000 @ A4	CBELL	25/09/13

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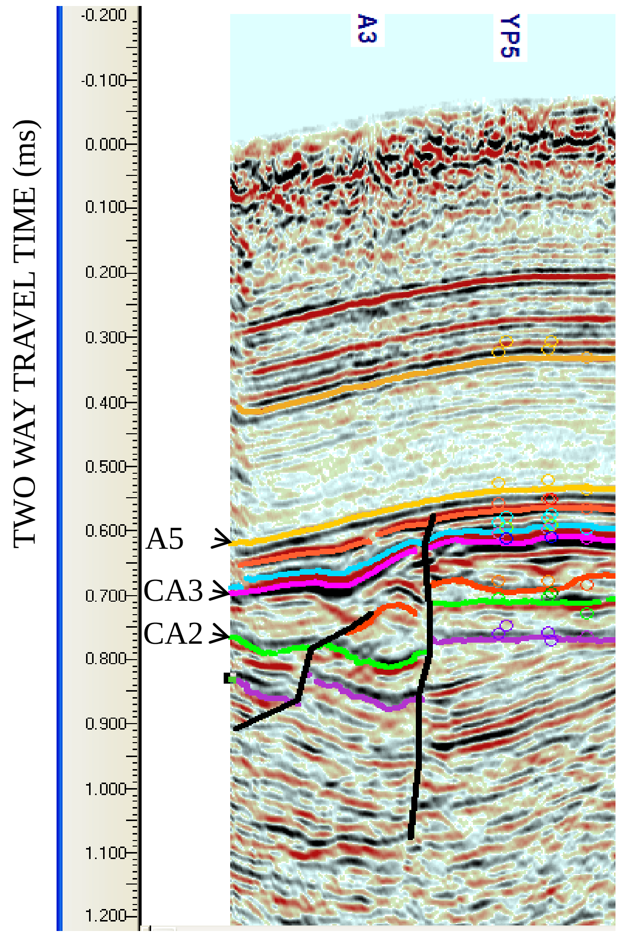
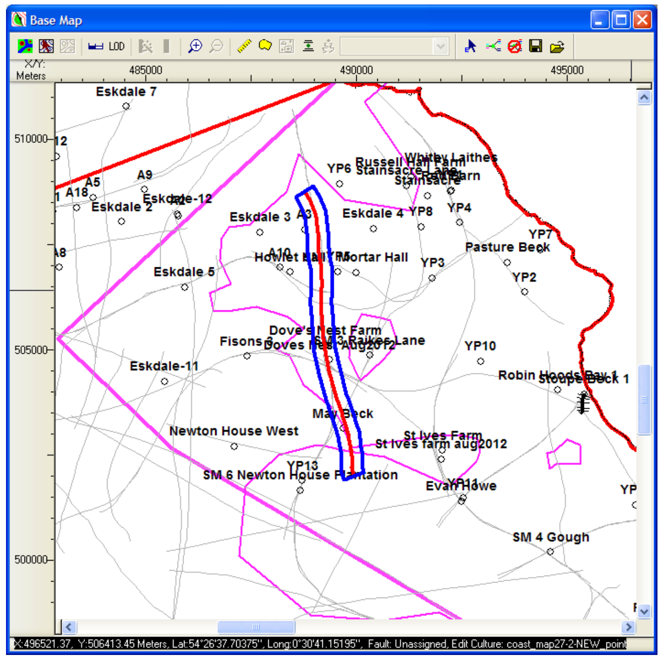
2012 YP 04

NORTH

SOUTH





NOTES

Strata Tops
A5 = Top Anhydrite
(Top Zechstein Evaporite)

CA3 = Brotherton Limestone

CA2 = Kirkham Abbey Formation

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FIGURE 12
TYPICAL SEISMIC SECTIOIN THROUGH
DONOVAN FAULT

STATUS

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CBELL		25/03/13

SCALE	DRG No	REV
NOT TO SCALE	1433/MHJ/12_	

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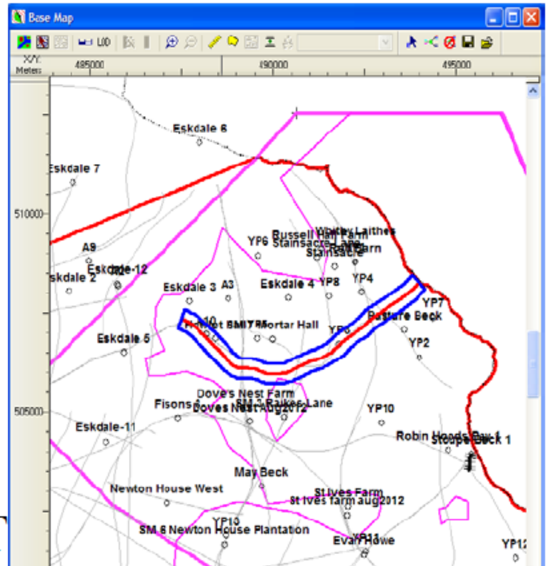
WEST



EAST

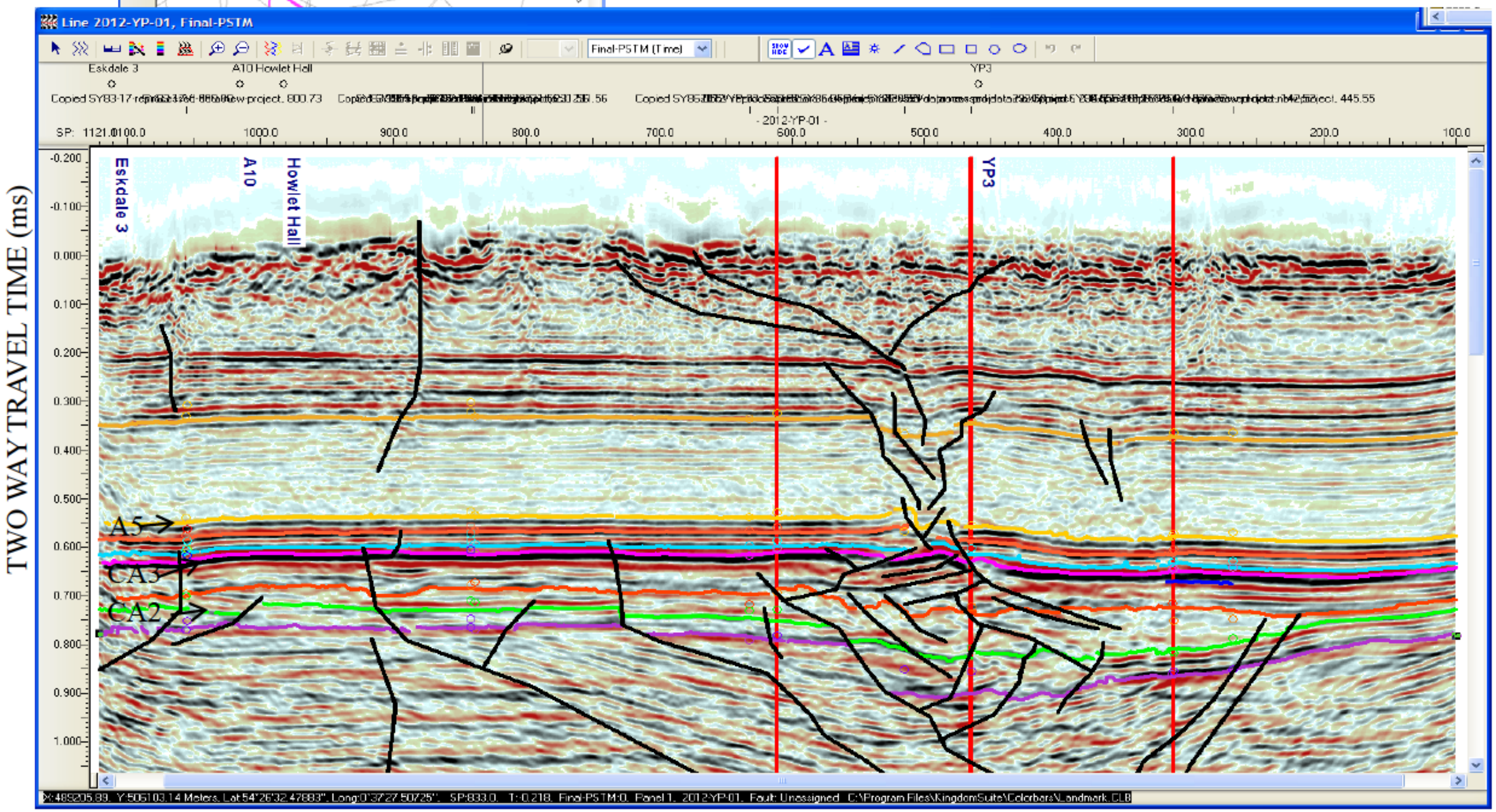


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FIGURE 13
TYPICALSEISMIC SECTION THROUGH WHITBY FAULT ZONE

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