ENVIRONMENTAL STATEMENT
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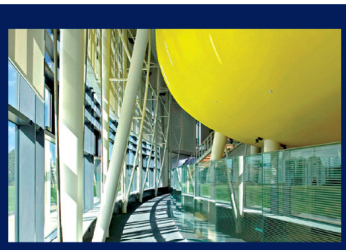

St Helena Wind Study
7th July 2006

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Executive Summary

The aim of this study was to compare the conditions on the Prosperous Bay Plain as they are currently against what they are likely to be if the proposed runway design is constructed.

This comparison was carried out by building a 3D computational model of the existing terrain from contour maps provided by WS Atkins; Computational Fluid Dynamics (CFD) software was utilised to simulate the effects of a southeasterly wind. The proposed terrain was then constructed (again, using drawings provided by Atkins) and the results were used to compare the two landscapes in terms of the degree of shelter provided in certain areas. The wind speed used was 8.5 m/s referenced at 10m above the centre of the runway.

The proposed runway design involves removing land from an area that currently provides shelter to a portion of the protected zone. The CFD results show that this area (highlighted in Figure 1) is highly likely to be subjected to significantly higher wind speeds than those experienced with the current topography.

1 Introduction

The proposed runway design involves removing land from an area that currently provides shelter to a portion of the protected zone shown in Figure 2. The aim of this study was to compare the conditions on the Prosperous Bay Plain as they are currently against what they are likely to be with the proposed runway design.

This comparison was carried out by building a 3D computational model of the existing terrain in the area of the Prosperous Bay Plain, using contour maps provided by WS Atkins; using computational wind engineering (CWE) techniques to simulate the effect of the prevailing southeasterly wind on the existing landscape. The software used to carry out this simulation was ANSYS-CFX 5.7; this is a Computational Fluid Dynamics (CFD) code that uses an unstructured mesh, which is ideal for modelling the undulating topography in this region of the island.

It is extremely important to note that the 3D model is an approximation of the topography in St Helena; in order to deliver results within the time frame and budget given, certain areas of the landscape (i.e. those that are most affected by the change in topography) are more accurate than surrounding areas (i.e. those likely to be less affected by the change in topography). It should also be noted that the accuracy of the data provided was in 10m contours, the 3D model is therefore no more accurate than this.

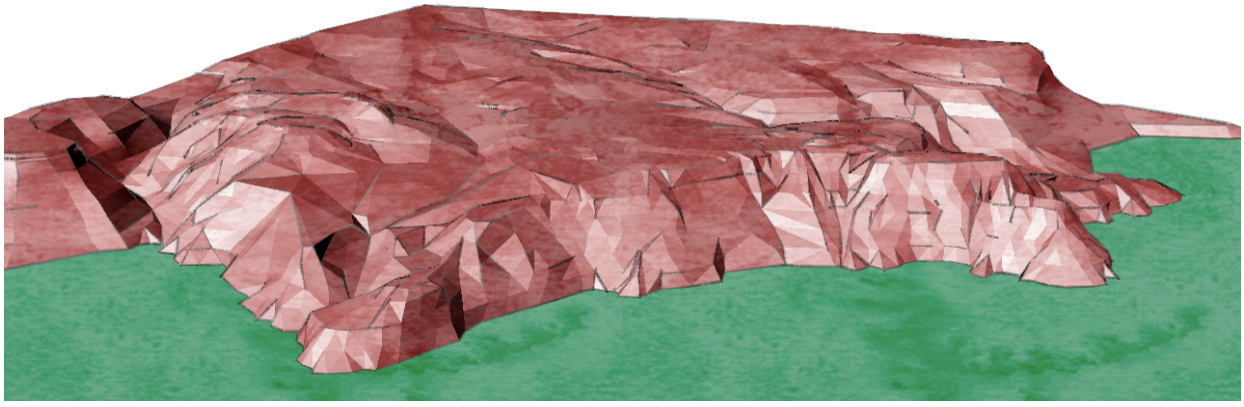

Figure 1 – 3D perspective of the model

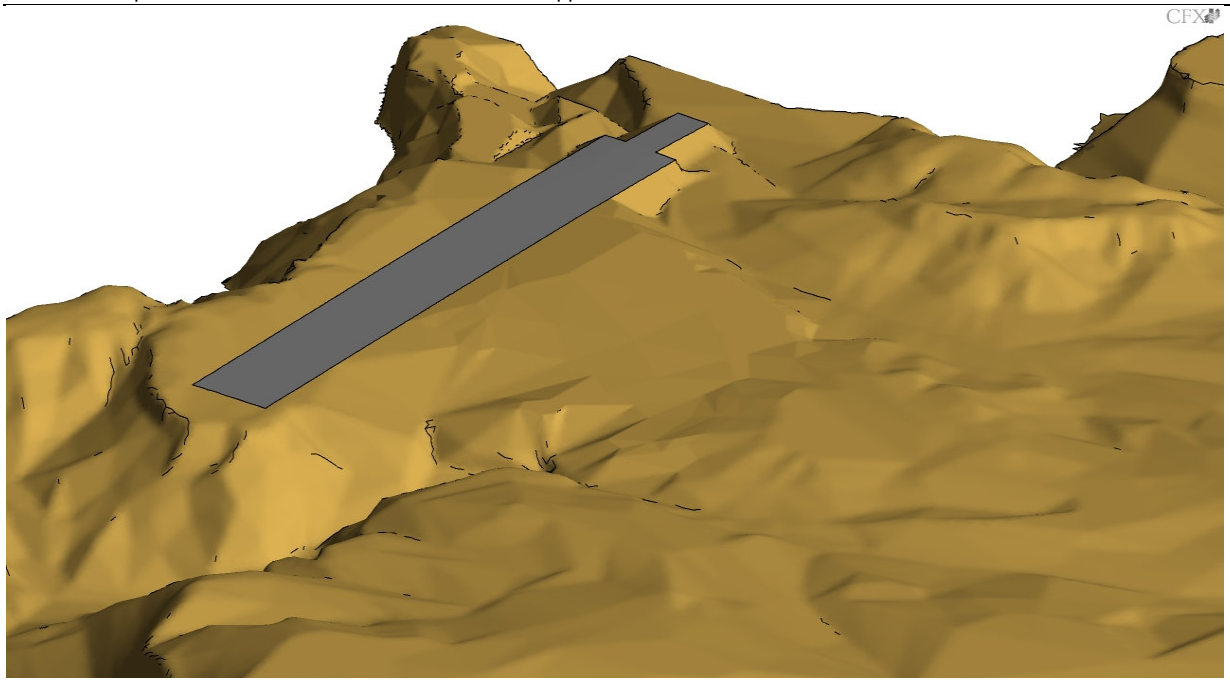

Figure 2 – 3D perspective showing the protected “bowl” and runway

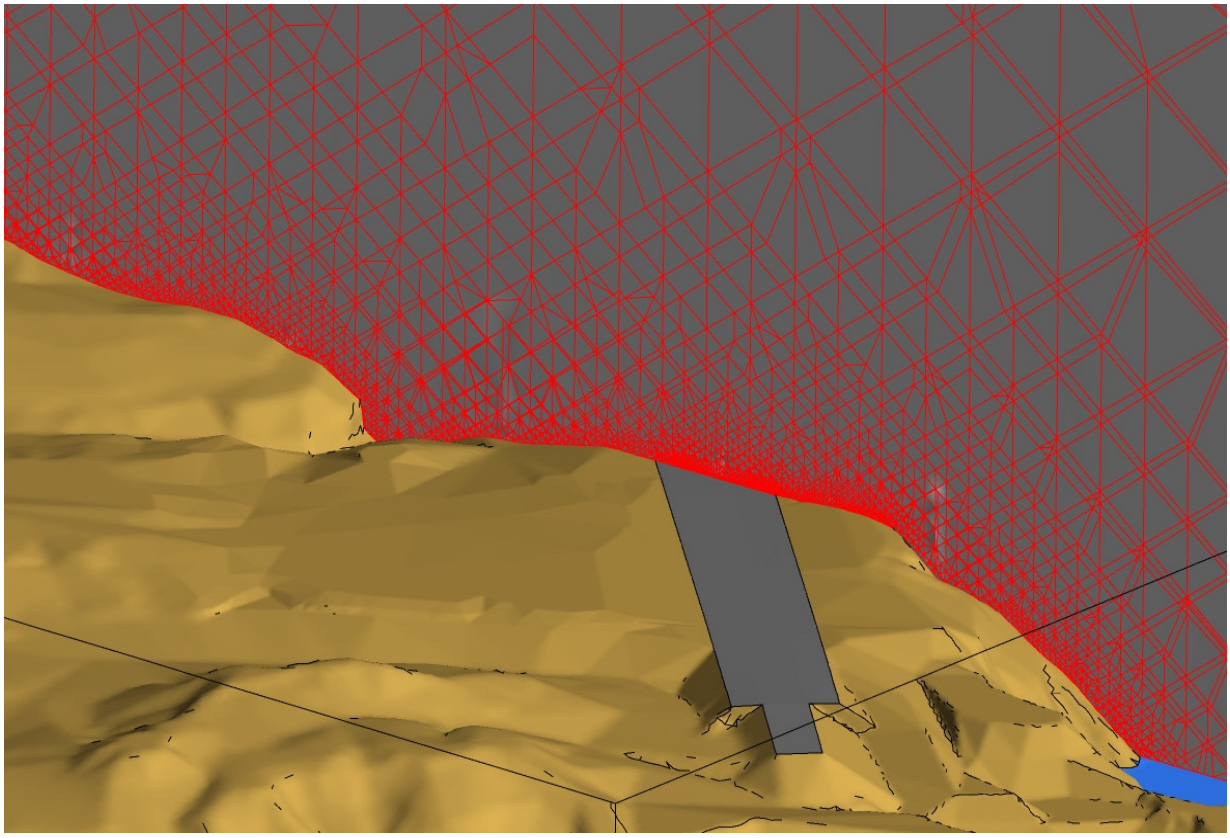

Figure 3 – Section showing the CFD mesh

2 Assessment Criteria

As this was a rather unique study, there are no established assessment criteria, as such. In order to make a comparison between the existing and proposed landscapes, within the budget and time constraints, it was important to make a number of assumptions and establish our own criteria.

Firstly, only one wind direction was simulated, this was because the wind data available showed that southeasterly winds are extremely prevalent in St Helena.

Secondly, an appropriate wind speed needed to be assumed. As the topography undulates quite significantly, there is a great variation in wind speeds across the surface of the land. For this reason the model was calibrated so that a wind speed of 8.5 m/s at a height of 10m about the centre of the proposed runway occurred; this was our reference point.

Due to the enormous scale of the model, it must be accepted that the results of the analysis carried out are not perfectly accurate and are to be used as a guide only. For this reason it was extremely important to model the existing terrain as well as the proposed in order to have a direct comparison; this way a relative increase in velocities over specified areas could be predicted. Though for given wind speeds (at the reference point), the areas affected may change slightly in size and position, these results can be used as a rough guide for “normal” wind speeds (i.e. those experienced for the vast majority of the year – say 95% of the time). Extreme wind speeds are likely to have more unpredictable effects.

3 Results

Figures 4 and 5 show the velocity plots for the existing and proposed landscapes respectively. The runway is outlined in black, as is the protected area. The runway outline is dotted in the case of the existing landscape.

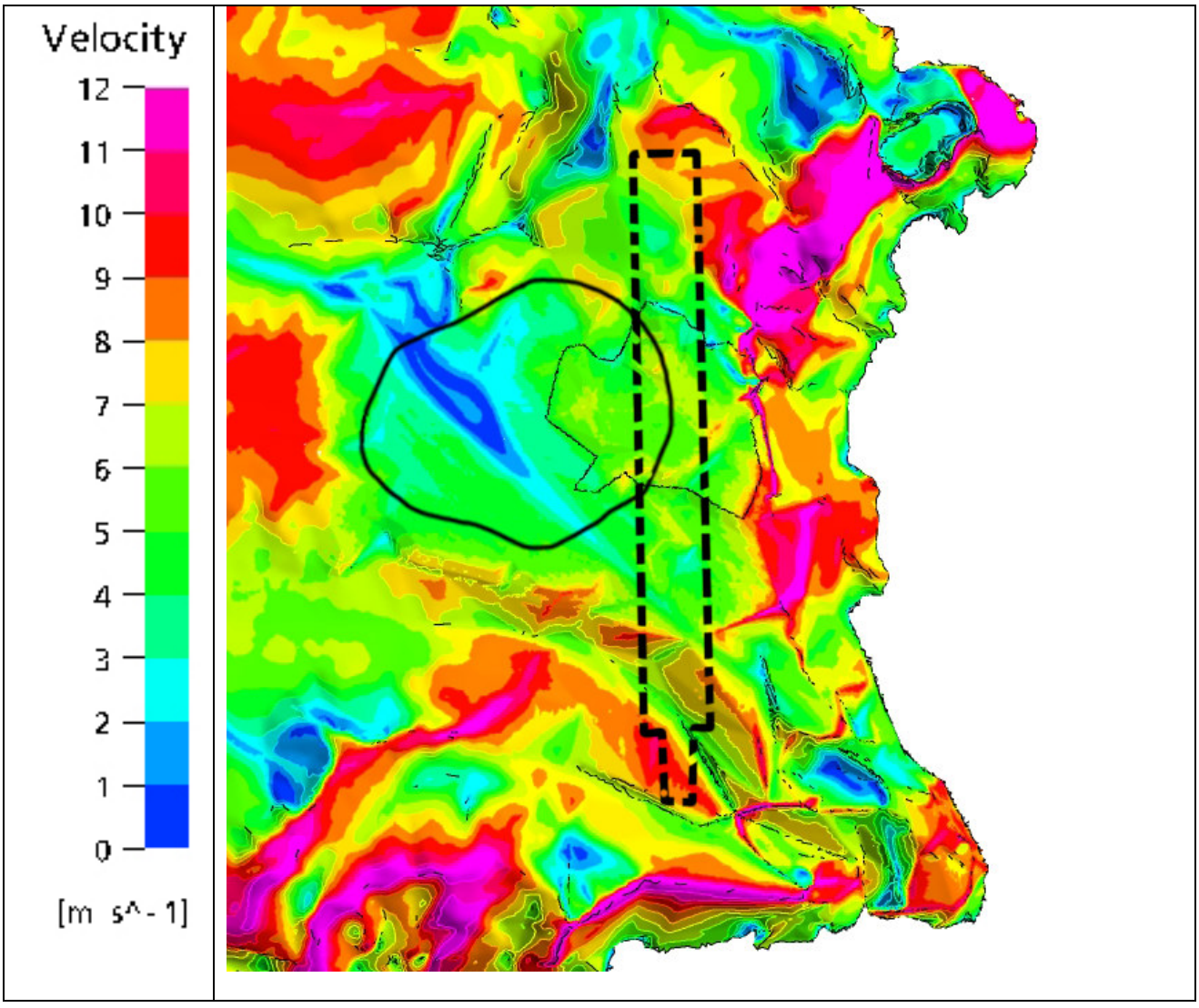

Figure 4 – Velocity plot for existing case

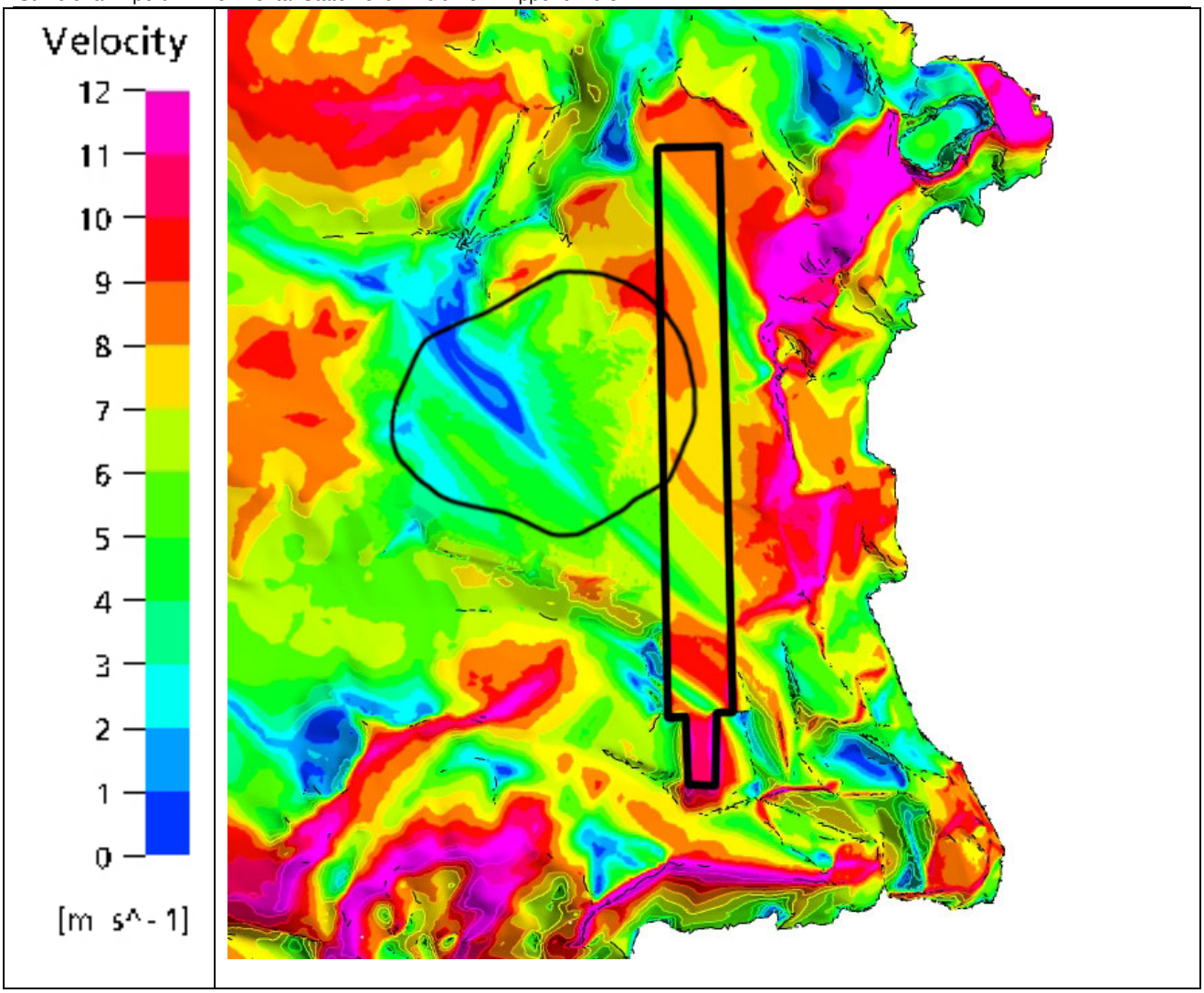

Figure 5 – Velocity plot for proposed case

It can be seen that the blue area in the middle of the protected zone, which represents wind speeds of less than 3m/s is reduced in size when the proposed results are compared to the existing ones. At the same time, the yellow to red area in the north east region of the protected zone, representing wind speeds greater than 7m/s increases in size. Figures 6 and 7 show these regions without the velocity plots: the red area representing wind speeds greater than 7 m/s and the purple area representing wind speeds less than 3 m/s.

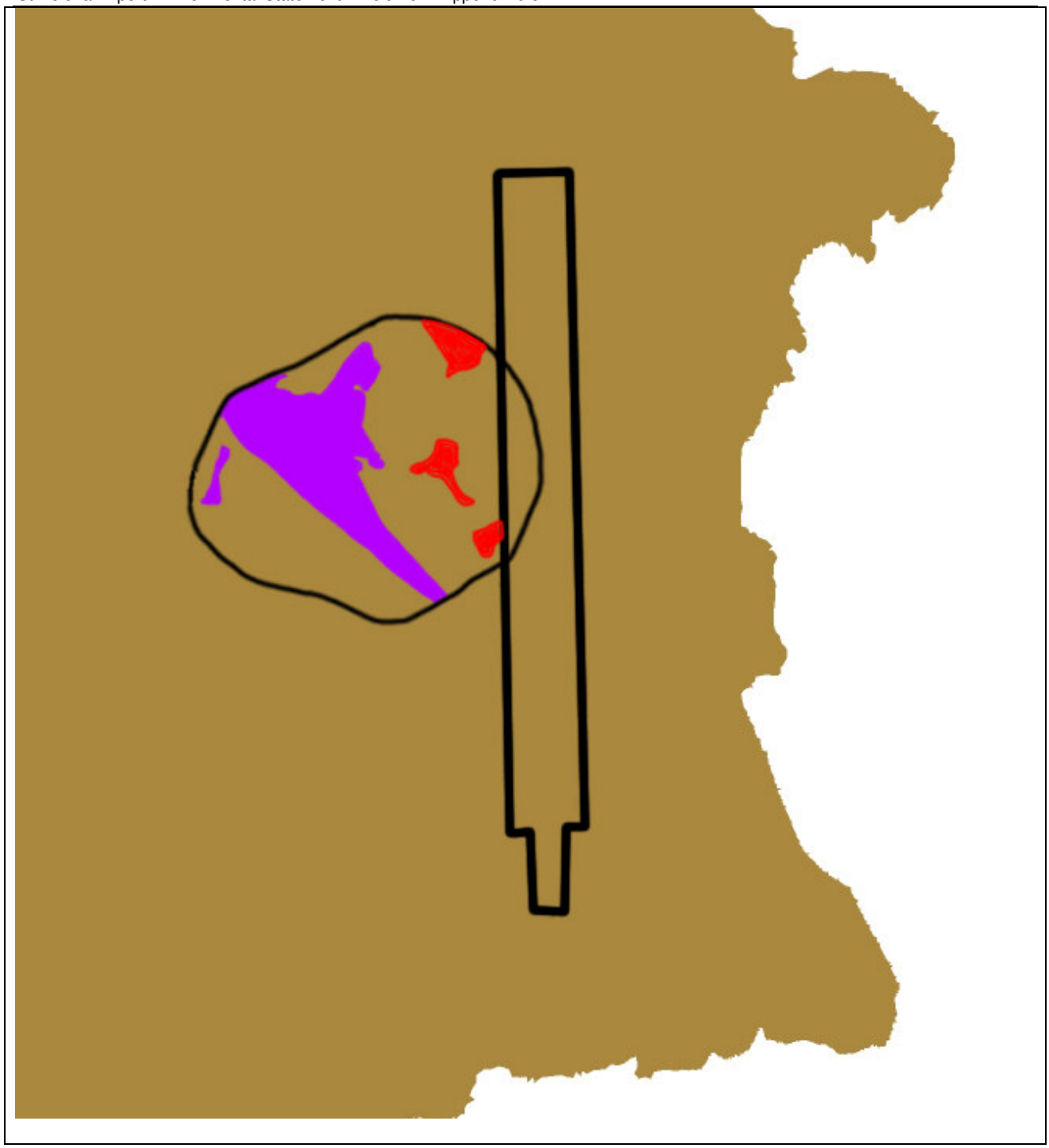

Figure 6 – Low velocity and high velocity areas highlighted for existing case

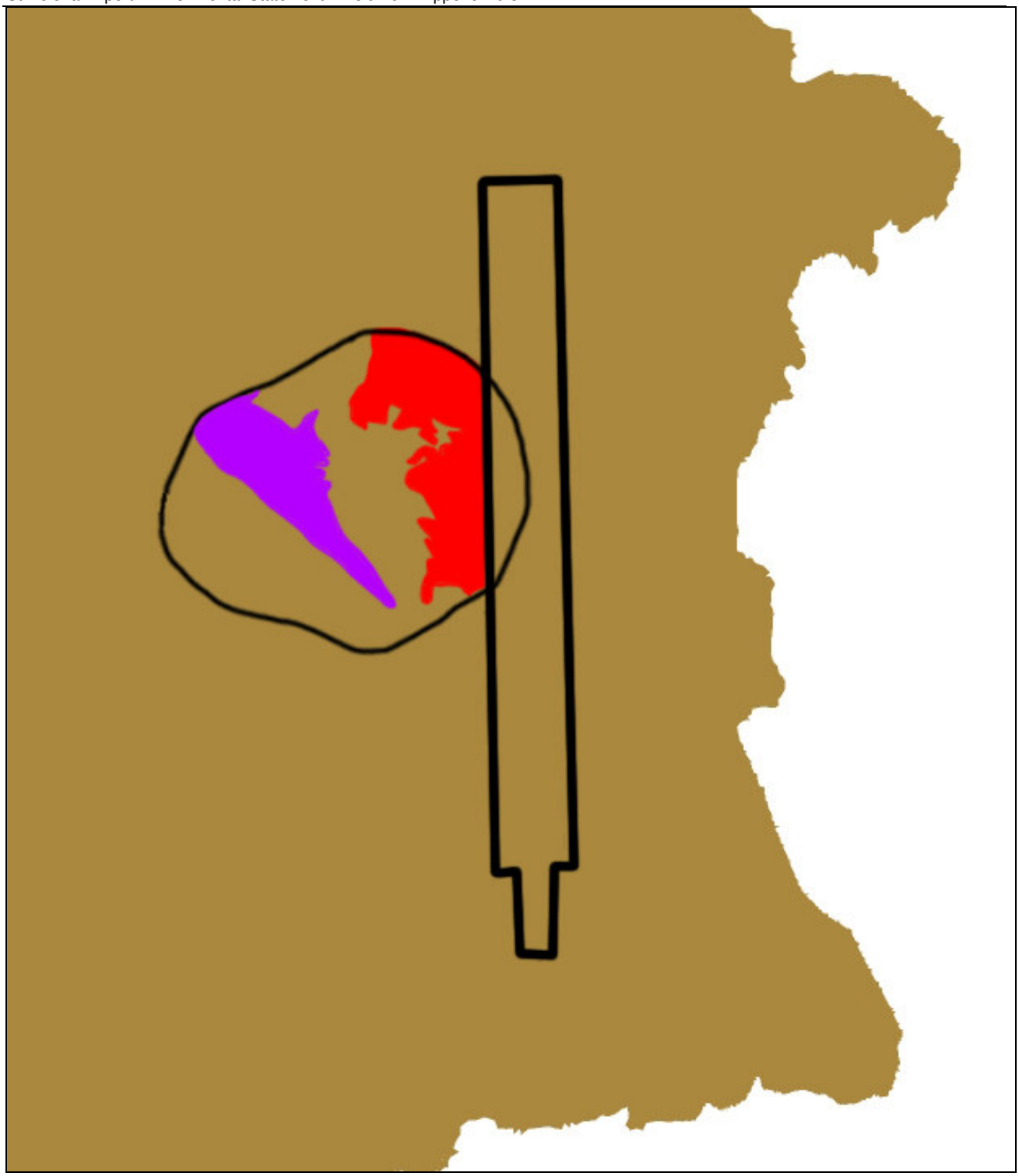

Figure 7 – Low velocity and high velocity areas highlighted for proposed case