

# Groundwater Monitoring of Low Level Waste Disposal Facilities at Dounreay, Scotland

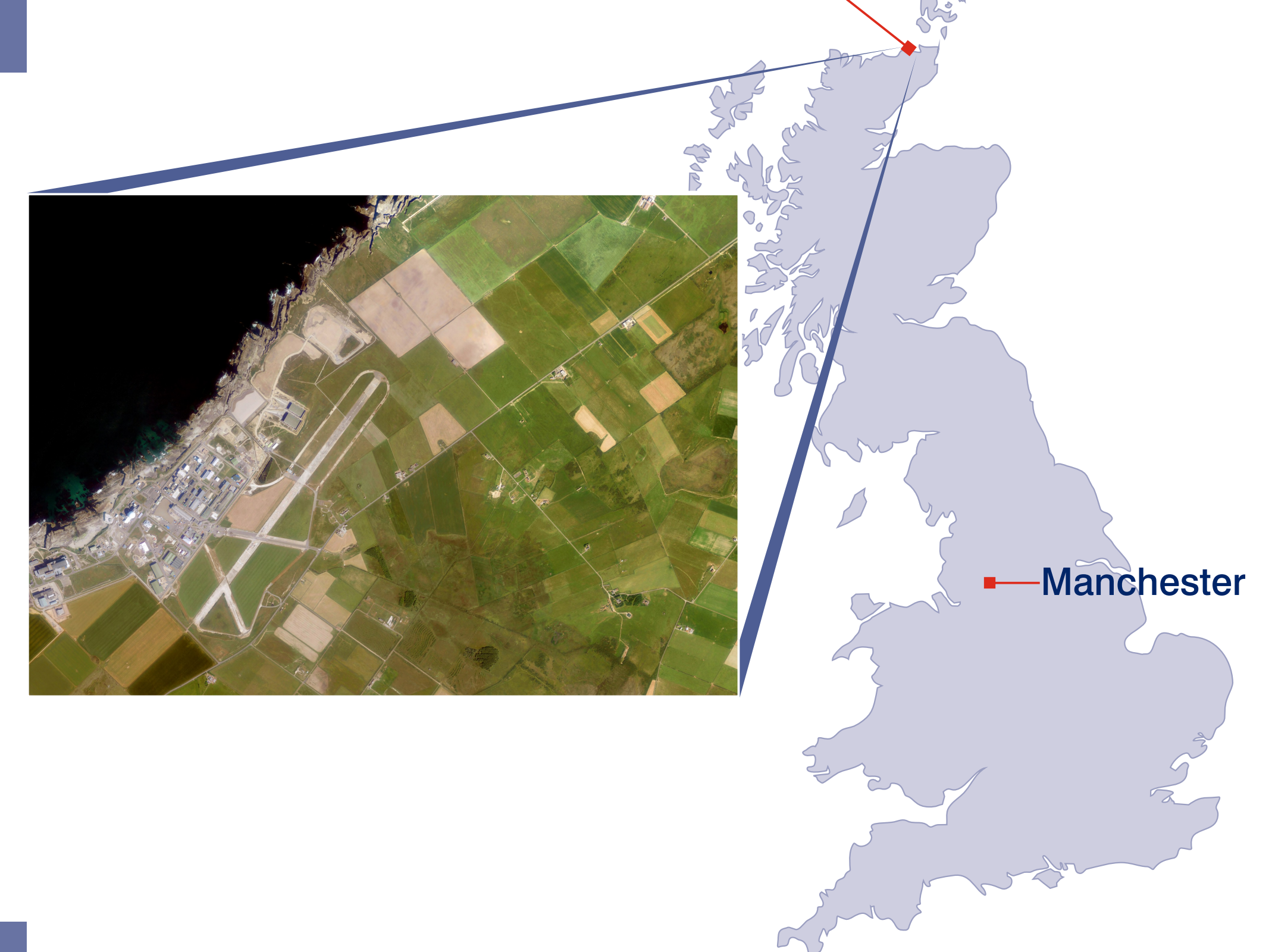
## Introduction

As part of decommissioning the Dounreay site, Low Level Waste (LLW) is produced and subsequently disposed within near surface concrete vaults. In order to protect the groundwater resource and local environment now and into the future the waste must be managed safely. This is ensured through careful design and monitoring as well as regulation by the Scottish Environmental Protection Agency (SEPA) and the associated Radioactive Substances Act (RSA) Authorisation which allows disposal of LLW at the facilities.

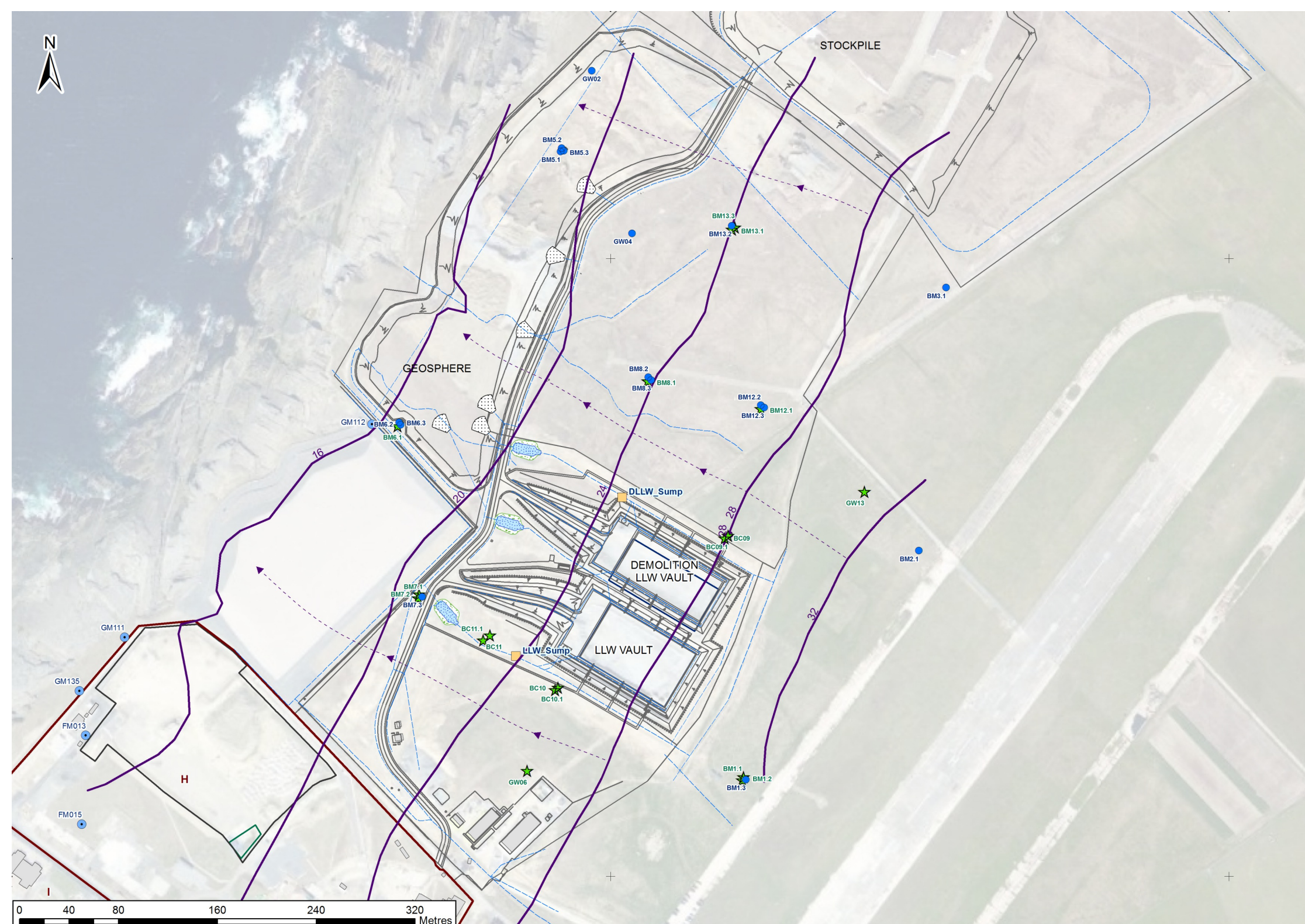
The first two vaults of the Low Level Waste Disposal Facilities at Dounreay started construction in 2011 with the first waste disposed in 2015. There is planning permission for a total of six vaults holding up to 175,000m<sup>3</sup> conditioned LLW.

The Dounreay site is currently scheduled to reach Interim End State in 2033 by which time the disposal facilities will be backfilled and capped.

Location of the Dounreay site



## 2009 - Baseline



Before any excavation or construction took place the area around the planned facilities was monitored for a period of 18 months from 2009-10 which provided a baseline to compare against future data.

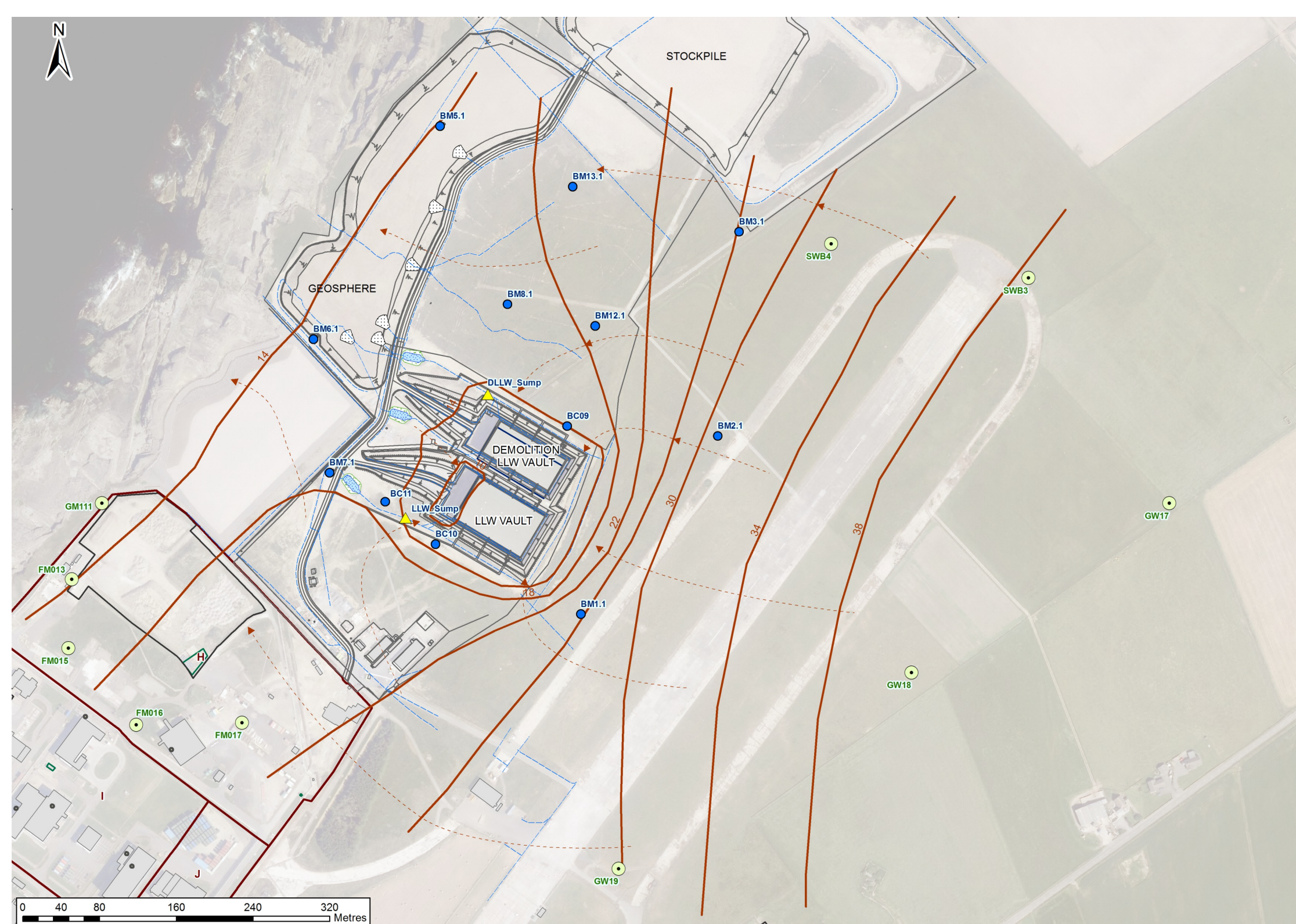
The baseline identified several radionuclides present within the groundwater including U235 and U238 as well as hazardous species such as mercury, cadmium and hydrocarbons all found naturally occurring within the middle Devonian bedrock of the Orcadian basin. The monitoring continued through the construction of the first two vaults and beyond.

Baseline groundwater contours



Vault excavation during construction

## 2015 - Operation



During the operational disposal phase, a pair of pumps in each excavation (Duty and stand-by) keep the excavations dry. This pumps a total of around 700m<sup>3</sup> per day with extraction monitored under a separate Controlled Activities Regulation (CAR) licence.

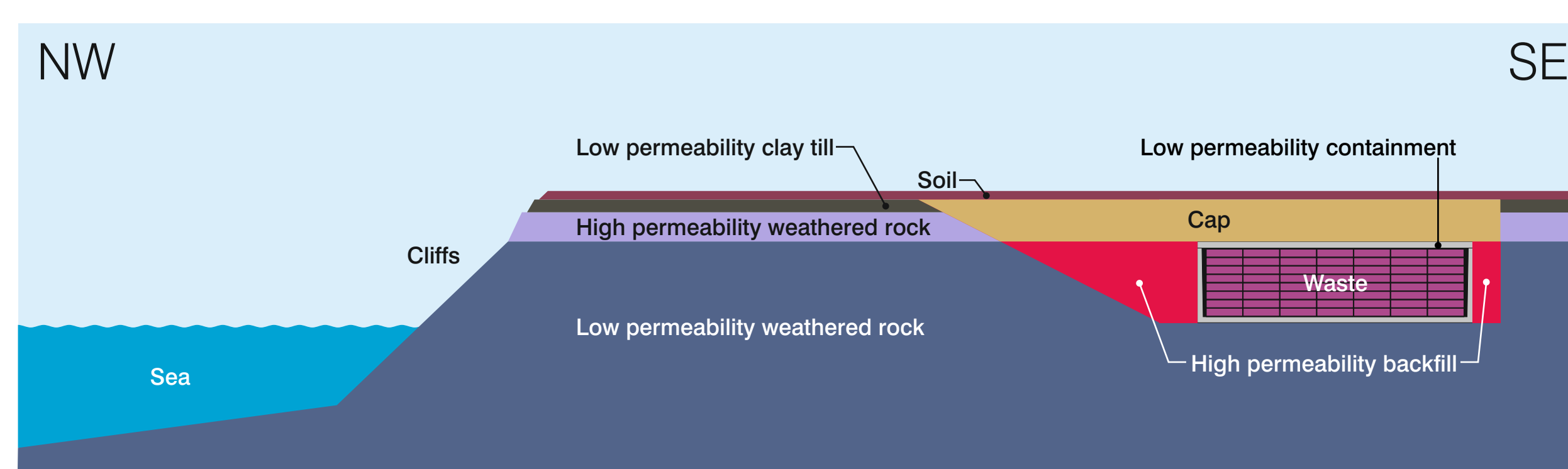
The surrounding area is monitored with a network of boreholes and surface sampling points. This network allows groundwater contours to be drawn showing the developing cone of depression and ensures the changing groundwater chemistry can be analysed.

Operational groundwater contours



Disposed waste packages in the vault

## 2033 - Post closure

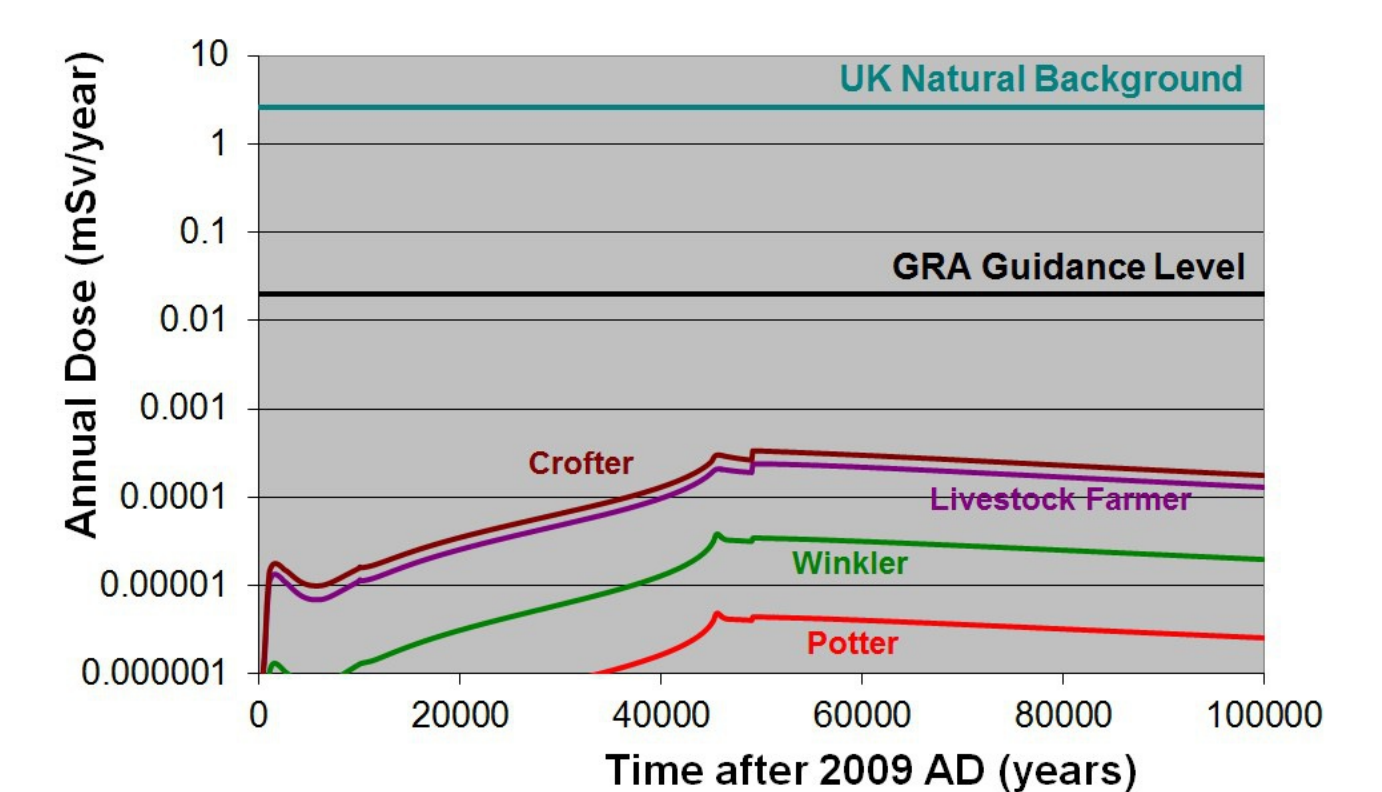


Cross section of disposal vault post closure

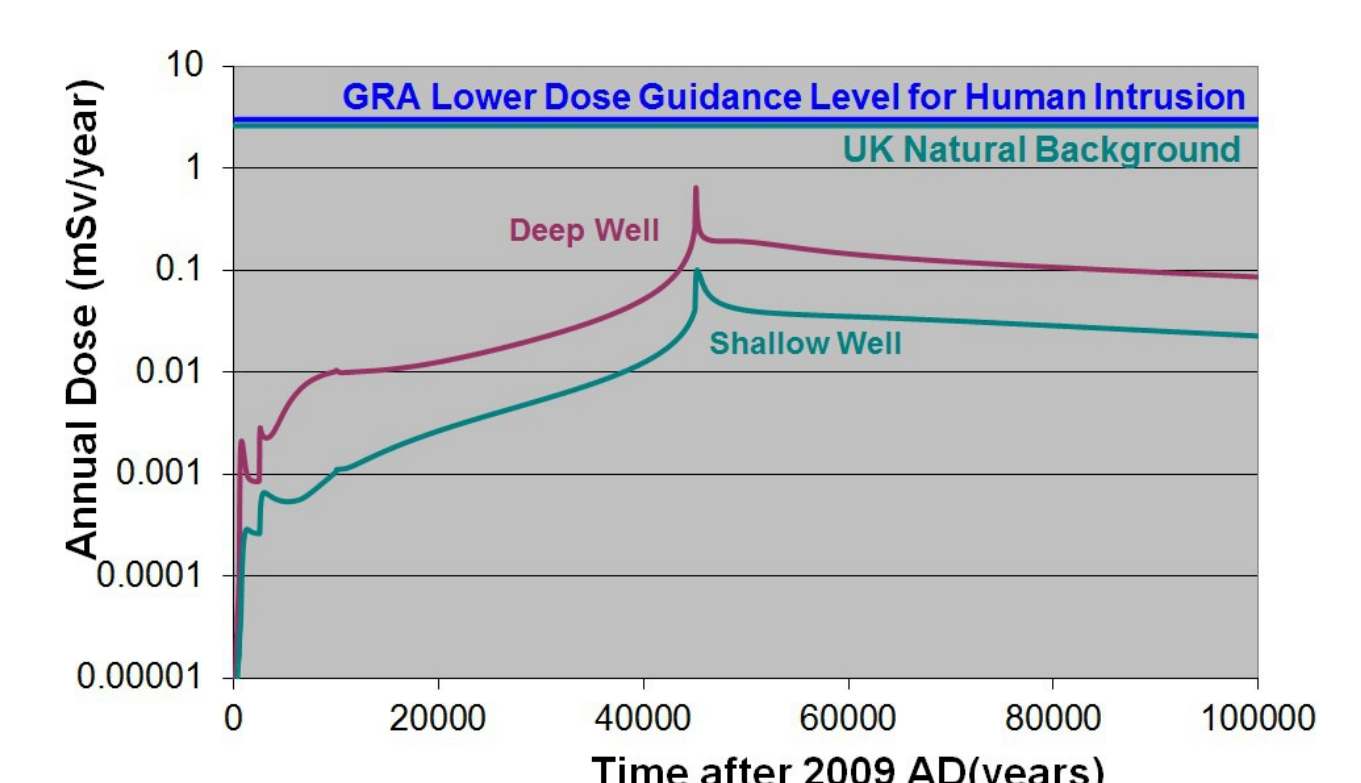
The purpose of the facilities is to dispose of LLW near surface as such they have been designed with the intent of minimising the effect on the groundwater resource.

This includes requirements on the bulk permeability of the vault walls, the conditioning of waste and the cap designs to passively minimise the quantity of groundwater flowing into the waste and in turn to surface.

These measures minimise the risk of significantly impacting the local groundwater resource as far as is reasonably practicable, as demonstrated by the calculated dose rates to Potentially Exposed Groups (PEGs).



Calculated dose rate to different PEGs



Calculated dose rate from groundwater downstream