

1 Introduction

1.1 Background and Objectives

Stantec UK Environmental Services¹ (Stantec ES) has developed an impact assessment methodology for determining the degree of impact of quarrying activities on neighbouring receptors. The objective of this technical note is to outline a methodology for assigning a degree of impact to potential effects on neighbouring receptors that have been identified in a Hydrogeological Impact Assessment (HIA). This methodology will also determine whether an effect is significant and if any mitigation measures are required. This methodology is to be applied across all HIAs undertaken by Stantec ES to ensure a consistent approach.

¹ Formerly known as ESI Limited. ESI became part of Stantec UK in 2018.

2 Impact Assessment Methodology

2.1 Overview

A source-pathway-receptor methodology has been applied to the impact assessment. In the context of the impact assessment for the Site these elements may be defined as:

Source: Activities associated with mineral extraction, including dewatering, water quality effects, and the quarry discharge;

Pathways: The groundwater flow pathways or hydrogeological linkages identified in the conceptual model;

Receptors: Abstractions, designated sites, rivers, aquifers and other key water features. The risk assessment process can be subdivided into a number of steps as described below.

2.2 Identification of Receptors

The identification of a risk requires the presence of all three elements in the source-pathway-receptor chain. The source for this assessment is, by definition, the proposed extraction activities within the Application Area. The first task in the risk assessment process is therefore to identify any relevant receptors. As a minimum, the following should be considered:

- Neighbouring groundwater and surface water abstractions including both licenced and private supplies;
- Underlying aquifers;
- Neighbouring surface water features (including waterbodies and watercourses); and
- Neighbouring water-dependent designated sites.

2.3 Identification of Pathways

Having established all potential impact sources and receptors, it is necessary to identify potential pathways between the quarry (the source) and each receptor (i.e. determine all source-pathway-receptor linkages). The assessment process must establish whether the quarrying activities could potentially affect any of the identified receptors. This is achieved by considering each potential source-pathway-receptor chain in the context of the conceptual model. Where there is believed to be no significant groundwater pathway between the quarry and a given receptor, this receptor can be removed from the impact assessment process. Where a pathway linkage is unclear, possibly due to uncertainty in the conceptual model, the pathway is assumed to exist at this stage of the assessment process.

This risk assessment approach serves to filter the list of potential receptors, and only those that are considered vulnerable (i.e. within the radius of influence or with a linking pathway) are considered in the impact assessment.

2.4 Quantification of Effects

The presence of a hydrogeological pathway between the quarry and receptor does not indicate that an effect will occur at the receptor. The next step in the impact assessment process must therefore be to address whether or not there is likely to be an effect at each potential receptor resulting from quarry development and restoration. This may require quantification, for example of the degree of groundwater level change at a receptor. As a minimum a qualitative assessment will be provided.

2.5 Assessment of Level of Impact and Significance

The demonstration and quantification of a potential effect does not necessarily indicate that the impact will be significant. The significance of potential effects is assessed individually for each receptor. There are two aspects to the assessment of significance.

- The size of the potential effect should be compared with a criterion that indicates the smallest significant impact. If the size of effect is smaller than the criterion then the effect does not represent a significant impact. In some cases it may be more appropriate to determine this on a qualitative basis.
- If the size of effect is potentially greater than the relevant criterion, it is necessary to assess the significance that the potential impact represents. The significance of an impact is dependent on the magnitude of the effect and the importance of the receptor.

2.5.1 Importance of receptors

Receptors have been assigned to one of three status categories; low, medium or high. The methodology for assigning to a particular category is based on the following criteria:

- Low Status: Unlikely to be of significant ecological or societal value (e.g. small ephemeral pond); surface water and groundwater abstractions that supply or impact on an individual or small number of people (e.g. farm or home supply), although this may be locally significant;
- Medium Status: Of local ecological or societal value or supporting medium or high status ecological features (e.g. springs); surface water or groundwater abstractions that supply or impact on a local community (e.g. local water supply or water supply to a local amenity);
- High Status: Nationally and internationally designated ecological sites (e.g. SACs) or features supporting these (e.g. springs); surface or groundwater abstractions that are utilised for public water supply. Also includes aquifers that are defined as Source Protection Zones (SPZs) or similar.

2.5.2 Degree of effect

The degree of effect at each receptor is to be evaluated separately on the basis of the conceptual model. The degree of effect is assessed without the application of mitigation measures. To assist in this evaluation, the following conservative guidelines have been adopted for screening purposes.

- For licensed groundwater abstraction boreholes a predicted groundwater level reduction in excess of 0.5 m is taken to indicate a medium to high degree of effect, with the exact category dependent on the magnitude of the predicted change and the available drawdown.
- For shallow wells and ponds, a predicted reduction in level in excess of 0.25 m is taken to indicate a medium to high degree of effect, with the exact category dependent on the magnitude of the predicted change and the available drawdown or degree to which levels fluctuate.
- For spring flows or baseflow-dependent watercourses, a derogation of flow in excess of 10% of mean low flows is taken to indicate a medium to high degree of effect. The exact category is dependent on the magnitude of the predicted change and the degree to which flows are groundwater dependent.
- Potential water quality effects will be greatest in the shallowest aquifer. Deeper aquifers will be less likely to be affected, and the level of effect will also be correspondingly lower, given the increased capacity for dilution and attenuation with depth. Effects on surface water will be dependent on the distance between the quarry and the relevant surface water feature.

Where an effect falls below the threshold criteria described above, it is taken to be negligible. Where it exceeds the critical thresholds, the degree of effect (low, medium, or high) is assessed, based on the particular conditions at that receptor. This assessment should relate the predicted effect to measured baseline conditions. For example, for groundwater levels, the effect should be compared to seasonal variability, and for stream flows, the change should be compared to measured baseflows.

2.5.3 Degree of impact

Table 2.1 shows how the receptors value and degree of effect are brought together to determine the degree of impact. A moderate or major degree of impact is considered to be significant. When a degree of impact is significant, mitigation measures are required.

Table 2.1 Impact assessment matrix

		Receptor Value		
		Low	Medium	High
Degree of Effect	Negligible	Negligible	Negligible	Negligible
	Low	Minor	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major