

6 LAND, SOILS AND GEOLOGY

6.1 Introduction

6.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by McCarthy Keville O'Sullivan (MKO), on behalf of Arlum Ltd, to carry out an assessment of the potential impacts and associated effects of a proposed housing development at Moneyduff, Oranmore Co. Galway on the land, soil, and geological environment.

This report provides a baseline assessment of the environmental setting of the Proposed Development in terms of land, soils, and geology, and discusses the potential impacts that the construction and operation of the Proposed Development will have. Where required, appropriate mitigation measures to limit any identified significant impacts to soils and geology are recommended and an assessment of residual impacts and significance of effects provided.

6.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience includes soils, subsoils and geology. We routinely complete impact assessments for land soils and geology, hydrology and hydrogeology for a large variety of project types.

This chapter of the EIAR was prepared by Michael Gill.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 17 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of residential and infrastructure developments in Ireland. In addition, he has substantial experience in surface water drainage design and SUDs design, and surface water/groundwater interactions.

6.1.3 Relevant Legislation

The EIAR is carried out in accordance with the follow legislation:

- S.I. No. 349 of 1989: European Communities (Environmental Impact Assessment) regulations and subsequent amendments (S.I. No. 84 of 1995, S.I. No. 352 of 1998, S.I. No. 93 of 1999; S.I. No. 450 of 2000; S.I. No. 538 of 2001); S.I. No. 30 of 2000 the Planning and Development Act, 2000; and S.I. 600 of 2001 Planning and Development Regulations and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment; and,
- S.I. No. 4 of 1995: The Heritage Act 1995.

6.1.4 Relevant Guidance

The soils and geology section of this EIAR is carried out in accordance with guidance contained in the following documents:

- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU);
- Environmental Protection Agency (2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (September 2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements);
- Environmental Protection Agency (September 2015): Draft – Revised Guidelines on the Information to be Contained in Environmental Impact Statements;
- Environmental Protection Agency (2003): Advice Notes on Current Practice (in the Preparation on Environmental Impact Statements);
- Environmental Protection Agency (2002): Guidelines on the Information to be Contained in Environmental Impact Statements;
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements; and,
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

6.2 Schedule of Works

6.2.1 Desk Study

A desk study of the Moneyduff site and the surrounding study area was largely completed in advance of undertaking the walkover survey and site investigations. The desk study involved collecting all the relevant geological data for the Proposed Development and study area. This included consultation with the following:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - National Draft Bedrock Aquifer map;
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 14 (Geology of Galway Bay). Geological Survey of Ireland (GSI, 2003);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets; and,
- General Soil Map of Ireland 2nd edition (www.epa.ie).

6.2.2 Site Investigations

A site inspection of the proposed development site and surrounding area was undertaken by HES on 05th January 2018.

The objectives of the site inspection were to determine the topographic layout of the proposed site, to investigate the geological and hydrological regime of the site and to determine potential flood patterns and flood zones at the development location.

6.2.3 Impact Assessment Methodology

Using information from the desk study and data from the site investigation, an estimation of the importance of the soil and geological environment within the study area is assessed using the criteria set out in Table 6.1 (NRA, 2008).

Table 6.1. Estimation of Importance of Soil and Geology Criteria (NRA, 2008).

Importance	Criteria	Typical Example
Very High	<p>Attribute has a high quality, significance or value on a regional or national scale.</p> <p>Degree or extent of soil contamination is significant on a national or regional scale.</p> <p>Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.</p>	<p>Geological feature rare on a regional or national scale (NHA).</p> <p>Large existing quarry or pit.</p> <p>Proven economically extractable mineral resource</p>
High	<p>Attribute has a high quality, significance or value on a local scale.</p> <p>Degree or extent of soil contamination is significant on a local scale.</p> <p>Volume of peat and/or soft organic soil underlying site is significant on a local scale.</p>	<p>Contaminated soil on site with previous heavy industrial usage.</p> <p>Large recent landfill site for mixed wastes.</p> <p>Geological feature of high value on a local scale (County Geological Site).</p> <p>Well drained and/or high fertility soils.</p> <p>Moderately sized existing quarry or pit.</p> <p>Marginally economic extractable mineral resource.</p>
Medium	<p>Attribute has a medium quality, significance or value on a local scale.</p> <p>Degree or extent of soil contamination is moderate on a local scale.</p> <p>Volume of peat and/or soft organic soil underlying site is moderate on a local scale.</p>	<p>Contaminated soil on site with previous light industrial usage.</p> <p>Small recent landfill site for mixed Wastes.</p> <p>Moderately drained and/or moderate fertility soils.</p> <p>Small existing quarry or pit.</p> <p>Sub-economic extractable mineral Resource.</p>
Low	<p>Attribute has a low quality, significance or value on a local scale.</p> <p>Degree or extent of soil contamination is minor on a local scale.</p> <p>Volume of peat and/or soft organic soil underlying site is small on a local scale.</p>	<p>Large historical and/or recent site for construction and demolition wastes.</p> <p>Small historical and/or recent landfill site for construction and demolition wastes.</p> <p>Poorly drained and/or low fertility soils.</p> <p>Uneconomically extractable mineral resource.</p>

The statutory criteria (EPA, 2002, 2003, 2015 and 2017) for the assessment of impacts require that likely impacts are described with respect to their extent, magnitude, type (*i.e.* negative, positive or neutral) probability, duration, frequency, reversibility, and transfrontier nature (if applicable). The descriptors used in this environmental impact assessment are those set out in EPA (2017) Glossary of Impacts as shown in Chapter 1 of this EIAR. In addition, the two impact characteristics proximity and probability are described for each impact and these are defined in Table 6.2.

In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of impacts are related to examples of potential impacts on the geology and morphology of the existing environment, as listed in Table 6.3.

Table 6.2. Additional Impact Characteristics.

Impact Characteristic	Degree/Nature	Description
Proximity	Direct	An impact which occurs within the area of the proposed project, as a direct result of the proposed project.
	Indirect	An impact which is caused by the interaction of effects, or by off-site developments.
Probability	Low	A low likelihood of occurrence of the impact.
	Medium	A medium likelihood of occurrence of the impact.
	High	A high likelihood of occurrence of the impact.

Table 6.3. Impact descriptors related to the receiving environment.

Impact Characteristics		Potential Geological/Hydrological Impacts
Quality	Significance	
Negative only	Profound	Widespread permanent impact on: <ul style="list-style-type: none"> - The extent or morphology of a cSAC. - Regionally important aquifers. - Extents of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Very Significant/ Significant	Local or widespread time dependent impacts on: <ul style="list-style-type: none"> -The extent or morphology of a cSAC / ecologically important area. -A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). -Extent of floodplains. Widespread permanent impacts on the extent or morphology of a NHA/ecologically important area, Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.

Positive or Negative	Moderate	Local time dependent impacts on: - The extent or morphology of a cSAC / NHA / ecologically important area. - A minor hydrogeological feature. - Extent of floodplains. Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends
Positive, Negative or Neutral	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Positive, Negative or Neutral	Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Neutral	Imperceptible	No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

6.3 Existing Environment

6.3.1 Site Description and Topography

The Proposed Development site is located in the townlands of Moneyduff and Oranhill in Oranmore, Co. Galway. The total study area is approximately 8.7ha (~0.09km²) in area.

The proposed site is used for rough grazing of horses and contains a number of areas disturbed and grassed over in the past.

The elevation of the site ranges between approximately 3.4 and 12.8m OD (metres above Ordnance Datum) The overall local topography generally slopes from east to west with the mounds of spoil creating artificial high points around the site. The dominant land use on the bordering land is residential housing to the north, an environmental reserve to the west and an empty site and further residential uses to the south and greenfield site to the east.

6.3.2 Soils and Subsoils

According to GSI mapping (www.gsi.ie), the site is dominated by shallow, well drained mineral soils (BminSW) and shallow, rocky, peaty mineral complexes (BminSRPT). The area to the west of the proposed site is dominated by peat and some minor areas of the proposed development site in the southwest also contains some peat deposits.

The mapped subsoil type (www.gsi.ie) for the proposed site indicate that the majority of the site is underlain by karstified bedrock outcrop/subcrop (KaRck) with some areas of raised peat in the southwest of the site. The local subsoils map is shown as Figure 6.1.

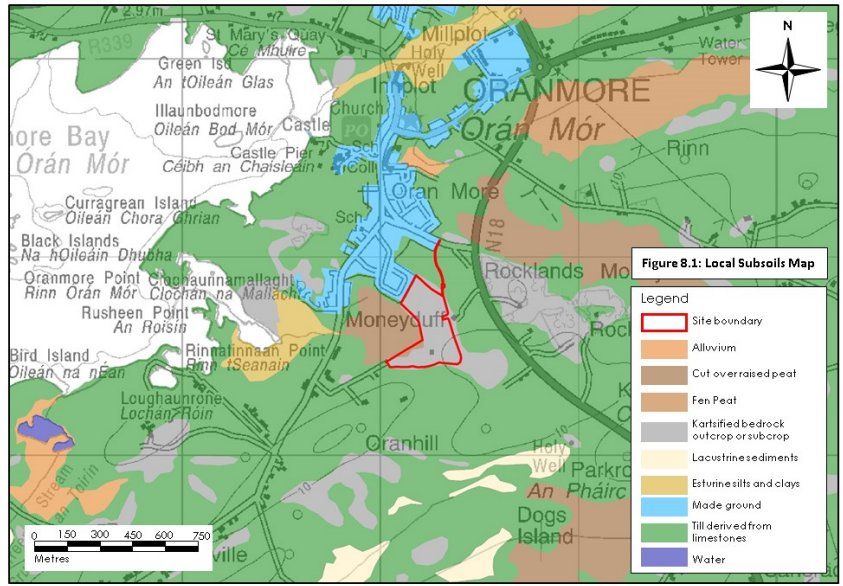


Figure 6.1 Local Subsoils Map

6.3.3 Bedrock Geology

Based on the GSI bedrock map of the region, the Proposed Development site is underlain by the Burren Formation which, at the proposed development site, comprises Dinantian Pure Bedded Limestones (DPBL). Locally in the area of the Proposed Development, the rock formation is described as pale grey clean skeletal limestone. The limestones are classified by the GSI as a Regionally Important Aquifer – Karstified (conduit) (Rkc).

A bedrock geology map of the area is attached as Figure 6.2.

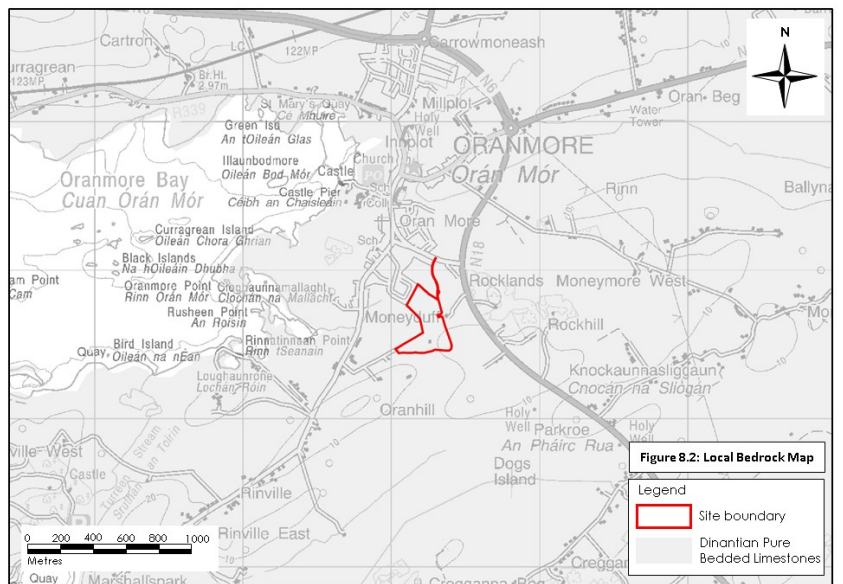


Figure 6.2 Bedrock Geology Map

6.3.4 Geological Heritage and Designated Sites

There are no recorded Geological Heritage sites within the proposed development area. The closest geological heritage site is an asbian carbonate mound, Rinville (IBG 8 Lower), which is located approximately 2.3km west-southwest of the site.

Immediately to the west of the proposed site is the Galway Bay Complex SAC (Code: 000268), and drainage from the site enters the Inner Galway Bay SPA (Code: 004031) approximately 500m downstream of the proposed site. Two isolated pockets of the Galway Bay Complex SAC (Code: 000268) also exist to the east of the site on the eastern side of the N18.

6.3.5 Soil Contamination

There are no known areas of soil contamination on the site. During the site walkovers, no areas of particular contamination concern were identified. Any material on the site appears to be excavated rock type material.

According to the EPA online mapping (<http://gis.epa.ie/Envision>), there are no licenced waste facilities on or within the immediate environs of the proposed development site.

There are no historic mines at or in the immediate vicinity of the site that could potentially have contaminated tailings.

6.3.6 Economic Geology

The GSI Online Minerals Database accessed via the Public Data Viewer shows no quarries within the proposed development area.

The GSI online Aggregate Potential Mapping Database shows that the proposed development site is not located within an area mapped as being of Very High or High granular aggregate potential (i.e. potential for gravel reserves).

6.4 Characteristics of the Proposed Development

The proposed development is described in Chapter 3 and will generally comprise the following:

1. Construction of 212 no. residential units comprising:
 - 34 no. House Type A (four-bed semi-detached unit)
 - 54 no. House Type B (three-bed semi-detached unit)
 - 16 no. House Type C (four-bed detached)
 - 16 no. House Type D (three-bed terraced unit)
 - 24 no. House Type E (three-bed semi-detached unit with attic conversion)
 - 50 no. House Type G (25 no. two-bed ground floor duplexes and 25 no. two-bed plus study first/second floor duplexes)
 - 6 no. House Type H (two-bed duplex apartments)
 - 12 no. house Type J (two-bed terrace)
2. Development of a crèche facility (374 sqm) and associated outdoor play areas and car parking.
3. Provision of new vehicular and pedestrian site access from the North-South Oranmore Distributor Road (the route of which was permitted under An Bord Pleanála Reference PL 07.237219, which was extended under Pl Ref 15/1334).

4. Provision of shared communal and private open space, site landscaping, car parking, site services and all associated site development works.

The proposed development will typically require minor alteration of ground levels to ensure it is at an adequate level for the proposed surface water drainage, foul water drainage and to mitigate flood risk.

Excavation of soil and subsoil will be required for the proposed development in preparation for the construction of building foundations and in the preparation of a suitable sub-formation for road construction, trenching for foul and drainage water infrastructure and other services.

Surface Water Drainage

It is proposed that the development will drain via gravity to 5 no. soakaways proposed on site. Water draining to soakaways will pass through silt traps and hydrocarbon interceptors prior to reaching each soakaway. No surface water from roofs or paved surfaces will be discharge from the site, other than via the soakaways to ground.

Water Supply

Water supply to the site will be via connection to the adjacent public (Irish Water) watermain.

Wastewater Infrastructure

The proposed on-site foul sewers will discharge by gravity to a pumping station to the west of the site, and the foul waste will discharge from this pumping station via pumped rising main to the adjacent public (Irish Water) foul sewer network.

6.5 Potential Impacts of the Proposed Development

6.5.1 Do Nothing Scenario

The use of the proposed development site for rough grazing by livestock would continue. The impact to the topsoil from compaction and poaching of soft ground from the presence of livestock would continue as a result of the Do Nothing Scenario. The potential impacts are imperceptible.

6.5.2 Likely impacts and Mitigation Measures – Construction Stage

The likely impacts of the proposed residential development and mitigation measures that will be put in place to eliminate or reduce them are shown below. These relate to the construction stage. It should be noted that the main potential impacts on the soils and geology environment will occur during the construction stage.

6.5.2.1 Subsoil Excavation and Bedrock Excavation

Excavation of existing fill, subsoil and bedrock will be required for site levelling, for the installation of foundations for the access roads, carpark and buildings, and service trenching. The cut and fill works on the site will be neutral, and there will be a requirement for import of ~20,000m³ of aggregate for building works. This will result in a permanent relocation of soil and subsoil at most excavation locations. The excavated materials are expected to include existing fill material, topsoil/subsoil, and some limestone bedrock.

Mechanism: Extraction/excavation.

Receptor: Land, topsoil, subsoil and bedrock.

Potential Impact: Negative, slight/moderate, direct, likely, permanent impact on soil, subsoil and bedrock.

6.5.2.1.1 Mitigation Measures/Impact Assessment

- Excavated (existing) overburden material will be reused on site, where possible;
- A minimal volume of topsoil and subsoil will be removed to allow for infrastructural work to take place due to optimisation of the layout by mitigation by design; and,
- Construction of service trenching, pumping station and surface water attenuation features will generate excess material, and all excess material will be used locally within the site for landscaping.

6.5.2.1.2 Residual Impact

Negative, direct, slight, likely, permanent impact on topsoil, subsoils and bedrock.

6.5.2.1.3 Significance of Effects

No significant effects on land, topsoil, subsoils or bedrock are anticipated.

6.5.2.2 Contamination of Soil by Leakages and Spillages and Alteration of Soil Geochemistry

Pathway: Topsoil, subsoil and bedrock pore space.

Receptor: Topsoil, subsoil and bedrock.

Potential Impact: Negative, direct, slight, short term, unlikely impact on topsoil, subsoils and bedrock.

6.5.2.2.1 Proposed Mitigation Measures

- All plant and machinery will be serviced before being mobilised to site;
- No plant maintenance will be completed on site, any broken down plant will be removed from site to be fixed;
- Refuelling will be completed in a controlled manner using drip trays at all times;
- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage areas away from open water;
- Fuel containers will be stored within a secondary containment system, e.g. bunds for static tanks or a drip tray for mobile stores;
- Containers and bunding for storage of hydrocarbons and other chemicals will have a holding capacity of 110% of the volume to be stored;
- Ancillary equipment such as hoses and pipes will be contained within the bund;
- Taps, nozzles or valves will be fitted with a lock system;
- Fuel and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- Drip-trays will be used for fixed or mobile plant such as pumps and generators in order to retain oil leaks and spills;
- Only designated trained operators will be authorised to refuel plant on site;
- Procedures and contingency plans will be set up to deal with emergency accidents or spills; and,
- An emergency spill kit with oil boom, absorbers *etc.* will be kept on-site for use in the event of an accidental spill. A specific team of staff will be trained in the use of spill containment.

Highest standards of site management will be maintained and utmost care and vigilance followed to prevent accidental contamination or unnecessary disturbance to the site and surrounding environment during construction. A named person will be given the task of overseeing the pollution prevention measures agreed for the site to ensure that they are operating safely and effectively.

6.5.2.2.2 Residual Impact

Negative, Imperceptible, direct, short term, unlikely impact.

6.5.2.2.3 Significance of Effects

No significant effects on land, soils, subsoils or bedrock are anticipated.

6.5.2.3 Soil and Subsoil Compaction

Mechanism: Excavation / handling / storage.

Receptor: Land, topsoil, subsoil.

Potential Impact: Negative, direct, slight, likely impact on topsoil and subsoils.

6.5.2.3.1 Proposed Mitigation Measures

The underlying in-situ soils and subsoils will be subject to a certain amount of compaction but this will be unavoidable.

Any infill material/landscaping that is required will be placed and levelled in appropriate lift thicknesses to ensure the material is not over compacted thereby retaining its drainage properties.

6.5.2.3.2 Residual Impact

Negative, slight, direct, likely impact on topsoil and subsoils.

6.5.2.3.3 Significance of Effects

No significant effects on land, soils, subsoils are anticipated.

6.5.2.4 Geological impact on local Designated Sites

Mechanism: Excavation / handling / storage of soil/subsoils.

Receptor: Land, topsoil, subsoil and associated designated sites.

Potential Impact: None, no direct excavation or development of any local designated sites are proposed.

6.5.2.4.1 Residual Impact

None.

6.5.2.4.2 Significance of Effects

None.

6.5.2.5 Assessment of Health Effects

Potential health effects arise mainly through the potential for soil and ground contamination. Residential developments are not a recognized source of significant potential pollution and so the potential for effects during the construction phase are negligible. Hydrocarbons will be used onsite during construction. However, the volumes will be small in the context of the scale of the project and will be handled and stored in accordance with best practice mitigation measures. The potential residual impacts associated with soil or ground contamination and subsequent health effects are negligible.

6.5.2.6 Potential Cumulative Impacts

There are four other proposed housing developments in the locality¹.

No significant cumulative impacts on land, soils and geology environment are anticipated during the construction or operation phases as long as mitigation measures outlined are put in place.

6.5.3 Likely Impacts and Mitigation Measures – Operational Stage

No impacts on soils and geology are anticipated during the operational phase. The operational stage of the residential development consists of the typical activities in a residential area and will not involve further disturbance to the topsoil, subsoils and geology of the area.

No significant cumulative impacts on the land, soils and geology environment are envisaged during the operational stage.

6.5.4 Likely Impacts and Mitigation Measures – Decommissioning Stage

The potential impacts associated with decommissioning will be similar to those of the construction phase but greatly reduced in magnitude. As observed in older residential developments, it is unlikely that all dwellings will be removed at the same time and instead houses are demolished on an ad-hoc basis by their owners.

For a site such as the proposed development site it is expected that any decommissioning/demolition in the distant future would be the first step in the construction of a new dwelling at the same location.

Notwithstanding the above, mitigation measures that are likely to be applied during decommissioning activities will be similar to those applied during construction where relevant. Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures in Section 6.5.2.2.

No significant cumulative impacts on the land, soils and geology environment are envisaged during the decommissioning stage.

¹ Residential Development Oranhill – Pl Ref 15/1107 / ABP Ref PL 07.246315

Thomas Considine, Patrick Sweeney and Ronnie Greene applied to Galway County Council for planning permission for development of 68 two storey houses and associated works. An Bord Pleanála granted permission for the development following a third party appeal on the 25th July 2018 subject to 17 no. conditions. The site adjoins the proposed development to the south.

Residential Development Oranhill – Pl Ref 09/1925/ ABP PL 07.237219

James Cannon applied for permission to Galway County Council for development of a proposed hotel and 161 no. units. The development was granted by An Bord Pleanála. The permission was extended by Roykeel Ltd, Brian and Fidelma Loughran under Pl Ref 15/1334. The site adjoins the proposed development to the east.

Residential Development Moneyduff – Pl Ref 09/2055 / ABP PL 07.237409

Pat and Liam Malone applied to Galway County Council for permission for 38 no. dwelling units and associated works. An Bord Pleanála granted permission following a third party appeal on 22/05/2018 subject to 13 no. conditions. The permission was extended under Pl Ref 17/980. The site is located approximately 130m to the north west of the proposed development.

Residential Development Frenchfort – Pl Ref 17/1268

Ardstone Homes applied to Galway County Council for permission to construct 86 no. units and associated works. Galway County Council issued notification of their decision to grant the development subject to 19 conditions on 7th June 2018. The site is located approximately 1km north of the proposed development.

6.5.5 Conclusion

Excavation of existing fill, topsoil, subsoil and bedrock will be required for site leveling and for the installation of drainage and services (wastewater, water supply, electricity, etc.) infrastructure. This will result in a permanent removal of subsoil and bedrock at most excavation locations.

All excess material will be used for reinstatement and landscaping works around the site at the end of the construction phase. Storage and handling of hydrocarbons/chemicals will be carried out using best practice methods. Measures to prevent subsoil erosion during excavation and reinstatement will be undertaken to prevent water quality impacts.

No significant impacts on the land, soil and geology of the site will occur.