A16.0 Land quality

A16.1 Methodology

The understanding of the baseline environment in respect to geology, hydrology, hydrogeology, contaminated land and historical uses has been informed through a combination of desk-based review of existing data / reports and targeted survey work.

The following data sources have been reviewed as part of the assessment to inform an understanding of the existing environment:

- 1:250,000 scale geological map of the Falkland Islands (British Geological Survey, 1998)
- The Geology of the Falkland Islands. (Aldis, D.T. and Edwards, E.J, 1999)
- Engineering geology related to quarrying at Port Stanley, Falkland Islands. (Rosenbaum, M.S., 1985).
- Sea Lion Field Development – Phase 1 Environmental Impact Assessment (Premier Oil Exploration and Production Limited, 1998).
- Google Earth (2020) publicly available aerial imagery.
- UXO Desk Study and Risk Assessment (**Ref. 8**)
- Discussions with F.I.G.'s Environmental Officer (November 2020).
- Environmental Contaminants Assessment, Port Stanley FIPASS (**Ref. 14**)
- PMI-56 [Land Quality Ground Investigation, Access Road] (**Ref. 15**)
- Port Stanley Ground Investigation Report (**Ref. 12**)
- Supplementary Environmental Contaminants Assessment of Water and Sludge within FIPASS Tanks, Port Stanley FIPASS (**Ref. 16**)
- Results from asbestos analysis undertaken on exhaust pipe insultation from FIPASS barges in 2016.
- Review of Health and Safety incident information on pyrophoric iron sulphide incident on FIPASS and also the Vessel strike on FIPASS and the subsequent emergency repairs to the fuel systems

The following sub-sections detail the site-specific survey work undertaken and the approach taken to assessment of impacts.

A16.1.1.1 Site-specific survey work

A ground investigation including sampling was undertaken following completion of a desk-based review of existing data sources which targeted two areas of potential concern within the study area, namely an area of the proposed access road and the FIPASS tanks. In addition to the targeted investigation into these specific areas, a ground investigation was undertaken for geotechnical purposes and the information from this investigation has also been used to inform the baseline understanding of the area. The site-specific investigation works undertaken are summarised below with the exploratory hole locations illustrated on **Figure 16.1**.

Key

Proposed scheme footprint

Construction phase site layout

Sample Locations

Borehole

Surface water

Trial pit

REV	DATE	DESCRIPTION	BY	CHK	APP
P02	01.12.21	SECOND ISSUE	GC	PP	SR
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CLIENT

bam nuttall

PROJECT

New Port Facility at the Falkland Islands

TITLE

Exploratory Hole and Surface Water Sample Locations

Marlborough House, Marlborough Crescent
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Tel +44(0)191 2111300
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Royal HaskoningDHV
Enhancing Society Together

DRAWN	CHECKED	APPROVED	
FC	PP	SR	
DATE 01.12.21	SCALE 1:1,500	REF.	
FIGURE No. 16-1		SUITABILITY S2	REVISION P02

Path: I:\N52204\Technical_Data\Projects\Falklands\MXDs\ES\LandQuality\Fig_16_1_ExploratoryHole_and_SW_RH_20211201.mxd

Port Stanley ground investigation, 2021

A geotechnical ground investigation was undertaken to inform the detailed design of a new access road within the landside area of the proposed scheme footprint. The ground investigation included the excavation of nine trial pits and drilling of seven boreholes across the landside area of the proposed scheme footprint. Details of the ground conditions encountered are provided in **Section A16.2.2**.

Environmental contaminants assessments, FIPASS, 2021

Assessment of the chemical composition of the rust, water and sludge within FIPASS tanks was undertaken to support with the dismantling strategy. Two phases of sample collection were undertaken with the preliminary samples collected in October 2020 and a supplementary phase in February / March 2021. Details of the investigation and results are provided within **Section A16.2.7** of this report.

Land quality ground investigation, access road, 2021

An investigation was undertaken to assess ground conditions within an area of the proposed scheme footprint where there was evidence of a historic diesel and IBC spills within a drainage ditch and where there has been storage of discarded materials and intermediate bulk containers (IBCs) containing waste oil (referred to as the access road ground investigation). A summary of the ground conditions encountered during the access road ground investigation is provided in **Section A16.2.2**. **Sections A16.2.4** and **A16.2.5** provide a summary of the chemical results associated with controlled waters (groundwater, surface water and soil leachates samples) and human health (soil samples).

It should be noted that there were constraints associated with the survey works undertaken which may have influenced the analytical results. For example, the requirement to transport samples to the UK for analysis in the absence of environmental laboratories in the UK may have resulted in volatile organic contaminants (VOCs) degrading during transit. In addition, there were a limited number of appropriate sample containers available for use on the Falkland Islands for the extra sampling, meaning that in some instances non-standard sample containers had to be used. Furthermore, some of the water samples were damaged in transit to the UK for lab analysis and therefore this influenced the ability to analyse some of the samples.

Approach to impact assessment

The method for determining the significance of potential impacts involves defining the sensitivity of the receptors and the magnitude of the effect. This section describes the criteria applied to assign values to receptor sensitivity and magnitude of potential effects. The terms used to define the sensitivity, magnitude and overall significance are based on those outlined in **Section A6.0**.

A16.1.1.2 Receptor sensitivity

Receptor sensitivity has been defined with reference to the adaptability, tolerance, recoverability and value of individual receptors. **Table 16.1** provides examples of the criteria for appraisal of sensitivity for identified receptors based on professional judgement.

Receptor sensitivity considers, for example, whether the receptor:

- is rare;
- has protected or threatened status;
- has importance at a local, regional or national scale; or,
- has a key role in ecosystem function (in the case of biological receptors).

Receptor sensitivity examples based on the above criteria are presented in **Table 16.1**.

Table 16.1 Assessment of the sensitivity of receptors associated with contamination

<table>
<tr><th>Sensitivity</th><th>Examples</th></tr>
<tr><td rowspan="4">Very high - has very limited or no capacity to accommodate physical or chemical changes.</td><td>General
Receptor is internationally or nationally important / rare with limited potential for offsetting / compensation.</td></tr>
<tr><td>Land quality – Human health
Construction workers involved in below ground construction works.
Public and local residents / school aged children (off-site within 50m).</td></tr>
<tr><td>Land quality – Controlled waters and ecology
Groundwater aquifers - within 50m of drinking water supplies.
Public and private water supplies / licensed surface water and groundwater abstractions for potable use (off site within 50m).
Supports habitats or species that are highly sensitive to changes in surface hydrology or water quality.
Surface and groundwaters supporting internationally designated sites.</td></tr>
<tr><td>Land quality - Built environment and property
Buildings, including services and foundations, of high historic value.
Crops and livestock with a very high commercial/ economic value.</td></tr>
<tr><td rowspan="4">High - has limited capacity to accommodate physical or chemical changes.</td><td>General
Receptor is regionally important / rare with limited potential for offsetting / compensation.</td></tr>
<tr><td>Land quality – Human health
Future end users (commercial / industrial end use / open space).
Public and local residents / school aged children (off-site at distances >50m but <250m).
Commercial workers (off-site within 50m).
Construction workers (above ground).</td></tr>
<tr><td>Land quality – Controlled waters and ecology
Groundwater aquifers - within 250m of drinking water supplies.
Private water supplies (off site within 250m).
Aquifers that supply drinking water abstractions.
Surface and groundwaters supporting nationally designated sites.</td></tr>
<tr><td>Land quality - Built environment and property
Buildings and infrastructure of high regional value for example schools, hospitals or residential buildings.
Crops and livestock with a high commercial/ economic value.</td></tr>
</table>

Sensitivity	Examples
Medium - has moderate capacity to accommodate physical or chemical changes.	**General** • Receptor is locally important / rare. **Land quality – human health** • Future end users (transport end uses such as car parks or highways). • Public and local residents / school aged children (off-site >250m). • Commercial workers (off-site at distances >50m but <250m). **Land quality – Controlled waters and ecology** • Aquifers suppling base flow to rivers. • Groundwater or surface waters supporting regionally important sites. **Land quality – Built environment and property** • Buildings and infrastructure of local importance or low sensitivity (commercial/ industrial buildings and main roads) • Crops and livestock with a medium to low commercial/ economic value
Low - is generally tolerant of physical or chemical changes.	**General** • Receptor is not considered to be particularly important / rare. **Land quality – Human health** • Commercial workers (off-site >250m). **Land quality – Controlled waters and ecology** • Unproductive strata. • Supports or contributes to habitats that are not sensitive to changes in surface hydrology or water quality. • Land with low sensitivity and/ or non-statutory designations. **Land quality – Built environment and property** • Car parks, local roads, bridges or footpaths. • Crops and livestock with no commercial/ economic value

A16.1.1.3 Magnitude of effect

Potential effects may be adverse, beneficial or neutral. The magnitude of an effect is assessed qualitatively, according to the criteria set out in **Table 16.2**.

For effects related to human health, magnitude reflects the likely increase or decrease in exposure risk for a receptor. For controlled waters, magnitude represents the likely effect that an activity would have on resource availability or value, at the receptor. Magnitude is therefore affected by the distance and connectivity between an impact source and the receptor.

Table 16.2 Definition of magnitude levels for land quality

Sensitivity	Examples
High – permanent or large-scale change affecting usability, risk or value over a wide area, or certain to affect regulatory compliance.	**Land quality – Human health** • Permanent or major change to existing risk of exposure (adverse / beneficial). • Unacceptable risk / severe harm to one or more receptors over the long-term or permanently (adverse). • Remediation and complete source removal (beneficial).
	Land quality – Controlled waters and ecology • Permanent, long-term or wide scale effects on water quality or availability (adverse / beneficial). • Permanent loss or long-term derogation of a water supply source (adverse). • Permanent habitat creation or complete loss (adverse / beneficial). • Measurable habitat change that is sustainable / recoverable over the long-term (adverse / beneficial).
	Land quality – Built environment • Catastrophic damage to buildings or structures. • Complete loss of crops or livestock.
Medium – permanent or long-term reversable change affecting usability, value or risk over the medium-term or local area: possibly affecting regulatory compliance.	**Land quality – Human health** • Medium-term or moderate change to existing risk of exposure (adverse / beneficial). • Unacceptable risks to one or more receptors over the medium-term (adverse).
	Land quality – Controlled waters and ecology • Medium-term or local scale effects on water quality or availability (adverse / beneficial). • Medium-term derogation of a water supply source (adverse). • Observable habitat change that is sustainable / recoverable over the medium-term (adverse / beneficial).
	Land quality – Built environment • Damage to buildings or structures. • Damage of crops or livestock.

Sensitivity	Examples
Low – temporary change affecting usability, risk or value over the short-term or within the site; measurable permanent change with minimal effect, usability, risk or value; no effect on regulatory compliance.	**Land quality – Human health** • Short-term temporary or minor change to existing risk exposure (adverse / beneficial). • Unacceptable risks to one or more receptors over the short-term (adverse).
	Land quality – Controlled waters and ecology • Short-term or very localised effects on water quality or availability (adverse / beneficial). • Short-term derogation of a water supply source (adverse). • Measurable permanent effects on a water supply source that do not impact on its operations (adverse). • Observable habitat change that is sustainable / recoverable over the short-term (adverse / beneficial).
	Land quality – Built environment • Easily repairable damage to buildings or structures. • Minor damage to crops or livestock.
Very low – minor permanent or temporary change, indiscernible over the medium to long-term. Short-term with no effect on usability, risk or value.	**Land quality – Human health** • Negligible change to existing risk of exposure. • Activity is unlikely to result in unacceptable risks to receptors (neutral).
	Land quality – Controlled waters and ecology • Very minor or intermittent impact on local water quality or availability (adverse / beneficial). • Usability of a water supply source will be unaffected (neutral). • Very slight local changes that have no observable impact on dependent receptors (neutral).
	Land quality – Built environment • Very slight non-structural damage or cosmetic harm to buildings or structures. • Negligible damage of crops or livestock.

A16.1.1.4 Impact significance

The impact assessment combines receptor sensitivity with magnitude of effect as shown in **Table 16.3**. Assessment of impact significance is qualitative and reliant on professional experience, interpretation and judgement. The matrix should therefore be viewed as a framework to aid understanding of how a judgement has been reached, rather than as a prescriptive, formulaic tool.

Table 16.3 Impact significance matrix

		Magnitude							
		High	Medium	Low	Very Low	Very Low	Low	Medium	High
		Adverse				Beneficial			
Sensitivity	Very High	Major adverse	Major adverse	Moderate adverse	Minor adverse	Minor beneficial	Moderate beneficial	Major beneficial	Major beneficial
	High	Major adverse	Moderate adverse	Minor adverse	Minor adverse	Minor beneficial	Minor beneficial	Moderate beneficial	Major beneficial
	Medium	Moderate adverse	Minor adverse	Minor adverse	Negligible	Negligible	Minor beneficial	Minor beneficial	Moderate beneficial
	Low	Minor adverse	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor beneficial

Effects that result in major or moderate impacts are considered to be 'significant' in EIA terms. Whilst minor impacts are not significant in their own right, it is important to distinguish these from other non-significant (negligible) impacts as they may contribute to significant impacts cumulatively or through interactions.

The definitions of significance are presented in **Table 16.4**.

Table 16.4 Impact significance definitions

Impact significance	Definition
Major adverse	A major increase in contamination risk from the existing baseline conditions, e.g. land that has a low contamination risk in the baseline becomes a very high risk.
Moderate adverse	A moderate increase in contamination risk from the existing baseline conditions, e.g. land that has a low contamination risk in the baseline becomes a high risk.
Minor adverse	A small increase in contamination risk from the existing baseline, e.g. land that has a low contamination risk in the baseline becomes a medium risk
Negligible	No change in contamination risks.
Minor beneficial	A small reduction in contamination risk from the existing baseline conditions, e.g. land that has a medium to low contamination risk in the baseline becomes a low risk
Moderate beneficial	A moderate reduction in contamination risk from the existing baseline conditions, e.g. land that has a high contamination risk in the baseline becomes a medium/low or low risk.
Major beneficial	A major reduction in contamination risk from the existing baseline conditions, e.g. land that has a very high contamination risk in the baseline becomes a low risk.

A16.1.1.5 Assessment of interaction of effects

The potential interactions with **Section A10.0, Section A17.0, Section A20.0** and **Section A22.0** have been taken into account in assessing the potential impacts of the proposed scheme during construction and operation.

A16.2 Baseline conditions

A16.2.1 Site history

No historical maps and plans of the landside area of the proposed scheme footprint could be sourced, and therefore the understanding of the site history has been informed by a review of Google Earth imagery and desk-based assessment. A summary of a review of Google Earth imagery (2004 – 2020) and aerial photographs contained with the UXO report (**Ref. 8**) is presented in **Table 16.5** (refer to **Figure 4.1** and **Drawing PB7829-RHD-CE-LS-DR-C-0028** for location details of each of the elements described below).

Table 16.5 Summary of site history

Area of the proposed scheme footprint	Summary of site history
Proposed access road	The landside areas of the proposed scheme footprint associated with the access road currently form part of the Stanley Growers Ltd site and are utilised as agricultural land. Stanley Growers Ltd began to operate in the late 1980s and it is assumed that the land had not been built upon prior to being incorporated into Stanley Growers Ltd boundary.
Welfare, stores and laydown area	This area of the proposed scheme has been utilised as agricultural land since the earliest available Google Earth imagery until the present day.
Dismantling location	This area of the proposed scheme has been recorded as a beach from the earliest available Google Earth imagery until the present day. An irrigation pond is located on the south western boundary of the dismantling location
Site offices and plant workshop	This area of the proposed scheme has been recorded as being covered by hardstanding since the earliest available Google Earth imagery until present day. A review of the imagery indicates that this area of the proposed scheme has been used to store shipping containers.
Remediation area and associated pipework	This area of the proposed scheme is located on an area of land that has previously been undeveloped with a covering of vegetation recorded since the earliest available Google Earth imagery until present day.
Stores and materials and waste laydown area	This area of the proposed scheme has been recorded as being partially covered in hardstanding since the earliest available Google Earth imagery until present day. The central portion of this area of the proposed scheme has had a covering of vegetation since the earliest available imagery. Pools of water have been recorded along the northern boundary of this part of the proposed scheme since the 2004 imagery.
Precast storage area, concrete batching plant and storage area	This area of the proposed scheme is recorded as being open land with a cover of vegetation since the 2004 imagery. The imagery suggests that there may have previously been structures present within this area of the proposed scheme due to linear outlines of what are thought to be building footprints.
Rock armour laydown and stockpile area	This area of the proposed scheme is located on an area of land that has previously been undeveloped with a covering of vegetation recorded since the earliest available Google Earth imagery until present day.
Accommodation area	This area of the proposed scheme is located on an area of land that has previously been undeveloped with a covering of vegetation recorded since the earliest available Google Earth imagery until present day.

*A Google Earth Image is available for 1985, however the image quality did not allow for any meaningful interpretation.

Off-site, the earliest available images (2004) show multiple polytunnels and associated buildings which are part of the Stanley Growers Ltd business, located approximately 40m to the south and south-west of the proposed access road. To the east and south-east of the proposed access road are a series of large fuel tanks as well as gas tanks associated with SSL (approximately 100m east); additional tanks are recorded 70m south-east. The tanks associated with SSL are present on the earliest available images (2004) with no significant changes identified on the latest Google Earth imagery (2019).

Multiple shipping containers (approximately 160m south-east of the proposed access road) are located in an industrial area adjacent to the current access road to FIPASS. This area is present on the earliest available Google Earth imagery (2004) and increased in size between 2006 and 2012 (no imagery available between these dates). Additional areas of hardstanding are identifiable on images dated 2015 and again in images from 2019. With the exception of an increase in the number of polytunnels located to the south and south-west of the proposed access road, no significant changes have been identified on the Google Earth imagery to the latest available image dated November 2019.

FIPASS was installed in Stanley Harbour in 1984 (Zetica, 2020) and comprises six permanently moored barges (each containing up to twenty ballast tanks) which are recorded on the earliest available Google Earth imagery (2004); no significant changes have been identified on the latest available image, dated November 2019 to the structure or linking causeway.

A16.2.2 Geology

The 1:250,000 scale geological map of the Falkland Islands (British Geological Society, 1998) indicates that the area of Stanley Harbour is underlain by the Port Stanley Formation, part of the West Falkland Group of late Devonian age. The Port Stanley Formation is described as unfossiliferous, medium-grained locally coarse quartz sandstones (some quartzitic) with some intervals of fine-grained sandstones, micaceous muddy siltstones and mudstones and silty shales.

Descriptions of superficial deposits in the vicinity of Stanley are provided by Aldiss and Edwards (1999) and Rosenbaum (1985) and are summarised in the **Table 16.6**. The available geological information does not provide an indication of whether artificial deposits are present in the Stanley area.

Table 16.6 Reported superficial deposits

Deposit	Geological age	Description	Comment
Peat	Holocene	Fibrous, moderately decomposed peat with a moderate water content and low inorganic soil content.	Peat deposits can extend to below high tide level.
Marine clay	Holocene	Firm, slightly over-consolidated, fissured, green grey sandy clay.	Rosenbaum (1985) notes that the clay softens when exposed to water, but that it nevertheless ‘retains its cohesiveness’.
Solifluction deposits	Pleistocene	Pale grey, unsorted stony sandy silty clays (diamictons) and stony sandy silts, and often contain subangular quartzite boulders. Clast supported accumulations of large blocks with a fine-grained matrix may also occur.	Aldiss and Edwards (1999) note that these deposits ‘underlie the soil in most parts of the Stanley area’ and that the solifluction deposits can extend below sea-level.

Deposit	Geological age	Description	Comment
Stone runs of gravel, cobble and boulder	Pleistocene	Cobble and boulder sized blocks of quartzite between 1 and 3m thickness	-

A summary of the geology encountered during the geotechnical ground investigation undertaken in October 2020 (**Ref. 12**) is provided in **Table 16.7. Table 16.8** reports the geology which was encountered during the access road ground investigation (**Ref. 15**). **Figure 16.1** illustrates the locations of exploratory holes within the context of the proposed scheme footprint.

Table 16.7 Site specific geology encountered during the Port Stanley ground investigation

Stratum	Depth to base of stratum (m below ground level (bgl))	Thickness (m)	Description
Topsoil	0.1 – 0.2	0.1 – 0.2	Grass over topsoil / dark brown sandy clay.
Peat	0 – 1.4	0.2 – 1.0	Dark brown amorphous / pseudo fibrous peat with abundant roots, rootlets and straw type material. Rounded to angular boulders of sandstone encountered at some locations.
Marine clay	0.45 – 12.0	0.3 – 10.1	Soft to stiff light blueish grey silty clay / clayey silt / slightly sandy slightly gravelly clay becoming gravelly with rounded and angular cobbles.
Solifluction deposits	0 – 17.1	0.1 – 5.1	Orange brown / yellow brown very gravelly fine to coarse sand / silty sand with medium cobble and boulder content. Gravel is angular to subrounded fine to coarse of sandstone. Cobbles and boulders are subangular to rounded.
Bedrock	15.9 – 20.0	2.9 – 4.1	Sandstone.

Table 16.8 Site-specific geology encountered during the October – November 2020 Land Quality Ground Investigation, Access Road

Stratum	Depth to base of stratum (m bgl)	Thickness (m)	Description
Topsoil	0.40	0.40	Compact hardcore and sand
Peat	0.30 – 0.65	0.30 – 0.65	Dark brown amorphous/pseudo fibrous peat with abundant roots, rootlets and straw type material. Rounded to angular boulders of sandstone encountered at some locations.
Solifluction deposits	0.30 – 1.80	1.20 – 1.50	Soft sandy CLAY.
Raised Beach Deposits	0.40 – 9.50	5.20 – 9.10	Light grey clayey gravelly fine to coarse SAND and GRAVEL. Gravel is subangular to subrounded fine to coarse gravel of sandstone.

Information gathered during consultation with F.I.G.'s Environmental Officer and Policy Advisor (November 2020) confirmed that there are no mining or mineral extraction sites within the proposed scheme footprint or within its vicinity. It was also confirmed by F.I.G.'s Environmental Officer and Policy Advisor that there are no designated geological sites within the landside area of the proposed scheme footprint; as a result, impacts to sensitive geological sites during the construction and operational phases are not considered further in this assessment.

A16.2.3 Hydrogeology

No information relating to the presence and designation of aquifers in the Stanley area or the extraction of groundwater for potable consumption was identified as part of the baseline review.

Due to the proximity of the landside part of the proposed scheme footprint to the marine environment, it is considered likely that any aquifers present beneath the area have been impacted by saline intrusion. Given this assumption, it is further assumed that if groundwater is present, it would not be considered suitable for potable groundwater abstraction.

During the access road ground investigation (**Ref. 15**), groundwater was encountered within the Raised Beach Deposits (sands and gravels) at depths between 1.59m bgl and 2.94m bgl. The groundwater elevation data collected during one round of monitoring on 6 November 2020 indicated that the groundwater within the area surrounding the irrigation pond is generally flowing to the north, towards the irrigation pond and Stanley Harbour beyond. It is considered likely that the groundwater beneath the area investigated is in hydraulic continuity with the irrigation pond and Stanley Harbour.

A16.2.4 Hydrology

A16.2.4.1 Hydrology and surface drainage

There are a number of surface water features located adjacent to the landside elements of the proposed scheme footprint, the largest being Stanley Harbour to the immediate north and an irrigation pond adjacent to the proposed new access road. In addition, there are drainage ditches located within the landside area of the proposed scheme footprint located south of the irrigation pond, adjacent to a waste storage area (discussed in **Section 16.2.6**).

A16.2.4.2 Surface water abstractions

Potable water to Stanley is supplied by two water mains, namely the high level and low level main. The low level main is fed from Murray Heights, whilst the high level main is fed from Sapper Hill.

Surface water is abstracted locally from the existing irrigation pond located to the north of the proposed new access road on land; such abstraction is undertaken by Stanley Growers Ltd for irrigation purposes.

As surface water features are considered to be the main source of water used for irrigation purposes within and adjacent to the landside elements of the proposed scheme, the sensitivity of hydrology is considered to be **high** (however it should be noted that the irrigation pond contains evident hydrocarbons on the surface (refer to **Section A16.2.6** for further information)).

A16.2.4.3 River flood zones

Information gathered during consultation with F.I.G.'s Environmental Officer and Policy Advisor (November 2020) indicates that the landside area of the proposed scheme is not located within a river flood zone.

A16.2.5 Land use

The proposed new access road runs through agricultural land owned by Stanley Growers Ltd. There are three polytunnels and a small building present within the Stanley Growers area, to the immediate east of the irrigation pond, with many more polytunnels located inland of the proposed access road. In the wider area, to the east of FIPASS Road, the land use is industrial in nature, with facilities to store gas, diesel oil, petrol and kerosene.

SSL, which provides fuel to both the domestic population of the Island and vessels that operate in the Island's waters, is located approximately 15m to the east of the landside area of the proposed scheme footprint. The SSL site comprises three large circular tanks, two medium circular tanks and a series of small rectangular tanks all located within the eastern half of the SSL site. Three buildings are located running along the southern edge of the SSL site. A medium sized circular tank (the fire water tank) and building is recorded on Google Earth imagery as being located adjacent to the current FIPASS access road.

A16.2.6 Ground, groundwater and surface water conditions

During the October 2020 geotechnical site investigation (**Ref. 12**), it was noted that waste materials (wood and organic material), scrap metal, parts of machinery and IBCs containing waste diesel were located in the vicinity of the proposed new access road (**Plate 16.1**), near to the irrigation pond. In addition, during a site walkover, an oily sheen was observed on a drainage ditch which runs through the area of the proposed access road and on the surface of the water within the irrigation pond (see **Figure 16.2** for location of drainage ditch and irrigation pond and **Plate 16.2** for image). Evidence of the use of an oil spill response kit within the drainage ditch and irrigation pond was also observed (**Plate 16.3**). Anecdotal evidence from F.I.G.'s Environmental Officer and Policy Advisor indicated there was a historical spillage of diesel from a pump used to remove water from the irrigation pond.

Plate 16.1 IBC's containing diesel

Plate 16.2 Oily sheen on surface of ditch which feeds the irrigation pond

Plate 16.3 Hydrocarbon sheen on surface of the irrigation pond with spill mats also evident

To further investigate this area, a specific land quality ground investigation was undertaken. As shown on **Figure 16.1,** the investigation comprised the excavation of five boreholes to a maximum depth of 9.3m bgl and the collection of soil, soil leachate and groundwater samples for laboratory analysis. In addition, surface water samples were collected and tested from the drainage ditch and irrigation pond (**Figure 16.1**). Groundwater level monitoring was also undertaken.

A description of the geological and hydrogeological findings from the investigation is provided in **Sections A16.2.2** and **A16.2.3** respectively.

In order to provide an assessment of risks to humans using the site both currently and post construction, a human health Generic Quantitative Risk Assessment (GQRA) was undertaken on the soil analytical results. The soil analytical results were assessed by comparing the contaminant concentrations against UK commercial end-use Generic Assessment Criteria (GACs). None of the results exceeded the commercial GACs which indicated that on-site soils in the area investigated did not present a risk to current and future site users and the area investigated was suitable for its proposed use as an access road.

The soil results were also compared against Acute Generic Assessment Criteria (aGAC) to assess potential risks to on-site workers undertaking excavations during construction of the access road and during future maintenance of the road. The comparison of data against the aGAC identified TPH aliphatic C21-C35 at one location (BH203 - 381mg/kg) which exceeded the benzene aGAC of 370mg/kg. The magnitude of the exceedances is considered unlikely to present an unacceptable risk to construction workers.

Notwithstanding the human health risk assessment discussed above, it is acknowledged that the investigation was based on a limited number of soil samples and there is uncertainty with regard to the analytical results due to investigation constraints. It is therefore not possible to entirely discount potential risk to users of the site post-development and workers during construction. In addition, the storage of containers filled with oil on unsurfaced areas of the site by Stanley Growers continues and therefore localised spillages and leaks from these containers cannot be discounted.

Soil leachate, groundwater and surface water samples were also collected during the ground investigation and tested. In order to provide an assessment of risks to controlled water receptors (irrigation pond and Stanley Harbour) from sources of contamination within the investigation area, a controlled water GQRA has been undertaken. The GQRA entailed comparing soil leachate, groundwater and surface water results with UK Water Framework Directive (WFD) Environmental Quality Standards (EQS) for transitional and coastal waters.

No assessment has been undertaken with regard to effect on the effectiveness of the new leak detection system specified to monitor the buried fuel pipelines.

Key

- Proposed scheme footprint
- Construction phase site layout

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P02	01.12.21	SECOND ISSUE	GC	PP	SR
P01	03.06.21	FIRST ISSUE	FC	PP	SR

CLIENT

PROJECT
New Port Facility at the Falkland Islands

TITLE
Location of Hydrocarbon Impacted Drainage Ditch and Irrigation Pond

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Royal HaskoningDHV
Enhancing Society Together

DRAWN	CHECKED	APPROVED
FC	PP	SR
DATE 01.12.21	SCALE 1:1,750	REF.

FIGURE No. 16-2 | SUITABILITY S2 | REVISION P02

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The GQRA identified a number of exceedances of the EQS in soil leachate and groundwater samples for a number of inorganic contaminants (chromium VI, lead, zinc, nickel and free cyanide), PAHs and TPH. The recorded exceedances of the EQS for inorganic contaminants are not considered to present an unacceptable risk to controlled water receptors as they were either recorded sporadically or likely to be attributable to natural background concentrations.

No assessment has been undertaken on the impact to human health from ingestion of fruit and vegetables, as this is outside the scope of the assessment.

The elevated PAHs and TPH above EQS recorded in groundwater samples and surface water samples generally correspond to the location where an oily sheen associated with the diesel spillage was observed on the drainage ditch and in groundwater in the area immediately surrounding the ditch. A surface water sample collected from the irrigation pond did not record TPH above EQS. As reported in **Section A16.1.1.1**, the lack of appropriate sample containers in the Falkland Islands and the long transport time to the laboratory in the UK may have resulted in the degradation of volatile contaminants before the samples arrived in the UK. In addition to the logistical constraints, a number of the glass bottles used to collect water samples had cracked during the freezing process required for transport meaning some samples were lost completely. Seven other water samples had insufficient sample for the full suite of analysis, therefore uncertainty in the data meant that a potential risk to the pond could not be entirely discounted.

A16.2.7 Condition of FIPASS

The tanks which make up the FIPASS barges are either empty or filled with sea water with varying volumes of water within each tank. Sludge is present at the base of some of the tanks below the sump pipe level.

A fuel line and re-fuelling infrastructure are present above the tanks, together with various other plant containing substances such as hydraulic oils e.g. refrigeration plant and wool plant. There is evidence that oils and fuels from such infrastructure have historically leaked into the tanks, with oily sheens and hydrocarbon odours present within some of the tanks. Free phase hydrocarbons were also observed in some of the tanks (detailed in **Section A16.2.7.2**). The accident of a vessel striking FIPASS heavily effected some tanks as the fuel lines were damaged when FIPASS was struck.

As detailed in **Section A16.1.1.1**, two phases of investigation of the FIPASS tanks has been undertaken, the preliminary phase in October 2020 and a supplementary phase in February and March 2021. During the investigations, samples of water, sludge and rust were recovered from the tanks. A summary of the findings from these investigation, as well as samples of pipe insulation recovered in 2016 and limited analysed for asbestos fibres is presented below. Further testing is also ongoing in November 2021 to further understand the risks.

A16.2.7.1 Asbestos analysis of exhaust pipe insultation (2016)

A total of nine samples of exhaust pipe insultation from FIPASS barges were recovered in 2016 and analysed for the presence of asbestos. No asbestos fibres were detected in any of the nine samples which were subject to analysis.

A16.2.7.2 Rust samples

Iron sulphide is a pyrophoric material which can spontaneously combust when exposed to air. It is created when iron oxide (rust) is converted to iron sulphide in an oxygen-free atmosphere where hydrogen sulphide gas is present or where the concentration of hydrogen sulphide exceeds that of oxygen. When the pyrophoric iron sulphide is exposed to air, it oxidises back to iron oxide and either sulphur or sulphur dioxide gas is formed. This chemical reaction can generate heat which has the potential to ignite flammable mixtures (such a hydrocarbons). Rust samples were collected from eight of the tanks and analysed by a laboratory for the presence of iron sulphide.

The existing facility has had a number of incidents and near misses with creation of iron sulphide, one of these incidents led to a small explosion that damaged some of the ballast tanks and stopped operational activities for a short period. Confined space working safe systems of work will be in place during construction including extra venting following the reviews of the incidents that have occurred on FIPASS.

Pyrophoric iron sulphide was not present in any of the rust samples analysed. This would suggest that in the tanks that have been vented, have no heat source, entered frequently and where rust samples were able to be tested, there is unlikely to be a potential risk of sulphur or sulphur dioxide gases being formed, which could cause a flammable atmosphere. Risk areas are where these conditions are not achieved.

A16.2.7.3 Water and sludge samples

During the investigations, a measurement and description of sludge was recorded at the base of 22 tanks. The sludge was recorded as being between 20mm to 200mm thick. Some of the sludge was described as having a hydrocarbon odour.

Six sludge samples collected from the base of the tanks during the preliminary investigation (October 2020) were found to contain too much water for the samples to be analysed as solids; they were therefore analysed as water. The results were compared against UK WFD EQS values protective of transitional and coastal waters. An evaluation was undertaken to identify if the water in the tanks would present a potential risk to Stanley Harbour or the South Atlantic, should the contents of the tanks leak or be spilled into the sea during dismantling. The laboratory analysis identified concentrations of PAH and TPH greater than the EQS within all the water samples analysed, suggesting the water in the tanks has the potential to cause harm to the water environment. This survey was targeted to areas likely to have spillage – i.e. plant rooms above, areas close to the vessel strike, under vehicle and plant servicing areas etc.

A supplementary investigation of the FIPASS tanks was undertaken between during February and March 2021. A total of 41 water samples were collected from the tanks and sent to the laboratory for analysis. The water analytical results were compared against EQS protective of transitional and coastal waters. In every water sample analysed, at least one contaminant was recorded at a concentration that exceeded an EQS. The most notable exceedances of the EQS were metals, PAHs and petroleum hydrocarbons. The analytical results from the water sampling also indicated that free phase product was present in four of the tanks. This water and free phase product within the tanks could present a risk to surface water receptors such as the Stanley Harbour and the South Atlantic, should the water be released or accidentally spilled into the sea during de-ballasting or during dismantling works. It should be noted however that there would likely be a very significant degree of dilution given the size of these waterbodies.

The presence of free phase product and elevated concentrations of dissolved phase contaminants in the tanks also has the potential to cause harm to site workers during dismantling. For example, breathing in diesel fumes may cause dizziness, drowsiness headaches; breathing in large amounts can result in coma, loss of muscle control, heart and lung problems. In addition, diesel can cause the skin to become irritated, dry and cracked and long-term skin exposure to diesel may result in eczema (dermatitis). There is also evidence that exposure to heavy diesel fuels (marine diesel) could possibly cause cancer (Public Health England, 2016). The hydrocarbons present within the tanks also have the potential to produce vapours that may form an ignitable flammable mixture with air.

In the supplementary phase of investigation, 14 sludge samples were also collected from the base of the tanks. The laboratory analytical results for the sludge samples were compared against the Society of Brownfield Risk Assessment (SoBRA, 2020) aGACs to assess the potential risks to site workers undertaking dismantling works. No exceedances of the aGACs were identified within the samples analysed, however the aGACs are only available for a limited number of contaminants, namely arsenic, benzene, cadmium, free cyanide, lead, phenol, trichloroethylene and vinyl chloride. The laboratory analysis of the sediments also identified TPH, PAH, VOCs, metals, phenols, organotins and polychlorinated biphenyls (PCBs) above the limit of detection in the samples analysed. There are no aGACs currently available to quantify the risk these contaminants pose to human health. The presence of these contaminants may pose a hazard to the health of site workers during the dismantling of the FIPASS tanks and wide ranging control measures will be required to manage these hazards

Asbestos fibres (chrysotile and amosite) were also identified within five of the sludge samples at quantifications of between 0.002% to 0.01%. However, the presence of asbestos fibres in the sludge does not present a risk to the health of site workers if they remain fully saturated, as this prevents fibres from becoming air-borne and subsequently being inhaled. Potential hazards to site workers may be created if the sludge were to become dry during dismantling works.

Further sampling and analysis for asbestos is to be undertaken for both the sludge inside the tanks and within the materials which make up the tanks to determine the source of the asbestos found. The source of any potential asbestos could derive from the former use of the tanks in the North Sea (prior to being transported into Stanley Harbour).or from use at FIPASS in the operational stage (initial feedback from the ongoing survey is indicating the materials are mainly fragments of asbestos gaskets from pipe flanges and equipment).

A16.2.8 Human health

During the construction phase, the critical human health receptors are likely to be construction workers, agricultural workers (both on and off-site) and adjacent off-site users (e.g. visitors to the Seamans Mission and those working in neighbouring commercial areas). The nearest residential area, aside from the Seamans Mission, is located approximately 400m south-west of the proposed scheme footprint.

Construction works for a vulnerable person care facility (Tussac House) are currently underway; the site is located approximately 300m west of the proposed scheme footprint. Following completion, the care facility will represent the nearest residential receptor to the proposed scheme footprint; the Seamans Mission is also in close range.

The sensitivity of human health receptors (construction workers, agricultural workers and off-site users) is considered to be **medium** to **very high**.

A16.2.9 Regulatory information

Regulatory information relating to the landside parts of the proposed scheme footprint and the surrounding 1km is limited. Consultation with F.I.G.'s Environmental Officer and Policy Advisor during November 2020 indicated that there are no official registers held for onshore discharges and that sewage disposal into Stanley Harbour is also not formerly regulated. The nearest landfill site to the proposed scheme footprint is the megabid landfill, located approximately 2km south-east of the proposed scheme footprint.

It is understood that a permit is not required for abstraction of water from the irrigation pond by Stanley Growers Ltd.

A16.2.10 Preliminary conceptual site model

A preliminary conceptual site model (PCSM) identifies the potential or known sources of contamination, receptors and pathways between the two. Where all three are present or are considered likely to be present (source-pathway-receptor linkage), they are called a potential contaminant linkage (PCL).

A PCSM (for baseline, construction and operation) has been produced for the proposed scheme using the baseline information detailed above. Key sources of contamination have been identified with regards to the proposed scheme are set out in **Table 16.9** and potential pathways and receptors are identified in **Table 16.10**.

Table 16.9 Potential contaminant sources on or near the proposed scheme footprint

Potential source	Source description and potential associated contaminants
Ground, groundwater and surface water impacted by fuel storage and usage.	Waste oils, diesel and kerosene are stored and utilised by Stanley Growers adjacent to the proposed scheme footprint. The waste oils, diesel and kerosene (collected from fishing, BAS and cruise vessels) are used to

Potential source	Source description and potential associated contaminants
	provide a heating source for Stanley Growers polytunnels and also used in a pump which abstracts water from the irrigation pond. A site walkover confirmed evidence of hydrocarbon contamination within a drainage ditch which had also migrated into the irrigation pond. Ground investigation and laboratory analysis has identified exceedances of EQS for metals, PAHs and TPH within soil-leachate, groundwater and surface water samples.
Ground contaminated by the storage of waste materials.	A variety of waste materials are stored adjacent to the proposed access road, such as machinery parts, wood and scrap metal. Ground investigation and laboratory analysis identified exceedances of EQS values for metals, PAH and TPH within soil leachate, groundwater and surface water samples. The proposed site offices are located in an area that has previously been utilised to store shipping containers, with the neighbouring area also storing other materials (unable to identify on drone imagery). There is the potential for a range of potential contaminants to be present depending on what has been stored in the area.
Made Ground	As the history of the landside areas of the proposed scheme footprint is largely unknown prior to 2004, it is possible that Made Ground materials exist. However, Made Ground was not encountered in the exploratory locations undertaken to date within the areas investigated (see **Figure 16.1**). Areas of hardstanding are present within some of the proposed working areas required for construction.
Contaminants in and on FIPASS	Investigations into the contents of FIPASS barges were conducted in 2020 and is ongoing in 2021. A fuel line and re-fuelling infrastructure are present on the top of FIPASS, and various other plant containing hydraulic oils are also present. Elevated concentrations of contaminants above EQS have been recorded within the water samples collected from within the tanks and free phase product was identified in four of the tanks. Sludge within the tanks recorded concentrations of a range of contaminants above the method of detection limit, including some asbestos fragments. Hydrocarbon vapours which were also noted in the tanks have the potential to be flammable. There is also a risk of pyrophoric iron sulphide being present in structural voids that require demolition.
Off-site sources: • Fuel storage (including pipelines). • Fuel Farm • Polytunnels which may contain oil/diesel heating systems. • Existing Made Ground/ infilled ground.	Based on historic use and business activity there is potential for other sources of contamination i.e. metals and metalloids, PAHs, fuel and oil hydrocarbons, VOCs, SVOCs, inorganic and organic contaminants, PCBs and ground gas.

Table 16.10 Receptors requiring assessment for land contamination

Receptor group	Receptors included within group	Sensitivity	Pathway
Hydrology	Controlled waters – the marine environment (including Stanley Harbour), irrigation pond, drainage ditches / streams	High to very high	Leaching, dissolution and migration of contaminants from existing soils or the sludge contents of FIPASS ballast tanks during dismantling. Lateral migration and discharge of groundwater, ballasted sea water within FIPASS tanks and surface water run-off.
Human health	Construction workers and maintenance workers	Very high	Direct exposure through dermal contact, ingestion or inhalation of soils and dusts or the contents of the FIPASS ballast tanks including gasses generated (which includes asbestos fragments) during construction / maintenance works. Exposure to mainly biological contaminants within the surficial silt removed from the bed of the harbour and pumped into geotubes on land.
	Future users of the access road and gatehouse	High	Direct exposure through dermal contact, ingestion or inhalation of soils and dusts in areas of the site not covered by road surfacing, e.g. swales and bund adjacent to the access road. Direct but limited exposure with windblown sediments associated with dried surficial silt once geotubes bags are open, if bags are confirmed as contaminated through testing Inhalation of soil or groundwater derived vapours in areas of the site not covered by road surfacing, e.g. swales and bund adjacent to the access road and users of buildings such as gatehouse.
	Site users – agricultural workers	High	
	Off-site users – agricultural workers, commercial works and local residents	High	
Infrastructure and utilities	New and existing infrastructure and utilities – Stanley Growers Ltd polytunnels and small building located adjacent, Seafarer's Mission and Tank farm (off site). Future services underneath the new	Medium	Direct contact with building foundations. Diffusion into services and fuel monitoring controls and leak warning systems.

Receptor group	Receptors included within group	Sensitivity	Pathway
	access road (new drinking water, fuel and power supplies).		
Property	Stanley Growers Ltd crops	High	Plant uptake and bioaccumulation of contaminants within the crops. Contaminated soils attached to fruit and vegetables following harvest.
Ecology	Ecological receptors	High	FIPASS is to be brought ashore for the purpose of dismantling. The tanks are proposed to be emptied and cleaned prior to transport to the dismantling location on land; however, there is a (relatively low) risk of any residual sludge contamination being released during transport and progressive dismantling.

A16.2.11 Future evolution of the baseline in the absence of the proposed scheme

With the exception of the power station and causeway substation and at the causeway junction no other proposed developments are within close proximity of the footprint of the proposed scheme.. The development of the power station site would require its own planning permission from F.I.G., with consideration of the potential for contamination to ensure that the site is suitable for the proposed end use. The power station development is, however, proposed to be undertaken after construction of the new quay. Consequently, in relation to the proposed scheme and its immediate receiving environment, it is reasonable to predict that no new sources of contaminated land would be introduced and there would be no significant deterioration in ground conditions in the absence of the proposed scheme if FIG addresses the issue of the non-compliant storage of the IBC's adjoining the new road.

A16.3 Potential impacts during construction

A16.3.1 Impacts to human health

A16.3.1.1 Exposure of workforce, land owners, land users and neighbouring land users to contaminated soils, groundwater and surface waters with associated health impacts

Earthworks and excavation activities, as well as the movement and stockpiling of material have the potential to mobilise existing ground contamination (where present). This could result in impacts to human health through dermal contact, inhalation and ingestion of contaminants.

As discussed in **Section A16.2.2**, recent ground investigations within the proposed scheme footprint did not identify the presence of Made Ground within any of the exploratory locations. As discussed in **Section A16.2.6**, there were no exceedances of the commercial GACs for the soil samples analysed, which indicates that on-site soils assessed as part of the investigation do not present a risk to current site users. The only exception to this is the presence of aliphatic C21 - C35 which was recorded in exceedance of the aGAC in one sample; however, this was a marginal exceedance only and is therefore considered unlikely to represent an unacceptable risk to construction workers.

It should be noted that the investigation was based upon a limited number of soil samples and there is uncertainty associated with the results due to the investigation constraints as discussed in **Section A16.1.1.1**. Therefore, potential risks to construction workers cannot be entirely discounted. It is also possible that contamination events, such as localised spillages and leaks from IBC containers stored on unsurfaced areas of the site, may occur between the time of the site investigation and the commencement of construction works.

A historical fuel spillage within a drainage ditch connecting to the irrigation pond is considered to be the main area of concern in relation to potential hazard to human health. Elevated TPH concentrations above the benzene EQS were identified within soil leachate, groundwater samples and surface water samples. Contaminated groundwater associated with the historical spill could potentially pose a risk to construction workers, if encountered during excavation works. There is also the potential for neighbouring site users to be impacted through the accidental discharge of the contaminated surface water within the ditch into the pond which is utilised by Stanley Growers Ltd for the purpose of irrigation. Although contamination has been identified within the irrigation pond, further release of water from the drainage ditch could result in the water being unsuitable for use as an irrigation source. Irrigation of crops with contaminated water, and subsequent consumption of the produce, could potentially pose an unacceptable hazard to human health. It should be noted that the presence of hydrocarbons in the pond is known to Stanley Growers Ltd.

There is the potential for new preferential pathways to be created as a result of the construction works. The new pathways may lead to the migration of vapours and ground gases into the proposed gatehouse, temporary offices and other structures associated with the temporary compounds and also may permeate into the proposed new drinking water supply pipe if not made of contamination resisting materials or a clean corridor provided for services.

It is proposed that the surficial silt sediments are removed from beneath FIPASS through suction techniques and transported onshore and placed into geotubes. This could result in impacts to human health through dermal contact, inhalation and ingestion of contaminants (due to the assumption that the material is biologically contaminated), particularly once the bags have been opened following the drying process (however only if these are tested and found to be contaminated). Although it is intended that the material inside the geotubes would bioremediate over time, there is potential for any residual hydrocarbon contamination within the material to create hazards to human health. Note that the biological contamination treatment in the bags for *E.coli* is greater than 99% effective

The sensitivity of receptors (construction workers and off-site users) is considered to be medium to very high. The impacts associated with the construction of the landside elements of the proposed scheme are predicted to be of local spatial extent (localised to the work areas), of short-term duration, of intermittent occurrence and high reversibility (occurring only during the construction works). The magnitude of effect is therefore considered to be low. An impact of **minor to moderate adverse** significance is therefore predicted to human health due to construction of the landside elements of the proposed scheme.

A16.3.1.2 Mitigation and residual impact

In order to mitigate the potential impact to human health during construction, the following mitigation measures are proposed:

- Creation and adoption of a site and task-specific health and safety plan prior to construction commencing.
- Provision and use of appropriate PPE for site workers, including for example gloves, barrier creams and overalls in order to limit direct contact with site soils, *E.coli* and groundwaters.
- Provision of adequate hygiene facilities and clean welfare facilities for all construction workers.
- Method statements for use if unexpected contamination in soil or groundwater is encountered during construction and to ensure safe management and disposal of materials.
- Dust suppression activities to reduce the risk relating to the creation and inhalation of wind-blown dusts only when digging out the hydrocarbon hotspots.

In addition to the points outlined above, consideration should be given to the potential impacts associated with the hydrocarbon impacted surface water. For works undertaken in the vicinity of the hydrocarbon impacted surface water ditch, it is recommended that a temporary oil / water interceptor is installed to prevent water containing hydrocarbons further discharging into the pond. With the adoption of these mitigation measures, the magnitude of effect is predicted to be very low resulting in a residual impact of **negligible** to **minor adverse significance**.

A16.3.1.3 Impacts to health of site workers during dismantling of FIPASS tanks

As discussed in **Sections A16.1.1** and **A16.2.7**, two phases of investigation of the FIPASS tanks have been undertaken with samples of water, sludge and rust collected from the tanks. During the investigations, the presence of free phase hydrocarbons and elevated concentrations of dissolved phase contaminants were identified within the ballast tanks.

Free phase and dissolved phase hydrocarbons have the potential to impact on the health of site workers during the dismantling works through direct contact and inhalation, as well as having the potential to form an ignitable flammable mixture with air. There is also the potential for site workers to come into direct contact with hydrocarbon contamination during the dismantling of FIPASS.

Sludge samples collected from within the tanks were assessed against aGACs protective of site workers. There were no exceedances of aGACs recorded within the samples tested, however values are only currently available for eight contaminants. Laboratory analysis of the sediments also identified TPH, PAH, VOCs, metals, phenols, organotins and PCBs above the limit of detection in the samples analysed. There are no aGACs available for these contaminants, as such the presence of these contaminants may pose a risk to the health of site workers during dismantling.

Asbestos fibres (chrysotile and amosite) were also identified within the sludge samples analysed. The presence of the asbestos fibres within the water however is not considered to pose a risk to site workers if the sludge remains fully saturated, meaning the release of the asbestos fibres is controlled and no other dry asbestos sources are found in the Stage One B surveys

As part of the dismantling works, the contaminated sludge and ballast water are to be removed from the tanks and transported to a holding tank for disposal, depending on the level of contamination identified within each of the tanks prior to the start of construction works. All tanks will be vented in accordance with Port Operators Safe system of work prior to entry. Site workers involved in the removal / transport of the contaminated material are potentially at risk via direct contact with the material and inhalation any vapour generated, however extraction of the majority of the ballast water and sludge will be undertaken via a pumping method thereby limiting potential impacts to human health. Where residual sludge / sediments on the tank walls and floor remains, there may be the requirement for site workers to enter the tanks so that the remaining material can be removed, to ensure the tanks are as clean as possible prior to dismantling onshore. It is anticipated that not all residual contamination will be able to be removed from the tanks, therefore works to remove as much as reasonably practical are recommended.

The sensitivity of the site workers is considered to be very high. Due to the potential presence of flammable/explosive contaminants within the FIPASS ballast tanks, the magnitude of effect is considered to be high as there is the potential for life changing injuries or death should an explosion occur. Controls and monitoring measures are in place at the moment and these will need to be strengthened in the dismantlement phase to manage the risk.

Due to the very high sensitivity of the site workers and the high magnitude of effect, the overall impact during the dismantling works is considered to be of **major adverse significance**.

A16.3.1.4 Mitigation and residual impact

The presence of a potentially flammable/explosive environment within the tanks will need to be considered when planning the dismantling works and the Principles of Prevention followed . Prior to dismantling, the atmosphere within the tanks should be monitored to assess whether it presents a fire and explosion hazard. The use of hot works (the creation of sparks or use of flames whilst cutting, welding, riveting, grinding, etc.) should be prohibited if an explosive or flammable atmosphere is identified within the tanks to prevent possible ignition. Works should be undertaken in accordance with Health and Safety Executive Guidance 2013 ‘Dangerous Substances and Explosive Atmospheres, Approved Code of Practice and Guidance’.

Measures should also be implemented that would minimise site workers coming into direct contact with any contaminated sludge and any contaminated ballast water within the tanks during the dismantling works. This could include, for example, designing the works so that direct human contact is avoided where possible. Where it is not possible to avoid direct contact, the provision of appropriate venting, PPE and adequate hygiene and welfare facilities should be implemented as well as the adoption of a site and task-specific health and safety assessment and detailed plan within the PEP. .

FIPASS tanks should be monitored for vapours and gases during the dismantling works with access into the confined spaces within the tanks avoided where possible. If entry into the tanks cannot be avoided (to remove any remaining sludge within the tanks following use of the pumps), access should be restricted to those who are suitably qualified with the use of specialist equipment and PPE. A detailed method statement and risk assessment should be produced within the PEP prior to any suitably qualified person entering the tanks.

Sludge within the ballast tanks should be kept fully saturated during the dismantling works in order to prevent asbestos fibres becoming airborne and creating a potentially unacceptable risk to site workers.

Following the implementation of these mitigation measures the magnitude of effect is reduced to very low, resulting in a residual impact of **minor adverse** significance.

A16.3.1.5 Impacts to the health of other site users, site neighbours and ecological receptors due to dismantling of FIPASS tanks

During dismantling works there may be the requirement to store fuels, oils and other liquids landside for use by machinery associated with the dismantling works. Accidental spills and leakages within the storage or refuelling areas could impact on the health of other site users, site neighbours and ecological receptors. Spills and leakages of contaminated surficial silt sediments and sludge from within the FIPASS ballast tanks during the dismantling works may also occur which could have a negative impact on the receptors identified.

It is proposed to remove any contaminated sludge and any contaminated ballast water within the tanks and bring their contents onshore to a sealed treatment tank located on shore. Where contaminated water is not present in the tanks, it is proposed that this is de-ballasted seawater is returned into the harbour as currently occurs in routine re-ballasting activities. Contaminated ballast water will be removed via a lorry mounted gulley pump and tank which will extract the water and transport it to the sealed holding tank facility. Any treated water draining from the sealed holding tank will be captured and passed through a hydrocarbon separator prior to discharge into the harbour. It is assumed that water within the holding tank will be treated to an acceptable level prior to discharge into the harbour (e.g. contaminants other than free phase hydrocarbons will be recorded at levels below their respective EQS).

Contaminated sludge remaining in the tanks will be removed using a jet wash, then collected via pumping and transported to the holding tank facility. There is the potential for leakages or spills to occur whilst transporting, depositing and storing the contaminated materials onshore that may represent a potential hazard. Following the discharge of the treated water within the holding tank, the contaminated sludge / sediments will remain in the tank for subsequent disposal to a suitable waste management facility (overseas).

The FIPASS barges are to be brought ashore to be dismantled; during the dismantling works there is the potential for dusts to be generated which could impact the health of off-site receptors.

The sensitivity of other site users, site neighbours and ecological receptors is considered to be medium.

The magnitude of effect during the dismantling works is considered to be low; this is due to the potential impacts being localised to the area of work and occurring during the dismantling process only (which is temporary in nature).

Due to the medium sensitivity of the receptors and the low magnitude of effect, the overall impact during the dismantling works is considered to be of **minor adverse** significance.

A16.3.1.6 Mitigation and residual impact

Prior to the discharge of ballast water from the holding tank facility into the harbour, it is recommended that a round of sampling is undertaken to ensure that the discharged water does not contain contaminants in excess of their respective EQS and does not pose a risk to ecological receptors. The process of managing this will be within the PEP as an ITP for the task.

Storage of fuels and oils associated with the dismantling works should be in accordance with best practice and emergency procedures and spill control procedures need to be developed and implemented during the dismantling works.

Following the implementation of the above mitigation measures, the magnitude of effect is very low, therefore residual impact is of **negligible** significance.

A16.3.2 Mobilisation of contaminants potentially resulting in impacts on soil/land use and pollution of groundwater, surface water and the ecological habitats they support

Landside excavation works will be required as part of the construction phase (predominantly associated with the construction of the access road and swales). These activities could disturb potential contaminants of concern (PCOC) which could then be mobilised and migrate, e.g. via shallow groundwater or surface runoff, impacting soils and controlled waters both on and off-site.

As discussed in **Section A16.2.6**, soil leachate, groundwater and surface water samples were analysed and assessed against EQS for transitional and coastal waters to assess the potential risks to controlled waters (irrigation pond and Stanley Harbour). The assessment identified a number of exceedances of the EQS in soil leachate and groundwater samples for a number of inorganic contaminants (chromium VI, lead, zinc, nickel and free cyanide), PAHs and TPH. The recorded exceedances of the EQS for inorganic contaminants were not considered to represent an unacceptable risk to controlled water receptors as they were recorded sporadically. The elevated PAHs and TPHs in both groundwater and surface water samples generally corresponded to the location where an oily sheen associated with the historical fuel spillage was observed.

The limitations on the survey work detailed in **Section A16.1.1.1** should be noted for this section of the report.

As mentioned in **Section A16.4.1**, potential risks exist in relation to the hydrocarbon impacted surface water within a drainage ditch (**Figure 16.2**). Construction works, if not properly managed, could lead to the accidental further release contaminated water from the ditch into the neighbouring irrigation pond during works to construct the culvert and linking ditch beneath the proposed new access road.

As mentioned in **Section A16.3.1**, potential risks exist in relation to surficial sediments from beneath FIPASS being pumped into geotubes on land for bioremediation. If not managed correctly, there is the potential for accidental release of the surficial silt during transport between FIPASS and the geotubes, as well as the subsequent opening of the geotubes once the material has dried and been subject to bioremediation.

Any migration and discharge of contamination (mainly biological from the surficial silt) onto land could result in a deterioration in soil and land quality. Discharge into surface waters could lead to a reduction in surface water quality and impact on the ecological habitats that they support.

The sensitivity of soils is considered to be very high as they are used both on and adjacent to the proposed scheme for food production at the Stanley Growers site. The sensitivity of surface waters (i.e. the irrigation pond) is also considered to be high as they are utilised as abstraction points The impacts associated with construction of the landside elements of the proposed scheme are predicted to be of local spatial extent (localised to the work areas), of short-term duration, of intermittent occurrence and high reversibility (occurring only during the construction phase). The magnitude of effect is therefore considered to be low. As a result, the overall impact during construction is considered to be of **minor adverse** significance for surface waters.

A16.3.2.1 Mitigation and residual impact

If encountered, careful management of contaminated groundwater will be required during construction works in order to prevent the release and spread of hydrocarbon contamination, especially in the vicinity of the drainage ditch where elevated concentrations of TPH have been identified in both groundwater and surface water samples. Encountered groundwater impacted by hydrocarbons should be collected in a tank prior to any treatment and discharge/ disposal. Runoff of water encountered during the works should also be managed to prevent the spread of hydrocarbons and further impact on the irrigation pond.

As discussed in **Section 16.3.1.2**, consideration should be given to the potential impacts associated with the hydrocarbon impacted surface water. It is recommended that a temporary oil / water interceptor is installed during the construction phase to prevent water containing hydrocarbons further discharging into the irrigation pond or treated prior to the commencement of construction works. With the implementation of these mitigation measures, the residual impact is considered to be of **negligible** significance.

A16.3.3 Alterations in topography, surface water flow patterns or infiltration rates leading to changes in groundwater recharge and groundwater levels

There is a possibility that the hydraulic regime of the local area will be affected by the landside elements of the proposed scheme. Works to ensure that the proposed access road meets highway specifications will result in areas of greater soil compaction which could potentially influence the groundwater regime by altering porosity and creating preferential groundwater flow paths. The creation of an area of hardstanding in the form of the access road, and new areas of hardstanding required for temporary use during the construction phase (e.g. plant workshops) may also negatively impact surface water flow patterns and infiltration rates to underlying groundwater bodies. The creation of the access road and temporary construction areas may also require alterations in local topography, which again has the potential to negatively impact surface water flow patterns and infiltration rates to underlying groundwater bodies.

If required, dewatering of groundwater (which was encountered at shallow depths during ground investigation) within excavations could also affect groundwater flow and water quality resulting in impacts to base flow of local surface water bodies (e.g. the irrigation pond). It should be noted that the level of the access road has been increased through the design process to minimise the risk of encountering groundwater or interfering with groundwater flow paths.

The groundwater within the area is considered to be of medium sensitivity. Any changes to infiltration rates, surface runoff or dewatering that may occur as a direct result of construction activities associated with the temporary compound areas is predicted to be of local spatial extent, of short-term duration (related to the working areas only), of intermittent occurrence and high reversibility. The magnitude of effect associated with construction works in these areas is therefore considered to be low. The impact during construction is therefore considered to be of **minor adverse** significance. In relation to the road, the impact will of local spatial extent (related to the road areas only) and of long-term duration (permanent), therefore the magnitude of effect is considered to be medium. The impact during construction of the access road is therefore considered to be of **minor adverse** significance.

A16.3.3.1 Mitigation and residual impact

The design of the access road will take into account the potential effects the road may have on existing surface water and groundwater flow pathways. As part of the road design, suitable drainage measures will be incorporated into the design of the access road thereby mitigating the potential impacts relating to surface water flow patterns and infiltration rates. As a result, the residual impact is considered to be of **negligible** significance.

A16.3.4 Impacts to controlled water receptors and the ecological habitats that they support due to dismantling of FIPASS tanks

The preliminary investigation of the FIPASS tanks identified concentrations of PAHs and TPHs in excess of the EQS protective of transitional and coastal waters (Stanley Harbour and the wider marine environment), within all the water samples recovered and analysed. During the supplementary investigation, at least one exceedance of the EQS was recorded in each of the 41 water samples analysed from the tanks. The most notable exceedances of the EQS were metals, PAHs and petroleum hydrocarbons. As mentioned previously, free phase hydrocarbons were identified within the tanks.

Contaminated sludge, water and free phase hydrocarbons within the tanks could present an unacceptable risk to surface water receptors should leakages or spills occur whilst transporting, depositing and storing the contaminated materials onshore in a sealed holding tank. The water draining from the holding tank will be captured and passed through a further fuel oil hydrocarbon interceptor prior to discharge into the harbour. It is assumed that water within the holding tank will be treated to an acceptable level prior to discharge into the harbour.

Prior to the breaking up of the tanks onshore, a trench will be created in the slipway to ensure that any remaining sludge or water will be captured preventing it from discharging back into the harbour. The trench will also ensure that any other potential contaminants, including small debris that may be released accidently during the dismantling works is captured and not allowed to discharge untreated or unchecked into the harbour.

Dismantling works also have the potential for accidental leaks and spillages to occur during removal of fuel lines and associated infrastructure on top of FIPASS which could pose a risk to controlled waters and the ecological habitats that they support. However, it should be noted that fuel disconnection and decommissioning of FIPASS is to be undertaken by SSL as owner of the assets (which already has a safe systems of work in place which will minimise the risk of pollution incidents), with fuel lines purged ahead of progressive dismantlement (by parties other than the main contractor).

The sensitivity of controlled water receptors is considered to be high. The magnitude of effect to controlled waters during the dismantling works is considered to be medium. As a result, the impact to controlled waters during dismantling is considered to be of **moderate adverse** significance.

It should be noted that potential impacts to controlled waters due to discharge of seawater back into the harbour from the geotube area is considered in **Section A8.3**.

A16.3.4.1 Mitigation and residual impact

In order to reduce the potential impacts to controlled waters and the ecological habitats that they support, the following mitigation measures are required:

- The existing fuel lines and associated infrastructure should be carefully decommissioned in order to avoid the potential release of contaminants into the marine environment.
- Emergency procedures and spill control procedures need to be developed and implemented during the dismantling works (as well as the ongoing controls and safe systems of work).

Following the implementation of these mitigation measures the magnitude of effect is reduced to low, therefore with the overall impact during the dismantling works is considered to be of **minor adverse** significance.

A16.4 Potential impacts during operation

A16.4.1 Impacts to future site users and controlled waters

It is anticipated that as part of the development of the proposed scheme, fuel lines will run alongside the new access road (underground) and refuelling areas will be present on the new FIPASS. There will also be a diesel tank on the quay, as well as temporary storage of IBC's. The presence of these features means that there is the potential for leakages and spills to occur which could impact on human health receptors, controlled waters and ecological habitats.

However, the new fuel lines that will be installed as part of the development of the proposed scheme will be fitted with monitoring systems that alarm and notifies SSL as owner. This monitoring system will be installed along its length that will detect if a leakage has occurred and where it is located. This will provide the mechanism for managing any leaks from the pipework during the operational phase.

Should excavation works be required during the operational lifespan of the access road (in order to maintain the road, for example) there is the potential to bring contaminated materials to the surface. This creates the potential for maintenance / construction workers, future site users and neighbouring land users to come into direct contact with contaminated soils. These impacts are assessed below.

The sensitivity of these receptors is as follows:

- Human health – medium.
- Controlled waters – medium.
- Ecological receptors – medium.
- Built environment - medium.

The magnitude of effect for the receptors identified as potentially being impacted by leaks and spillages is considered to be medium, as spillages of particularly hydrocarbons could have medium-term impacts. The impacts associated with the excavation of soils is predicted to be of local spatial extent (localised to areas where contamination may be present and to areas where excavation works are required to remove the hot spots), will be of short-term duration and intermittent occurrence. Therefore, the magnitude of effect is considered to be low.

Due to the medium sensitivity of the receptors and the medium magnitude of effect, the overall impact during the operational phase in relation to leaks and spills is considered to be of **minor adverse** significance. The impacts associated with the excavation of potentially contaminated soils is also considered to be of **minor adverse significance**.

A16.4.1.1 Mitigation and residual impact

Storage of fuels should be done in accordance with the following:

- Environment Agency PPG 07 – Safe Storage – the safe operation of refuelling sites; and
- Environment Agency PPG 08 – Safe storage and disposal of used oils.

Emergency procedures, in line with best practice, should be in place to deal with leaks and spillages effectively to limit the potential impacts to human health and the surrounding environment.

It is recommended that site and task specific risk assessments and method statements be developed and implemented should excavation works be required during the operational phase of the access road.

Following the implementation of the above mitigation measures, the magnitude of effect is considered to be low. Therefore, the residual impact during the operational phase of the proposed scheme is considered to be of **minor adverse** significance.