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## 14. LAND CONTAMINATION

This Chapter responds to issues raised in relation to the land contamination impact assessment for the Traveston Crossing Dam EIS.

Fourteen submissions were received which raised issues relating to land contamination. The main issues raised were related to the identification of sites, particularly the identification of cattle dips throughout the inundation area, the remediation of these sites and the need for a Third Party Reviewer. Discussion of these issues is presented in this chapter.

### 14.1 Assessment Methodology

#### 14.1.1 Preliminary Site Investigation

One submission claimed that the methodology for identifying potentially contaminated sites was inadequate and should be augmented to reduce the risk of not identifying sites that may be contaminated.

With respect to (potential) contaminated land matters, a study area review was conducted of the Project footprint, covering the entire FSL area and land to the purchase boundary. This basic investigation covered the essential components that constitute a preliminary site investigation (PSI) as outlined in the EPA guidelines (refer page 5-170 of the EIS), with the exception of working up a full site history for individual land parcels, on-site inspections and sampling due to the large number of land parcels investigated (599 parcels) and limited land accessibility.

The methodology that was adopted for the conduct of this preliminary site investigation format is a commonly accepted and acknowledged practice within Queensland contaminated land profession when undertaking an EIS. This risk – based approach is adopted for situations such as this, where:

- the Project footprint constitutes a large area with a large number of land parcels; and
- the Project footprint constitutes a predominantly rural environment, where activities contributing to potential soil contamination are limited.

It is acknowledged that any methodology designed to identify potentially contaminated sites has an inherent risk of not capturing all (potentially) contaminated sites, even where other sources of site history information are accessed. This is due to the existence of information gaps (e.g. lack of record keeping), existence of contradicting information and inability to verify the accuracy of all information (note that both the NEPM, 1999 and the EPA guidelines reference the possibility of data limitations).

The process outlined above has been acknowledged by the EPA's Contaminated Land Unit as appropriately scaled for the purpose of this EIS in this particular environmental setting.

#### 14.1.2 Additional Investigations

A number of submissions raised issues about the extent of investigations to delineate potential contamination within the Project area. Notwithstanding the study area review that has been carried out to date, QWI is committed to undertaking further investigation as necessary to ensure that contaminated land does not pose an unmanaged risk to the community and environment.

A schedule of further works, including full PSI and detailed site investigation (DSI), risk assessment and remediation/management, as required, has been presented in the Mitigation of Impacts section (reference 5.6.2.2) for contaminated land matters. It is proposed that this schedule be implemented and completed prior to inundation.

The first step in undertaking this schedule of further works will be the “ground-truthing” of information gathered during the basic site review, specifically with respect to the 82 properties identified with potential contamination in the basic site review. In relation to the land parcels currently classified as representing either high or medium potential contamination risk, this ground truthing will be required to determine which of the additional investigation activities will be applied, i.e:

- 1) no further investigations works deemed necessary, unless additional information indicated the presence of contamination is received;
- 2) completion of a full PSI with reference to QLD EPA requirements; or
- 3) completion of a full DSI with reference to QLD EPA requirements.

As part of this ground truthing, additional site history of the currently identified land parcels will be collated, particularly through site inspections and interviews with landholders, local residents and historians. Recollections and anecdotal records, especially those related to the potential presence of livestock dips, will require cross – checking with records from other sources of information, such as Local Government and State Government agencies and any limitations of data will be noted. If, during such activities, additional land parcels are identified as being of interest with respect to contaminated land matters, these land parcels will be subjected to the same review and ground truthing activities as those land parcels identified during the initial review. Existing mapping of potential contaminated sites will be updated upon completion of the ground-truthing and subsequent investigation processes followed.

All land parcels for which further contaminated land investigations are to be conducted (i.e. those determined to proceed to levels (2) or (3) highlighted above) will be subjected to a full site history review and other investigation components as referenced by the NEPM and the EPA guidelines.

Based on the results of these investigations, including the risk to human health posed by the contaminants of concern, sites will be assessed as necessary (depending on contaminant concentrations encountered and evaluation of the source-pathway-receptor linkage post inundation) and remediation/management options evaluated and implemented where required, prior to inundation.

#### **14.1.3 Use of Third Party Reviewer for Contaminated Land Matters**

QWI is committed to utilising suitably qualified and experienced practitioners to carry out contaminated land investigations and implement relevant mitigation strategies. Towards this end, the introduction of a system of Third Party Review (TPR) by the EPA is acknowledged.

QWI recognises that this use of a TPR is a voluntary process in situations where statutory decisions relating to contaminated land matters are sought from the EPA. It is understood that the use of a TPR is applied most often in circumstances where the contamination complexity is of high level and/or there is a medium to high level risk to human health or the environment.

Although QWI may not necessarily seek any statutory decisions with respect to using a TPR, QWI appreciates that the planned ground truthing/PSI/DSI activities may identify the need to engage a TPR if more numerous, higher risk potentially contaminated sites are encountered. QWI commits to continuing communications with the EPA regarding this matter throughout Project planning and execution.

#### **14.2 Potentially Contaminating Activities and Contaminants of Concern**

One submission identified that Stockyards and quarries are not notifiable activities under the *Environmental Protection Act 1994* (EP Act). It is acknowledged that where these activities have been undertaken, there is a risk of contamination through association with related activities that

may utilise materials with the potential to contaminate. However, the term 'notifiable activities' has specific meaning in legislation and its use to describe activities outside of this definition is confusing.

Table 5.37 of the EIS highlights the primary notifiable activities considered likely to be present within the Project area, given the nature of the environmental setting.

It is acknowledged that the activities described as unregistered waste dumping (e.g. farm dumping), stockyards and quarries are not strictly notifiable activities as prescribed by the EP Act. However, it is considered that such descriptions should be included in the list of activities to be considered as part of this contaminated land investigation as they are known to be part of the activities supporting life and productivity within the Project area. Those potentially contaminated sites (whether or not subject to a Notifiable Activity as defined by the EP Act) encountered within the study area and found to be of moderate to high risk through the process of ground truthing and/or PSI, will be investigated and managed.

*Stockyards* are associated with mustering points, many of which are associated with the presence of livestock dips or spray races or the 'casual' application of pesticides to animals by way of hand spraying.

*Quarries* are often associated with ancillary activities that have the potential to cause land contamination, such as fuel storage for quarrying plant and equipment, waste oil storage and chemical storage in maintenance workshops and storage of explosives.

*Unregistered waste dumping (e.g. farm dumps)* activities are generally expected to represent low risk activities primarily associated with disposal of domestic (farm stead) waste. However, the potential for some of these areas to contain old farm chemicals should be explored as far as is practicable.

#### Septic tanks

In regards to septic tanks, the principal contaminants are organic compounds. Other contaminants of concern, are pathogenic bacteria and viruses and, to a lesser extent, metals. Most of these contaminants are introduced into the systems by their users and generally attach/accumulate in the biosolids of the tanks. Biosolids accumulations from septic tanks have the potential to pollute surface water, groundwater, soil, air and the food chain primarily through system failures (resulting in overflow to land), badly constructed percolation systems (allowing water to escape without proper treatment) and poor system maintenance (resulting in 'overloading' of the system and consequently, non-treatment).

The management of septic tanks and their (potential) impact on the environment is in the first instance a public health management issue addressed in the *Public Health Act 2005* (refer to section 11 in that Act) rather than an environmental impact management matter. It is for this reason that the environmental protection legislation does not consider the operation of a septic tank a notifiable activity, as defined in the EP Act. Consequently, environmental impacts resulting from septic tanks are not managed through the contaminated land provisions of the EP Act. Notwithstanding this, the general environmental duty requirements of s.319 of the EP Act still apply to the operation of septic tanks.

The management of septic tanks, including ensuring their proper installation and operation (Covered under the auspices of the *Plumbing and Drainage Act 2002*), is a Local Government responsibility by administrative delegation from the Department of Local Government, Sport and Recreation (the lead agency for this Act).

For the purposes of addressing all potential land contamination impacts, septic tanks as potential pollutant sources and options for relevant mitigation measures have been considered in the EIS as applicable to the study area.

One submission identified that the acronym UST was not defined. UST refers to Underground Storage Tank, in the context of contaminated land matters primarily associated with the storage of bulk fuels or chemicals.

In relation to contaminants of concern, arsenic is considered within the context of this Project primarily as a result of its use in insecticides (sodium and copper arsenates(III) known as 'emerald green', 'Scheeles's green'). One submission identified that arsenic is not usually considered to be a heavy metal. Arsenic is a metalloid in nature exhibiting characteristics between the obvious metals and obvious non-metals. The classification is arbitrary and more based on the structure and properties of the free element rather than the complex element. Arsenic is classified as a 'heavy metal' for the purpose of referencing in this EIS, principally due to its inclusion in the list of heavy metals as referred to for laboratory analyses.

### **14.3 Risk Assessment**

One submission requested further information with respect to the risk assessment outlined within section 5.6.2.1 of the EIS. The qualitative risk assessment was undertaken using a Project – based risk matrix. The risk matrix was based on consideration of the source-pathway-receptor linkage as relevant to the proposed land use. Consumption of potable water has not been included in this risk assessment, as potable water will require treatment prior to supply and this will remove the contaminants of concern.

Typical methods used for correcting water quality deficiencies that are associated with water sources (e.g. from dams) are also capable of removing contaminants that may be liberated from potentially contaminated land underlying the inundation area (notwithstanding that all identified contaminated sites will be remediated to the extent required to minimise this). Such methods<sup>1</sup> include:

- coagulation and filtration: typically used to improve tastes, odours, colour and turbidity, this method also removes copper and zinc (to varying degrees, depending on the nature of other impurities present) and up to 50 % of arsenic concentration in the inflow (and these are expected to be low, given that arsenic binds strongly to soil and is therefore not readily liberated into water);
- flocculation and filtration/sedimentation: adsorption onto flocs will remove trace organics, herbicides, oils and insecticides; and
- activated carbon adsorption: in addition to improving tastes, odours and colour, this method also removes metals, phenolic substances, trace organics, herbicides, oils and insecticides.

The matrix designed for this Project was divided into three levels of risk. A "Low" risk rating was assigned to properties that had no identified visual or documented record of potential historical contaminating activities. The "Medium" risk category was assigned to potentially contaminated properties located in deeper water of the FSL, with low – mobility contaminants (e.g. heavy metals). The medium classification is based upon the assumption that although there may be contamination present, there would be limited pathways for contaminants to reach the receptors of concern. A "High" risk classification was assigned to potentially contaminated properties where potential sources of contaminants were considered readily accessible by receptors. This included

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<sup>1</sup> D Barnes, PJ Bliss, BW Gould, HR Valentine, "Water and Wastewater Engineering Systems", Pitman 1983

all potential contaminants in the upland and shallow water and sediments environments, and readily mobile contaminants (e.g. petroleum) in the deeper water environment within the FSL.

It is intended to review the risk matrix and the results of its current application as part of the ground truthing process. This will then form a basis for evaluating the sites in subsequent risk – based investigation/remediation activities.

**Table 14-1** represents the summary of the risk rating associated with each of the 82 land parcels of interest. In assigning the risk rating to the individual land parcels, some assumptions were made, including:

- site location (in relation to inundation level) was rated A (nearshore/upland), B (Shallow Water and sediments) or C (Deep water and sediments) respectively;
- contaminating activities were rated 1 (No visible indications/records of contaminative Activities), 2 (Potential for Lower Risk Contaminants (Toxicity/Mobility)), 3 (Potential for Higher Risk Contaminants (Toxicity/Mobility)) and 4 (Notifiable Activities on site) respectively;
- source-pathway-receptor linkages were examined and some assumptions were set in contributing to the final risk rating;
- landfills were assigned a contaminating activity rating of 3, based on anecdotal information and professional experience that relates an unknown extent of types of material disposed of, but likely to contain some hazardous substances such as farm chemicals;
- cattle dips were assigned a contaminating activity rating of 3, based on the low mobility of contaminants typically associated with such sources (arsenic and Dichloro-Diphenyl-Trichloroethane (DDT) bind strongly to soil particles), but the relatively high toxicity (DDT produces breakdown products as/more toxic as the parent product);
- for rail corridors, the location of these is the higher rating factor rather than the contaminating activity (other than at railyards, arsenic is the main contaminant of concern);
- transformers represent potential contamination of high toxicity, but low to medium mobility;
- heavy metal contamination sources represent varying degrees of toxicity and mobility, depending on the combination of metals and chemistry of the environmental setting; and
- overall Risk Rating of L, M, H was assigned based on the Project risk matrix presented in Table 5.39 of the EIS with the following underlying assumptions.

The matrix was divided into three levels of risk.

A “Low” risk rating was assigned to properties that had no identified visual or documented record of potential historical contaminating activities.

The “Medium” risk category was assigned to potentially contaminated properties located in deeper water of the FSL, with low–mobility contaminants (e.g. heavy metals). The medium classification is based upon the assumption that although there may be contamination present, there would be limited pathways for contaminants to reach the receptors of concern.

A “High” risk classification was applied to all sources of contaminants which were considered readily accessible by receptors. This included all potential contaminants in the upland and shallow water and sediments environments, and readily mobile contaminants (e.g. petroleum) in the deeper water environment within the FSL.

**Table 14-1 Risk Rating Summary**

Lot	Plan	Notifiable Activity	Description of Immediate Site	Site Location	Contaminating Activity	Risk Rating
10	RP23248"	Chemical Spraying	Agricultural cropping, potential for agricultural chemicals stored on this property.	B	1	H
2	RP851773"	Chemical Spraying	Rural property possible storage of chemicals and/or fuels.	A	2	H
174	M37973"	Chemical Spraying	This potential notifiable activity also occurs on the same lot described above.	A	2	H
1	RP35106"	Chemical Spraying	This potential notifiable activity also occurs on the same lot described above.	A	2	H
2	RP212323"	Chemical Storage	Large size sheds located on this property with possible storage of farm chemical and/or fuels. No evidence of mining within this lot was observed during the historical review.	B	2	H
9	RP35104"	Chemical Storage	Large size sheds located on this property with possible storage of farm chemical and/or fuels in 5 observed tanks on site.	C	2	M
1	RP35105"	Chemical Storage	This potential notifiable activity also occurs on the same lot described above.	C	2	M
306	MCH3579"	Chemical Storage	This potential notifiable activity also occurs on the same lot described above.	C	2	M
1	RP77825"	Electrical Substation	Transformer sub-station with possible fuel/oil storage.	A	3	H
2	RP7029*	Hazardous Contaminants	Railway corridor. Environmental Management Register (EMR) search states "possible high arsenic levels along rail corridor"	A	4	H
124	SP112668*	Hazardous Contaminants	Railway corridor. EMR search states "possible high arsenic levels along rail corridor"	A	4	H
131	CP827298*	Hazardous Contaminants	Railway corridor. EMR search states "possible high arsenic levels along rail corridor"	A	4	H
5	SP142164"	Landfill	Possible rural landfill site.	A	3	H
2	RP843847"	Landfill	Possible rural landfill site.	A	3	H

Lot	Plan	Notifiable Activity	Description of Immediate Site	Site Location	Contaminating Activity	Risk Rating
3	SP142164*	Livestock Dip or Spray Race	Rural property with large industrial size sheds and potential old machinery/materials stored on site. EMR search identified this site has been subdivided from Lot 2 RP115540. which is also included on the EMR for "livestock dip or spray race".	B	4	H
2	RP115540*	Livestock Dip or Spray Race	see Lot 3 SP142164.	B	4	H
112	MCH3674*	Livestock Dip or Spray Race	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	4	H
3	SP116489x	Livestock Dip or Spray Race	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	3	H
22	SP119423*	Livestock Dip or Spray Race	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels. EMR search identified this site has been subdivided from Lot 22 MCH2767 which is also included on the EMR for "livestock dip or spray race"	C	4	H
22	MCH2767*	Livestock Dip or Spray Race	see Lot 22 SP119423.	C	4	H
2	RP122339*	Livestock Dip or Spray Race	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	4	H
1	LX1527*	Livestock Dip or Spray Race	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	4	H
2	RP76776*	Livestock Dip or Spray Race	Rural property with livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	4	H
2	RP204177*	Livestock Dip or Spray Race	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	4	H
39	M37964*	Livestock Dip or Spray Race	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	B	4	H

Lot	Plan	Notifiable Activity	Description of Immediate Site	Site Location	Contaminating Activity	Risk Rating
11	RP837925"	Mine Wastes	Property identified by Natural Resources Mines and Water. No evidence of mining operations evident in historical photos	A	1	L
2	SP183245"	Mine Wastes	Property identified by Natural Resources Mines and Water. No evidence of mining operations evident in historical photos	A	1	L
2	RP89989"	Other	Industrial sheds associated with agricultural crops, possibly avocados/mangos, potential for agricultural chemicals stored on this property.	A	2	H
1	RP205 859"	Other	Industrial sheds associated with agricultural crops, possibly avocados/mangos, potential for agricultural chemicals stored on this property.	A	2	H
2	RP174315"	Other	Old industrial size sheds located on this property.	A	2	H
2	RP901803"	Other	Rural property with possible storage of chemicals and/or fuels.	A	2	H
42	M37964"	Other	Industrial shed and large storage of unknown material.	A	2	H
3	RP131351"	Petroleum Product or Oil Storage	Industrial building, possible workshop and fuel storage with railway line frontage on western side of property.	A	2	H
1	RP899991"	Petroleum Product or Oil Storage	Pumping station with possible fuel storage.	A	3	H
1	RP809011"	Petroleum Product or Oil Storage	Airstrip and hanger located on property. Possible storage of fuels and/or chemicals.	B	3	H
1	RP212323"	Quarry	Quarry in northwest corner of site. No other evidence of mining within this lot was observed during the historical aerial review.	A	2	H
1	RP100526"	Quarry	Quarry located on rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	B	2	H
385	M37853"	Quarry	Quarry in southwest corner of site.	C	2	M
568	M37364"	Quarry	Quarry located on property.	A	2	H
1	RP203496"	Quarry	This potential notifiable activity also occurs on the same lot described above.	C	2	H

Lot	Plan	Notifiable Activity	Description of Immediate Site	Site Location	Contaminating Activity	Risk Rating
2	LX663"	Railway yard/line	Railway corridor	A	1	L
91	CP827295"	Railway yard/line	Railway corridor	A	1	L
5	RP7029"	Railway yard/line	Railway corridor	A	2	H
2	RP23274"	Railway yard/line	Railway corridor. The 1958 photograph also identified this property as a railway storage yard.	A	2	H
101	SP112667"	Railway yard/line	Railway corridor	A	1	H
102	SP112667"	Railway yard/line	Railway corridor	A	1	L
103	SP112667"	Railway yard/line	Railway corridor	A	1	L
2	RP101518"	Railway yard/line	Railway corridor. The 1958 photograph also identified this property as a railway storage yard.	A	2	H
1	RP102466"	Railway yard/line	Railway corridor. The 1958 photograph also identified this property as a railway storage yard.	A	2	H
2	RP102466"	Railway yard/line	Railway corridor. The 1958 photograph also identified this property as a railway storage yard.	A	2	H
5	RP806651"	Railway yard/line	Railway corridor. The 1958 photograph also identified this property as a railway storage yard.	A	2	H
1	RP23265"	Railway yard/line	Railway corridor. The 1958 photograph also identified this property as a railway storage yard.	A	2	H
4	RP806651"	Railway yard/line	Railway corridor. The 1958 photograph also identified this property as a railway storage yard.	A	2	H
95	SP104992x	Railway Yards	Railway corridor. The 1958 photograph also identified this property as a railway storage yard.	A	2	H
7	RP187935*	Service Stations	Industrial size sheds located on this property.	A	4	H
3	CP817546"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	2	H

Lot	Plan	Notifiable Activity	Description of Immediate Site	Site Location	Contaminating Activity	Risk Rating
1	RP66619"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	2	H
2	LX2139"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels in above ground storage tank.	A	2	H
11	RP12416"	Stock Yard	Rural property with possible storage of chemicals and/or fuels.	A	2	H
130	M37940"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	B	2	H
384	RP901798"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
368	M37262"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
2	RP84847"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
12	RP187457"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
86	LX2320"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
6	RP23249"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
3	RP843759"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	C	2	M
6	RP23245"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	C	2	M

Lot	Plan	Notifiable Activity	Description of Immediate Site	Site Location	Contaminating Activity	Risk Rating
1191	RP802647"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	C	3	H
1637	L37954"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
1	RP69334"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	B	2	H
2	RP23255"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	B	2	H
2	RP151688"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
13	SP166009"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
1	RP188192"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
1	L371291"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
3	RP851902"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
3	RP843847"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	2	H
6	SP105624"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	2	L
2	RP187921"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	2	H

Lot	Plan	Notifiable Activity	Description of Immediate Site	Site Location	Contaminating Activity	Risk Rating
3	RP187921"	Stock Yard	This potential notifiable activity also occurs on the same lot described above.	A	1	L
32	MCH257"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
10	MCH5064"	Stock Yard	Rural property with possible livestock dip or spray race operation and possible storage of chemicals and/or fuels.	A	1	L
1	RP223015*	Wood Treatment and Preservation	Industrial building, possible workshop and fuel storage with railway line frontage on western side of property.	A	4	H

\* EMR/CLR search result

" Property not listed on EMR/CLR

x Property listed on EMR/CLR as an amalgamation of two individually listed EMR/CLR sites.

The results indicate that, of the 82 sites of interest with respect to land contamination, 53 were assessed as having the potential to pose a high risk and thus would require completion of a more detailed PSI and potentially a DSI. The remaining 29 sites were considered to represent a medium to low potential. These would require the completion of a site visit to determine whether the identified potentially contaminating activity took place at the site, and if so completion of a PSI.

#### 14.4 Mitigation of Impacts

The overall goal for the mitigation of impacts from contamination is to make the land within the study area "fit for purpose" in a SAFE manner:

- S - securing protection of human health and the environment through relevant mitigation following appropriate further investigation whilst allowing the proposed land use
- A - achieving the protection of human health and the environment to the applicable quality standards as stipulated by relevant guidelines and in consultation with the EPA's Contaminated Land Unit
- F - financial compatibility is a consideration in the choice of mitigation option to ensure that whilst the stated remediation purpose is achieved, it is achieved in a cost balanced manner, given the source of funding
- E - environmentally sustainability is a consideration in the choice of mitigation option, i.e. using designs that will ensure that remediation effectiveness will stand up to the rigours of the long – term land use (e.g. capping designs with engineered life greater than 30 years, i.e. that normally applied in landfill rehabilitation) whilst using environmentally sustainable resources, ensuring the remediation activity itself does not cause a detrimental environmental impact and allowing for cost balanced maintenance and monitoring following implementation.

Removal of land parcels from the EPA's EMR is not a primary goal as precedent for inundated land remaining listed on the EMR at the same time as being fit for purpose has already been set: the entire land parcel comprising all of Wivenhoe Dam remains listed on the EMR. Thus, complete removal of contamination is not a necessity unless this is required to ensure that risks to human health and the environment are adequately addressed. The overall remediation goal for any land parcel with identified and delineated soil contamination is to ensure that the soil will not have a detrimental impact on the surrounding community and environment, including the water quality of the Project.

In devising and evaluating remediation (mitigation) options for the Project, a number of assumptions have been made. Remediation approaches (such as on – site bioremediation of petroleum hydrocarbon contaminated soil) that are likely to be time constrained and not finalised prior to inundation (in addition to the necessary preceding further investigations) have been discarded. Additionally, constraints relating to availability (e.g. areas within the Project footprint that could be used for entombment without representing an unacceptable environmental risk) and demonstrable success of remediation methodology have narrowed the number of approaches presented in the EIS. If Project related circumstances were to change, the assumptions and consequent remediation options would be revisited and additional options considered, where appropriate.

It is envisaged that the outlined remediation options would be exercised either singly or in combination as evaluated through the outcomes of the DSI's. For septic tanks, this would mean that Option 4 would not be implemented by itself (due to human safety issues) but would always be exercised in conjunction with Option 2. Notwithstanding this approach, alternate remediation options would be considered where the outcomes of the DSI indicate that those mitigation selections considered to date are not technically feasible.

In the summary of the contaminated land section of the EIS, an additional mitigation approach was listed, namely the use on-site remediation techniques to reduce contaminant levels in situ. This approach was included as a value – add rather than an option to be implemented in its own right. This option does not refer to the bioremediation of fuel contaminated soil from UST's but rather to more sophisticated remediation techniques that can be used in the long – term in addition to the short – term options to be implemented prior to inundation. An example of this would be phyto-remediation where use of certain flora species is designed to ensure uptake of contaminants at depth over the long – term while a cap would ensure protection immediately following installation. This is an approach that is sometimes used to deal with adsorption trenches of septic tanks when that infrastructure is no longer required.

In implementing the relevant mitigation measures, the Environmental Management Plan (EMP) presented in the EIS will be refined to reflect site specific issues as they come to hand. Potential mobilisation of contaminants of concerns during land disturbance (construction activities) is addressed in the EMP through management of dust emissions. Additionally, procedures for the management of unexpected contamination will be included, with the overall aim being the protection of human health and the environment.

If during any site earthworks or excavation, offensive or noxious odours and/or evidence of gross contamination not previously detected is observed, site works are to cease in that area and action taken to immediately abate the (potential) environmental harm. The area will be isolated through high – visibility fencing or other appropriate means and appropriate signage so that other activities may continue elsewhere within the remediation site without representing additional risks.

The administering authority is to be notified of any unexpected contamination with the potential to cause environmental harm in writing within two business days of detection and advised of appropriate remedial action.

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In the event that investigations should reveal unexpected levels of contaminants, QWI may engage a TPR to review these levels and determine appropriate additional remediation activities. QWI commits to continuing communications with the EPA regarding this matter throughout the Project planning and execution.

In summary, with respect to addressing contaminated land matters within the Project area, QWI commits to:

- implementing a ground truthing process to confirm and supplement contaminated land knowledge about the Project area;
- undertaking a review of the risk matrix and results as part of the ground truthing process;
- undertaking further investigations where necessary, based on the outcomes of the ground truthing process;
- implementing appropriate remediation strategies to achieve the stated goal, namely to ensure that for any land parcel with identified and delineated soil contamination, the soil will not have a detrimental impact on the surrounding community and environment, including the water quality of the Project, and
- conducting these activities in a SAFE manner.