

1 DWS Risk Assessment Matrix Accompanying Information

The ratings applied in this section are based on the assumption that the construction and operation activities would be carried out according to widely accepted good practice. The management measures considered to be widely accepted good practice in this assessment, and those recorded in the Aquatic Impact Assessment, should also be specified in the Environmental Management Plan to provide assurance that they will in fact be implemented. For completeness, these management measures are recorded in the risk assessment template.

Additional management measures (mitigation measures) that are unusual (i.e. not standard practice), or are site specific, have not been considered in these ratings. In instances where such measures are required, including in instances where such measures could be part of a motivation to reduce the risk category, these are recorded as a separate list of mitigation measures in the risk assessment matrix.

The proposed development includes the construction of an additional residential dwelling (including access road) on the Farm 782, Humansdorp RD. Construction activities had already commenced in April 2017 prior to any environmental assessments being conducted. Thereafter construction was halted and a Section 24G Application was conducted, in terms of the National Environmental Management Act (NEMA)(Act 107 of 1998) in order to rectify the unlawful commencement of a listed activity conducted in the absence of the requisite environmental authorisation.

The following activities have already been undertaken for the development:

- An area of approximately 900 m² has been cleared for the residence dwelling unit and access road;
- In the cleared area for the residential dwelling unit, Rye Grass (*Lolium multiflorum*) and Buffalo Grass (*Stenotaphrum secundatum*) has been planted to prevent erosion until the residential dwelling unit can be constructed;
- The access road has been built, and two stormwater pipes (culvert) have been placed at the watercourse crossing; and
- Electricity and water infrastructure has been installed on the proposed site.

Therefore the risks and impacts rated below have been assessed according to the existing impacts related to the completed construction activities as well as the future potential impacts which may occur as a result of the future construction of the residential dwelling (that have not commenced to date).

1.1 Activity 1: Disturbance of riparian habitat and vegetation during construction (already completed)

Table 1 presents the reasoning for ratings included for Activity 1 in the Risk Assessment Matrix.

Table 1: Impact 1 – Loss of riparian habitat and disturbance of the beds and banks, and vegetation of the drainage line when the access road was constructed

Risks	Rating	Reasons
		Severity
Flow Regime	2	<p>The required earthworks which occurred within the drainage lines do not appear to have altered the direction of flow in any significant manner. Due to the clearing activities, loose soil material was washed down the banks and accumulated within the constructed culverts, partially blocking low-flow scenarios (affecting flow mostly only during rainfall events due to the ephemeral nature of the drainage line).</p> <p>The construction activities occurred outside the boundaries of all of the identified wetlands. The completed earthworks should not alter the direction of flow, or the size of the catchment area.</p> <p>Where vegetation in the surrounding catchment was cleared runoff may have been marginally increased due to the absence of vegetation which causes a decrease in the infiltration rates in the catchment. However, due to minimal level of vegetation cleared as well as the rehabilitation efforts to stabilise the soils, this is not anticipated to alter the amount of water entering the drainage lines by a significant amount.</p> <p>If rehabilitation measures to minimise erosion and promote vegetation regrowth are implemented, and the constructed culverts are regularly monitored and cleared of any sediment blocking the flow path, the flow regime should not be affected significantly, which include flows in the systems and natural runoff.</p>
Physical and Chemical (Water Quality)	2	<p>The absence of vegetation cover and subsequent erosion could contribute to sedimentation which could cumulatively impact on the water quality of the drainage line, however due to the adjacent downstream dam (Wetland 1), it is not anticipated that sediment laden runoff will affect the drainage line downstream. The water quality of Wetland 1 has most likely been affected by the sediment laden runoff entering the wetland. However, if general rehabilitation measures are applied to prevent further erosion of the watercourse banks, the impact is expected to be of low significance.</p>
Habitat (Geomorph and Vegetation)	1	<p>As mentioned above, the construction activities occurred outside the wetlands' boundaries. Although it is possible for the geomorphology of habitat of the down-gradient Wetland 1 to be affected by erosion and sedimentation resulting from the un-vegetated sections still requiring rehabilitation, with the recommended rehabilitation measures, sediment laden runoff should be limited.</p> <p>The geomorphology and vegetation of the drainage line was slightly affected during construction (minor earthworks, vegetation clearing and construction of culverts). The geomorphology of Wetland 1 may be slightly affected due to additional sediment entering the wetland, however the change is considered insignificant. Considering the small footprint of the earthworks and the minor vegetation clearance that occurred, this impact should be insignificant if the proposed rehabilitation measures are applied.</p> <p>If erosion continues to occur within the drainage lines due to high rainfall events occurring prior to adequate rehabilitation, the minor gullies/ runnels may worsen which may slightly affect the geomorphology of the drainage line at the crossing point, however if the recommended rehabilitation measures are correctly applied it is not anticipated that any significant changes will occur. Also, the location of the adjacent</p>

Risks	Rating	Reasons
Biota	2	<p>downstream dam (Wetland 1) will inhibit sediment laden runoff from affecting the drainage line downstream.</p> <p>The drainage line has been directly affected at the crossing point of the access road. Due to the small footprint, it is not believed that significant impacts to the existing biota occurred as a result (compared to the sparse vegetation on adjacent banks). There is however a chance that aquatic biota such as frogs and other small amphibians were disturbed or even killed during earthworks activities.</p> <p>The activities occurred outside all wetlands' boundaries. Although it is possible for biota of the down-gradient Wetland 1 to be affected by erosion and sedimentation resulting from the cleared banks, it is not anticipated that biota will be affected in a significant way and specifically if rehabilitation efforts are successful.</p>
Consequence		
Spatial Scale of <i>impact</i>	1	Due to the small size of the construction footprint, as well as the dam (Wetland 1) directly adjacent (downstream) to the affected area, the impact remains isolated to the construction area.
Duration of <i>impact</i>	2	Changes to the existing habitat, if any, are expected to last no more than one year. No change in the PES, EIS or REC of the watercourses is anticipated as a result of this impact.
Likelihood		
Frequency of <i>Activity</i>	1	Clearing of vegetation and bulk earthworks occurred once. No further activities are proposed at this crossing except for the proposed rehabilitation measures.
Frequency of <i>Impact</i>	1	Vegetation and habitat disturbance related to subsequent erosion (following the vegetation clearing and earthworks activities) has already occurred, however it is unclear of the frequency of this impact. It most likely only occurs during high rainfall events as the drainage line is ephemeral and was dry at the time of the site visit. Therefore, impact would occur only during high rainfall events. Rainfall data (Kareedouw) depicts that high rainfall events (>10 mm) occur on average 5.4% of the year (19.7 days per year).
Legal Issues	5	Located within 100 m from the edge of the watercourse, as well as within 500 m from several wetlands.
Detection	1	Impacts to the drainage line such as erosion and sedimentation, are readily visible. Changes in biota (in the form of clearing or alien invasive plant species) would also be readily visible.

1.2 Activity 2: Vegetation clearance, soil and material stockpiling during construction (already completed)

Table 2 presents the reasoning for ratings included for Activity 2 in the Risk Assessment Matrix.

Table 2: Impact 2 – Erosion and sedimentation of the drainage line and downstream wetland

Risks	Rating	Reasons
Severity		
Flow Regime	2	<p>The constructed culvert was partially blocked by rocky soils which accumulated on both the upstream and downstream ends of the culvert pipes. The drainage line is ephemeral and most likely only flows during rainfall events. The blockages probably impound flow to a small degree.</p> <p>In addition, erosion runnels are present downstream from the access road directly adjacent to the northern edge of the dam (Wetland 1). If the runnels erode significantly it could potentially affect the natural flow regime in a small degree, however should sufficient vegetation re-establish via rehabilitation, the current erosion should cease.</p> <p>If the recommended rehabilitation measures are applied and the culverts are regularly monitored and cleared of any blockages and sufficient vegetation re-establishes, then it is unlikely that any significant changes to the flow will occur in the future.</p>
Physical and Chemical (Water Quality)	2	<p>Construction of the access road most likely affected Wetland 1 (farm dam) and Drainage 1 in terms of sedimentation as a result of vegetation clearing and loosening of the soils for the construction of the access road. However, it is difficult to establish at this stage to what degree the construction activities contributed to the sedimentation build-up in the dam since surrounding agricultural practices may have also contributed to sediment laden water reaching the dam. Erosion runnels are however, present downstream from the access road directly adjacent to the northern edge of the dam, which indicates that some sediment has been washed into the dam as a result of erosion.</p> <p>Due to the location of the earthen dam (Wetland 1) just downstream from the crossing, it is likely that all sediment would have accumulated in the dam preventing it from impacting the rest of the drainage line downstream. It is also possible that sediment laden runoff (resulting from the construction of the access road) reached Wetland 2, as it is located down-gradient from the start of the access road, but in a much lower degree than Wetland 1, if at all.</p> <p>It is unclear whether the brackish water at Wetland 1 was caused/ intensified by the construction activities or if it is merely due to the surrounding agricultural practices. If water quality has been affected by the construction</p>

Habitat (Geomorph and Vegetation)	2	<p>activities, the significance of the impact is likely to be low.</p> <p>As previously mentioned, sediment has been deposited into Wetland 1 as a result of erosion occurring between the culvert and the wetland. The amount of sediment which has been deposited is unclear, however considering the size and minor nature of the erosion runnels, it is unlikely that it was a substantial amount. Therefore, the geomorphology of the impacted section of drainage line and Wetland 1 has most likely been affected, however in a negligible way.</p>
Biota	2	<p>The drainage line is ephemeral and was not currently flowing during the site visit, however Wetland 1 did have water present (although the water level appears to have lowered recently). Water may have been temporarily impounded by the culvert blockages (perhaps during rainfall events which occurred).</p> <p>The obligate vegetation on the outer (dry) edges of the wetland was dying/ dead during the site visit. It is unlikely that the vegetation affected by the lower water level is a result of the culvert blockages. The area was experiencing a significant dry spell according to the land owner which is the most likely cause of the drop in water levels, however the impounded water resulting from the blocked culverts may have had a cumulative effect, however negligible.</p> <p>If the erosion upstream from Wetland 1 becomes significant enough, the additional deposited sediment could impact on the vegetation growing long the edges of the wetland. If rehabilitation measures are successful, this is unlikely to occur.</p>

Consequence

Spatial Scale of <i>impact</i>	1	Due to the small size of the construction footprint, as well as the dam (Wetland 1) directly adjacent (downstream) to the affected area, the impact remains isolated to the construction area.
Duration of <i>impact</i>	2	If the recommended rehabilitation measures are applied and sufficient vegetation establishes, any impacts are expected to last no more than one year. No change in the PES, EIS or REC of the watercourse is anticipated as a result of this impact.

Likelihood

Frequency of Activity	1	Construction was completed in less than 6 months.
Frequency of Impact	1	Erosion and sedimentation related to the vegetation clearing and stockpiling activities has already occurred, however it is unclear of the frequency of this impact. It most likely only occurs during high rainfall events as the drainage line is ephemeral and was dry at the time of the site visit. Therefore, the impact would occur only during high rainfall events. Rainfall data (Kareedouw) depicts that high rainfall events (>10 mm) occur on average 5.4% of the year (19.7 days per year).

Legal Issues	5	Located within 100 m from the edge of the watercourse, as well as within 500 m from several wetlands.
Detection	1	Erosion runnels, and siltation of the wetland should be readily visible.

1.3 Activity 3: Vegetation clearance, soil and material stockpiling (proposed residence construction)

Table 2 presents the reasoning for ratings included for Activity 3 in the Risk Assessment Matrix.

Table 3: Impact 3 – Increased potential for sediment laden runoff entering the watercourses during construction of the proposed new residence

Risks	Rating	Reasons
Severity		
Flow Regime	1	<p>Construction activities of the proposed residence could potentially affect the aquatic systems in close proximity to the footprint, such as Drainage 1 (approximately 55 m). However the thick vegetation between the site and the drainage line would most likely trap a large portion of sediment before it reaches the drainage line.</p> <p>If the recommended mitigation and rehabilitation measures are adhered to, it is unlikely that sediment would be deposited within the drainage line to such a degree that it would affect the flow.</p>
Physical and Chemical (Water Quality)	1	<p>As mentioned above, the thick vegetation which exists between the site and the watercourses will most likely trap most of the sediment prior to it reaching the watercourses. Therefore, it is improbable that the water quality of the downstream watercourses will be affected in a significant manner.</p>
Habitat (Geomorph and Vegetation)	1	<p>If sediment builds up within any of the downstream watercourses it could affect the geomorphology or vegetation, however it is unlikely that significant amounts of sediment will reach any of the watercourses as a result of construction activities.</p> <p>Considering the size of the site, the surrounding vegetation, as well as the fact that the previously cleared area (for the construction of the residence) has been sufficiently rehabilitated with grass species in the interim, it is not foreseeable that the amounts of sediment required to cause a significant impact would be transported from the site to the watercourses.</p> <p>There is potential for erosion to occur as a result of the vegetation clearing. It is anticipated that the erosion will be confined to the immediate site due to the level of thick surrounding vegetation. The soil is however characterised as structureless, grey sandy soils with imperfect drainage and high erodability qualities. If erosion occurs as a result of construction, it could potentially extend to the point where it reaches</p>

		the adjacent drainage line, in turn, impacting on the geomorphology and riparian vegetation of the watercourse. If rehab measures are properly implemented as was previously done on the site, erosion is unlikely to occur Therefore, the likelihood of the geomorphology or vegetation of any of the watercourses being affected is very low.
Biota	1	It is improbable that aquatic biota will be impacted by sedimentation and/ or erosion.
Consequence		
Spatial Scale of <i>impact</i>	1	Due to the thick surrounding vegetation and small size of the footprint it is unlikely that the impact will extend beyond the immediate area.
Duration of <i>impact</i>	2	If the recommended mitigation measures are applied and regular monitoring (and rectification if necessary) occurs, any impacts are expected to last no more than one year. No change in the PES, EIS or REC of the watercourse is anticipated as a result of this impact.
Likelihood		
Frequency of Activity	1	Vegetation clearance will occur at the onset of construction however, disturbed soils and stockpiled material will be present for the majority of the duration of construction. Construction is expected to be completed within <6 months.
Frequency of Impact	1	The impact would occur only during high rainfall events. Rainfall data (Kareedouw) depicts that high rainfall events (>10 mm) occur on average 5.4% of the year (19.7 days per year).
Legal Issues	5	Located within 100 m from the edge of the watercourse, as well as within 500 m from several wetlands.
Detection	3	Erosion gullies should be readily visible. Sediment deposits within the drainage line would however be more difficult to observe due to the thick surrounding vegetation and steep nature of the coastal hillside.

1.4 Activity 4: Handling and storage of hazardous materials and waste management (proposed residence construction)

Table 4 presents the reasoning for ratings included for Activity 4 in the Risk Assessment Matrix.

Table 4: Impact 4 – Contamination of wetlands, watercourses and groundwater as a result of the construction of the proposed new residence

Risks	Rating	Reasons
Severity		
Flow Regime	1	Contamination resulting from hazardous materials will not affect the flow regime of the surrounding watercourses. Solid waste resulting from construction activities may enter the watercourses, and, if significant amounts are present, could affect the flow regime of the watercourse. Should the

Physical and Chemical (Water Quality)	2	<p>recommended mitigation measures be adhered to, it is unlikely that this will occur.</p> <p>Site camp activities are proposed outside the watercourses' boundaries. However the operation of plant and equipment will occur on site up-gradient/ upstream from some watercourses and access to the site is via a crossing on Drainage 1 (directly adjacent and upstream to Wetland 1) and therefore potential exists for accidental spills of hydrocarbons or leakage of such substances from construction machinery to enter the aquatic systems either directly or through surface runoff during rainfall events or subsurface movement. Solid waste in the form of general litter left by labourers or construction materials can also alter the quality of water entering the downstream systems.</p> <p>If significant contamination occurs the impact on water quality may potentially be harmful to the aquatic system and potentially downstream systems as well. However, with all mitigation measures in place, water contamination could be mostly avoided or minimised.</p>
Habitat (Geomorph and Vegetation)	1	<p>Hazardous spills and poor waste management practices could result in soil and water contamination would could impact the habitat of the down-gradient watercourses. However, if general waste management and hazardous materials handling measures are followed, the above impact is not likely to affect the geomorphology and habitat of the downstream systems.</p>
Biota	2	<p>Accidental spills of hydrocarbons or leakage of such substances from construction machinery may enter the aquatic systems directly or through surface runoff during rainfall events or subsurface movement and then migrate to downstream systems. Such chemicals, fuels or pollutants would alter the water quality, having an effect on aquatic ecology in the form of biodiversity loss, i.e. the loss of vegetation and fauna that are sensitive to changes in water quality (especially from toxicant inputs). Solid waste in the form of general litter left by labourers can also affect water quality and biota downstream.</p> <p>If the recommended mitigation measures are adequately applied then it is unlikely that contamination will occur on a level significant enough to impact the aquatic biota.</p>

Consequence

Spatial Scale of <i>impact</i>	1	<p>Contaminants could potentially be transported, via the adjacent drainage line, to the beach and potentially the sea, however this is very unlikely. Should mitigation measures be adhered to, If contamination does occur it will most likely be contained within the development footprint.</p>
Duration of <i>impact</i>	2	<p>Changes to the water quality, habitat and existing biota, are expected to last no more than one year from the time that the relevant impact occurred if the recommended monitoring and maintenance is applied. No significant change in the PES, EIS or REC of the drainage line is anticipated as a result of this impact.</p>

Likelihood

Frequency of <i>Activity</i>	1	<p>Construction vehicles on site and activities within the Construction Site Camp, will only occur once over an estimated period of 6 months (or less).</p>
Frequency of <i>Impact</i>	1	<p>It is not anticipated that spills significant enough to reach the watercourses will occur on a regular basis, if at all. However, small spills within the construction footprint could be transported to the watercourses during high rainfall events.</p>

		Therefore, the impact would mostly occur only during high rainfall events. This is estimated to be <20%.
		The impact would occur only during high rainfall events. Rainfall data (Kareedouw) depicts that high rainfall events (>10 mm) occur on average 5.4% of the year (19.7 days per year).
Legal Issues	5	Located within 100 m from the edge of the watercourse, as well as within 500 m from several wetlands.
Detection	2	Should contamination of water of downstream areas occur due to construction vehicles and waste, this can possibly be detected via observation, but surface and groundwater samples will have to be taken to verify the quality of the water and whether contamination has taken place.

1.5 Activity 5: Access road infrastructure within drainage line (operational phase)

Table 5 presents the reasoning for ratings included for Activity 3 in the Risk Assessment Matrix.

Table 5: Impact 5 – Blocking the natural flow of surface/ groundwater

Risks	Rating	Reasons
Severity		
Flow Regime	1	<p>The presence of road infrastructure (crossing with culverts surrounded by earth) within the drainage line could impact on the flow regime (surface as well as subsurface flow) if the culverts get blocked.</p> <p>Currently there is no flow within the drainage lines. If the correct rehabilitation and monitoring measures are applied it is not anticipated that a water flow related impact will occur.</p>
Physical and Chemical (Water Quality)	1	<p>If water is impounded at the crossing for a significant period of time, in conjunction with the current levels of evaporation within Wetland 1, the salt and sediment levels within the remaining water will increase, resulting in decreased water quality.</p> <p>Should regular monitoring and clearing of the culverts occur, it is not anticipated that water will be impounded.</p>
Habitat (Geomorph and Vegetation)	1	<p>If water is impounded at the crossing it is possible that sediment could accumulate altering the geomorphology of Drainage 1 and potentially form an artificial wetland.</p> <p>Should regular monitoring and clearing of the culverts occur, it is not anticipated that water will be impounded.</p>
Biota	1	<p>If the pipeline infrastructure crossing the drainage line does not allow flows similar to that of pre-construction flows, then it may inhibit aquatic biota from migrating downstream. Currently there is an irregular flow of water within the drainage line. If the correct design and construction measures were applied it is not anticipated that a water flow related impact will occur.</p> <p>If impoundment of water occurs as a result of blocked culverts, it may inhibit aquatic biota from migrating upstream or downstream. Biota which is dependent on regular flow may be impacted (or in extreme circumstance cease to exist) by</p>

changes to the flow regime (or lack of flow resulting from impoundment).

However, if mitigation measures are followed this is unlikely to significantly affect the flow.

Consequence

Spatial Scale of <i>impact</i>	1	In the event that the water is impounded it is most likely only going to affect Drainage 1 and Wetland 1.
Duration of <i>impact</i>	1	Changes to the geomorphology, flow and aquatic biota, are expected to last no more than one month from the time that the relevant impact occurred if the recommended monitoring and maintenance is applied. No significant change in the PES, EIS or REC of the drainage line is anticipated as a result of this impact.

Likelihood

Frequency of <i>Activity</i>	1	Blockages are not expected to occur more than once per annum.
Frequency of <i>Impact</i>	1	The impact would most likely only occur during periods of water flow within the drainage line. Flow will most likely only be present during high rainfall events. Rainfall data (Kareedouw) depicts that high rainfall events (>10 mm) occur on average 5.4% of the year (19.7 days per year). Therefore, the potential for flow is estimated to be less than 20%.
Legal Issues	5	Located within 100 m from the edge of the watercourse, as well as within 500 m from several wetlands.
Detection	1	Should water become blocked and stagnate as a result of blockage of flows, this can be easily detected via observation.