

RISK MATRIX (Based on DWS 2015 publication: Section 21 c and i water use Risk Assessment Protocol)

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Risk to be scored for construction and operational phases of the project. MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

No.	Phases	Activity	Aspect	Impact	Severity				Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures	Borderline LOW MODERATE Rating Classes	PES AND EIS OF WATERCOURSES
					Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota															
1	Construction Phase (activity already completed)	Vegetation clearing prior to construction during the construction of the access road (already completed)	Disturbance of riparian habitat and vegetation for construction of access road.	During the construction activities for the access road, vegetation in the non-perennial drainage line (Drainage 1) was disturbed and filled in for the crossing of the road via culverts. The impact to biodiversity at the drainage line is mostly contained to the area required for the construction of the access road. There is a disturbed section of the bank on the upstream side of the access road, it however is unclear if this was caused by the construction activities or from other activities (note the many farming practices occurring in the drainage line catchment). Minor erosion runnels are present on the banks of the access road as well as the section of drainage line directly downstream of the culvert (to be discussed in Impact 2).	2. Small / potentially harmful	2. Small / potentially harmful	1. Insignificant / non-harmful	2. Small / potentially harmful	1.75	1. Area specific (at impact site)	2. One month to one year, PES, EIS and/or REC impacted but no change in status	4.75	1. Annually or less	1. Almost never / almost impossible / >20%	5. Fully covered by legislation (wetlands are legally governed)	1. Immediately	8	38	L	80%	The following measures are recommended for rehabilitation of the disturbed area: <ul style="list-style-type: none"> <li>All invasive alien plants propagating within the disturbed areas must be removed and disposed of as waste. All disturbed areas must be regularly monitored for the emergence of alien invasive species;</li> <li>The disturbed banks should be monitored for vegetation regrowth. If possible, the banks should be regularly watered to ensure sufficient regrowth;</li> <li>If sufficient vegetation does not establish, additional topsoil must be sourced from the proposed residence construction activities and a layer of no less than 100 mm should be spread to enable revegetation of the banks. If all else fails, the unvegetated areas must be hydro-seeded with a seed-mix appropriate to the area. A botanical specialist should be consulted regarding the correct seed-mix; and</li> <li>All erosion gullies/ channels created since the construction of the access road should be filled immediately to ensure further silt does not drain into Wetland 1 and the area revegetated. If necessary, geo-textile material must be installed to stabilise the soils.</li> </ul>	N/A	PES, EIS or REC scores are reflected in the Aquatic Assessment Report. An Impact to the PES, EIS or REC of the watercourses/s are not anticipated. Especially if the mitigation measures are implemented, no change to watercourses condition should occur.
2	Construction Phase (activity already completed)	Vegetation clearing and soil stockpiling for construction of the access road (already completed)	Erosion and sedimentation resulting from vegetation clearance and stockpiling.	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. However, it is difficult to establish at this stage to what degree the construction activities contributed to the sedimentation build-up in the dam. The culvert at the drainage line crossing was semi-blocked by rocky soils which has collected on both the upstream and downstream ends of the culvert pipes. In addition, erosion runnels are present downstream from the access road directly adjacent to the northern edge of the dam (Wetland 1), which indicates that sediment has been washed into the dam. Due to the location of the dam 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 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).	2. Small / potentially harmful	2. Small / potentially harmful	2. Small / potentially harmful	2. Small / potentially harmful	2	1. Area specific (at impact site)	2. One month to one year, PES, EIS and/or REC impacted but no change in status	5	1. Annually or less	1. Almost never / almost impossible / >20%	5. Fully covered by legislation (wetlands are legally governed)	1. Immediately	8	40	L	80%	The following measures are recommended for rehabilitation of the disturbed area: <ul style="list-style-type: none"> <li>The rehabilitation measures mentioned above in Impact 1 must be administered to ensure sufficient vegetation regrowth; and</li> <li>All erosion gullies/ channels created since the construction of the access road should be filled immediately to ensure further silt does not drain into Wetland 1 and the area revegetated. If necessary, geo-textile material must be installed to stabilise the soils.</li> </ul>	N/A	PES, EIS or REC scores are reflected in the Aquatic Assessment Report. An Impact to the PES, EIS or REC of the watercourses/s are not anticipated. Especially if the mitigation measures are implemented, no change to watercourses condition should occur.
3	Construction Phase (not yet commenced)	Vegetation clearing and soil and materials stockpiling for construction of the proposed new residence	Increased potential for sediment laden run-off entering the watercourses due to increased surface water runoff velocities, loose earth and stockpiles	During the construction phase (of the proposed new residence) when vegetation is cleared, large quantities of loose earth may easily be washed from the construction zone or be transported down slope during high rainfall events, resulting in increased sedimentation of aquatic systems occurring downstream. This would impact on aquatic biota, but could also influence the geomorphology of aquatic systems and overall functioning in severe circumstances. Construction activities of the proposed residence is most likely to affect the aquatic systems in close proximity to the alignment, such as Drainage 1 (approximately 55 m). The construction of the residence will include construction activities such as vegetation clearance, excavations and earthworks that could lead to additional sedimentation of down-stream watercourses.	1. Insignificant / non-harmful	1. Insignificant / non-harmful	1. Insignificant / non-harmful	1. Insignificant / non-harmful	1	1. Area specific (at impact site)	2. One month to one year, PES, EIS and/or REC impacted but no change in status	4	1. Annually or less	1. Almost never / almost impossible / >20%	5. Fully covered by legislation (wetlands are legally governed)	3. Need some effort	10	40	L	80%	The following measures are recommended for the construction phase: <ul style="list-style-type: none"> <li>Clearing of vegetation should be kept to a minimum;</li> <li>Excavated or spoil material (including any foreign materials) as well as topsoil stockpiles should not be placed within the recommended buffers (preferably further away) of the wetlands or drainage line in order to reduce the possibility of material being washed downstream;</li> <li>Disturbed areas should be rehabilitated immediately after construction in the relevant area (with indigenous vegetation or using topsoil);</li> <li>Rehabilitated areas should be monitored well and measures must be implemented to ensure that topsoil does not wash away, e.g. using swales; and</li> <li>Any erosion gullies/ channels created during construction should be filled immediately to ensure silt does not drain into aquatic systems and the area revegetated.</li> </ul> The following measure is recommended for the operational phase: <ul style="list-style-type: none"> <li>Any erosion gullies/ channels should be filled and stabilised as soon as possible. Also, disturbed and bare ground surfaces should be rehabilitated with suitable indigenous vegetation to stabilise soils; and</li> <li>Regular maintenance checks must be conducted to ensure that the culvert pipes remain free of blockages (sediment, litter, vegetation, etc). All blockages must be cleared immediately</li> </ul>	N/A	PES, EIS or REC scores are reflected in the Aquatic Assessment Report. An Impact to the PES, EIS or REC of the watercourses/s are not anticipated. Especially if the mitigation measures are implemented, no change to watercourses condition should occur.
4	Construction Phase (not yet commenced)	Handling and storage of hazardous materials (including waste management) during construction of the proposed new residence	Construction vehicles and equipment on site and activities within the Construction Site Camp (including waste management).	Construction activities could cause contamination of wetlands, watercourses and groundwater if proper management is not practiced. Accidental spills of hydrocarbons (oils, diesel, etc.) or leakage of such substances from construction machinery may enter watercourses directly, through surface runoff during rainfall events or subsurface movement (through groundwater) and then migrate to downstream systems. Such chemicals, fuels or pollutants would alter the water quality within the wetlands or drainage line, having an effect on aquatic ecology in the form of biodiversity loss, i.e. the loss of vegetation and wetland fauna that are sensitive to changes in water quality (especially from toxicant inputs). Wetland 1 & Drainage 1 are at the most risk of being affected by contaminated runoff from the construction site and activities as they occur on or in close proximity to the access road and proposed residence. Contaminated water within the catchment could reach the wetland and/ or drainage line via overland runoff, subsurface seepage or via groundwater. This could lead to a potential decrease in water quality and associated impacts in the systems that could indirectly impact on groundwater quality. Potential exists for spillages which may occur within the site camp or on the access road to migrate/ seep towards Wetland 2 and Drainage 2 and therefore possibly Wetland 3 as a result, but that is an unlikely scenario due to the distance, the grassy vegetation that exists between the access road and the relevant watercourses and the compacted nature of the access road.	1. Insignificant / non-harmful	2. Small / potentially harmful	1. Insignificant / non-harmful	2. Small / potentially harmful	1.5	1. Area specific (at impact site)	2. One month to one year, PES, EIS and/or REC impacted but no change in status	4.5	1. Annually or less	1. Almost never / almost impossible / >20%	5. Fully covered by legislation (wetlands are legally governed)	2. Without much effort	9	40.5	L	80%	The following measures are recommended for the construction phase: <ul style="list-style-type: none"> <li>The construction site camp and laydown areas for stockpiles etc. should be located on higher ground and not within the sensitivity buffers recommended for wetlands and watercourses;</li> <li>The proper storage and handling of hazardous substances (hydrocarbons and chemicals) needs to be administered on site and at the construction camp site. If hazardous liquids are stored/ used on site, spill kits must be available;</li> <li>Hazardous materials must be stored on an impermeable, bunded surface within a weather-proof structure;</li> <li>Storage and maintenance of machinery and construction-related equipment should preferably be done in the construction site camp and not within the sensitivity buffers recommended for wetlands and watercourses;</li> <li>No wash water from washing of mechanical plant or equipment to be discharged to any watercourse or wetland;</li> <li>Appropriate solid waste disposal facilities must be provided on-site during construction and adequate signage be provided;</li> <li>Spillages should be cleaned up immediately and contaminants properly drained and disposed of using appropriate waste facilities (not to be disposed of within the natural environment). Any contaminated soil from the construction site must be removed and disposed of appropriately;</li> <li>Spill kits must be available on site;</li> <li>Cement batching activities should occur in the construction camp, as far as possible, and conducted on an impermeable surface. Cement products/ wash may not be disposed of into the natural environment;</li> <li>Drip-trays must be provided beneath standing vehicles and machinery, and routine checks should be done to ensure that these are in a good condition;</li> <li>Portable toilets must be provided where construction is occurring. Workers need to be encouraged to use these facilities and not the natural environment. Disposal slips should be kept for auditing purposes;</li> <li>All construction plant equipment, general waste, surplus rock, and other foreign materials must be completely removed from site once construction has been completed.</li> </ul>	N/A	PES, EIS or REC scores are reflected in the Aquatic Assessment Report. An Impact to the PES, EIS or REC of the watercourses/s are not anticipated. Especially if the mitigation measures are implemented, no change to watercourses condition should occur.
5	Operational Phase (construction completed)	Access road infrastructure within drainage line.	Blocking the natural flow of surface/ground water and potential geomorphological changes.	The construction of the access road and pipe culverts in the drainage line has the potential to influence the hydrology of the system. The two pipe culverts appear to be of sufficient size (and was rated as such), but confirmation will be required from a professional hydrologist/ engineer. Due to sedimentation, the culverts at the road crossing have become semi-blocked forming a barrier for water flow along the drainage line. Although the drainage line is ephemeral, the sedimentation of the culvert pipes may lead to ponding on the upstream side, resulting in reduced/ no flow in the downstream section of the drainage line, potentially affecting aquatic biota dependent on the seasonal presence of water.	1. Insignificant / non-harmful	1. Insignificant / non-harmful	1. Insignificant / non-harmful	1. Insignificant / non-harmful	1	3. Regional / neighboring areas (downstream within quaternary)	1. One day to one month, PES, EIS and/or REC not impacted	5	1. Annually or less	1. Almost never / almost impossible / >20%	5. Fully covered by legislation (wetlands are legally governed)	1. Immediately	8	40	L	80%	The following measures are recommended for rehabilitation of the disturbed area: <ul style="list-style-type: none"> <li>All existing sediment within the culvert pipes must be removed and disposed of appropriately; and</li> <li>A professional hydrologist/ engineer needs to provide an opinion regarding the appropriateness of the culverts installed in the access road crossing of the drainage line.</li> </ul>	N/A	PES, EIS or REC scores are reflected in the Aquatic Assessment Report. An Impact to the PES, EIS or REC of the wetland/s are not anticipated.