

Table 2.1 Initial assessment of potential impacts on primary environmental aspects

Aspect	Reference	Site Reference	Potential risks and impacts –Nature and description	Significance before mitigation	Extent	Con-sequence	Duration	Probability	Recommendations to avoid, reverse, manage and mitigate the impact	Significance after mitigation
1. GEOGRAPHICAL IMPORTANT BIODIVERSITY AREAS			The site and activity alternatives are not compatible with the geographical location and have the potential to have direct and indirect impacts on sensitive environments:							
	1.1	Irrigation canal road servitude	The servitude is located within the Loskop Dam nature Reserve. The pipeline will be constructed within the road reserve and due to the confined space available indigenous trees may be affected during construction.	High	Site	Negative Direct Indirect	Long term	Definite	The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.	Medium
	1.2	Pump stations	The sites are located on the edge of a protected area (PA). The activity may have negative impacts on site that will have negative consequences on the integrity of the PA. The main potential impact is the loss of vegetation and associated fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small.	Medium	Site	Negative Direct Indirect	Permanent	Definite	The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.	Low
	1.3	Contractors camp	The site is located on modified land (old lands) within 5km of a protected area (PA). The activity may have negative impacts on site that will have negative consequences on the integrity of the PA. The main potential impact is the loss of vegetation and associated fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small and it is located on modified land.	Medium	Site	Negative Direct Indirect	Permanent	Definite	The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.	Low
	1.4	Raw water reservoir	The site is located in a critical biodiversity area (CBA) and within 5km of a protected area (PA). The activity may have negative impacts on site that will have negative consequences on the integrity of the PA. The main potential impact is the loss of vegetation and associated fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small and it is located on modified land.	Medium	Site	Negative Direct Indirect	Permanent	Definite	The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.	Low
	1.5	Connecting pipeline	The site is located in a critical biodiversity area (CBA) and ecological support area (ESA). The activity may have negative impacts on site that will have negative consequences on the integrity of the CBA. The main potential impact is the loss of vegetation and associated fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small and it is located on modified land.	Medium	Site	Negative Direct Indirect	Permanent	Definite	The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.	Low
	1.6	Purification plant	The site is located on heavily modified land within a critical biodiversity area (CBA). The activity may have negative impacts on site that will have negative consequences on the integrity of the CBA. The main potential impact is the loss of vegetation and associated fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small and it is located on modified land.	Medium	Site	Negative Direct Indirect	Permanent	Definite	The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.	Low

2. PHYSICAL	1.7	Watercourse crossings	The six water crossing sites will have construction related impacts on geographically sensitive wetland areas. The main potential impact is the loss of vegetation, modification of the watercourse characteristics and consequently fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small and it is located on modified land.	Medium	Site	Negative Direct Indirect	Permanent	Definite	The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.	Low
			The topographic features of the site have the potential to result in direct and indirect impacts:							
	2.1	All sites	Topographic features may pose constraints that will result in indirect impacts related to the construction phase.	Medium	Site	Negative Indirect	Permanent	Probable	The activity sites must be selected and the design must be formulated in order to ensure that site preparation, soil removal, levelling and cuts into the slopes are kept to the minimum.	Low
			Geophysical features on site have the potential to result in direct and indirect impacts:							
	2.2	All sites (excl. watercourses)	Soil type or rocky outcrops may pose constraints that can result in indirect consequences e.g. loss of habitat and soil erosion.	Medium	Site	Negative Direct Indirect	Permanent	Probable	<ul style="list-style-type: none"> Unstable soil and rocky outcrops must be avoided. Where such features cannot be avoided special methods must be employed to manage the impacts. Complete rehabilitation must be conducted. 	Low
	2.3	Watercourse crossings	Excavations through wetlands can result in direct consequences e.g. loss of habitat and soil erosion.	High	Site	Negative Direct Indirect	Permanent	Probable	<ul style="list-style-type: none"> The pipeline must be elevated above ground level on pedestals where long distances will be crossed over wetlands. Where excavations are necessary, the soil that must be removed in layered sequence and must be backfilled in the same sequence. Complete rehabilitation must be conducted. 	Low
			Negative impacts on watercourses:							
2.4	Watercourse crossings	Six watercourses will be crossed. The morphology of the wetlands will be affected as consequence of the following: <ul style="list-style-type: none"> Loss of vegetation and fragmentation of habitat will occur. This impact will be amplified if access roads have to be constructed. Erosion will occur where vegetation is removed and will deposit silt into the wetlands. Excavations will have a high erosion potential Alien invasive vegetation will invade disturbed areas 	High	Site	Negative Direct Indirect	Permanent	Definite	<ul style="list-style-type: none"> The least sensitive sites with regards to the water courses crossing sites must be identified during the design phase (this has been done). Vegetation clearing must be minimal. Excavations must be completed and backfilled in as short a period of time as possible. Beds and embankments must be protected during construction and restored to original shape at completion. Complete rehabilitation must be conducted. Alien invasive vegetation monitoring and management will be necessary. 	Low	

	2.5	Watercourse crossings	Six watercourses will be crossed. Hydrology and flow may be affected as consequence of the following: <ul style="list-style-type: none"> Flow will be diverted during construction from a point in front of the activity site to beyond the site. Flow may be impeded if the pipeline is constructed on pedestals in the permanent zone or stream channels. Subsurface flow may be impeded 	High	Site	Negative Direct Indirect	Permanent	Definite	<ul style="list-style-type: none"> The least sensitive sites with regards to the water courses crossing sites must be identified during the design phase (this has been done). Excavations must be completed and backfilled in as short a period of time as possible. It is important that hydraulic continuity is maintained at a level approximating that at which the E horizon was encountered. This can be achieved by providing a layer of permeable material of equivalent depth to the depth of the E horizon exposed in the trench. It is also important to recognize that the soil profile reflects seasonal saturation, and if voids in the trench fill with water, the pipe may, depending on its specific gravity, float. If this is likely to occur, then it might be advisable to consider placing saddles or other anchoring devices over the pipe. Complete rehabilitation must be conducted. 	Low
			Negative impacts on water resources and soil							
	2.6	All sites	Topsoil will be displaced during the construction phase and may be lost if not safeguarded.	Medium	Site	Negative Direct	Permanent	Probable	Site footprints only must be prepared and soil that is displaced will be stockpiled and used for rehabilitation.	Low
			Soil and water may become polluted during construction phase.	Medium	Site	Negative Direct	Permanent	Probable	The EMPr will include measures to prevent and address pollution and waste management during construction. Solid waste will be disposed of at a registered site and waste water will be stored in sealed tanks and removed by a service provider. Pollution potential will be low.	Low
			Water will be used for construction and potable use during operational phase.	Medium	Site	Negative Direct	Permanent	Probable	Water will be sourced from the local municipality and stored in tanks for use at the construction camp and for construction purposes. Measures will be in place to prevent the unnecessary loss and misuse of this resource.	Low
			Soil erosion will occur as result of hardened and cleared slopes and surfaces.	Medium	Site	Negative Direct	Permanent	Probable	Vegetation clearing and surface preparation will be minimal in order to prevent this impact. Bare surfaces must be protected.	Low
			Impacts related to storm water management and erosion potential							
	2.7		Increased storm water run-off will be generated as result of hardened surfaces. Storm water is not anticipated to create a serious negative impact as the development sites are rather small in scale and vegetation clearing and site preparation will be limited to the site footprints only in order to maintain the natural flow of storm water.	Medium	Site	Negative Direct	Permanent	Probable	The EMPr will provide measures to mitigate the effect of storm water and this aspect will be monitored in order to address any negative consequences if it becomes apparent at a later stage.	Low
			Soil erosion will occur as result of hardened and cleared slopes and surfaces. Vegetation clearing and surface preparation will be minimal in order to prevent this impact.	Medium	Site	Negative Direct	Permanent	Probable	Vegetation clearing and surface preparation will be minimal in order to prevent this impact. Bare surfaces will be protected with vegetation and paving will be done with grass blocks to enable surface water run-off to be absorbed by the soil.	Low

	2.8	Pump stations; contractors camp	Visual impact These structures will be relatively small and will not be visible from a distance more than 1km. It is not anticipated to have a significant visual impact.	Medium	Site	Negative Direct	Permanent	Probable	<ul style="list-style-type: none"> The construction sites must be kept tidy and in good order. Structures must be maintained to be in a good visual order. 	Low
	2.9	Raw water reservoir; WTW	These structures will be larger and will be visible on the horizon. However, these structures will not pose an intrusion but will be accepted as essential infrastructure similar to ESKOM powerlines and similar reservoir structures visible on the horizons of the region.	Medium	Site	Negative Direct	Permanent	Probable	<ul style="list-style-type: none"> The construction sites must be kept tidy and in good order. Structures must be maintained to be in a good visual order. 	Low
3. BIOLOGICAL			Loss of biota and fragmentation of habitat							
	3.1	Pump stations	The sites are located on the edge of a protected area (PA). The main potential impact is the loss of vegetation and associated fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small.	Medium	Site	Negative Direct Indirect	Permanent	Definite	<p>The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). No RDL biota is present or prominent trees will be affected.</p> <p>The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.</p>	Low
	3.2	Contractors camp	The site is located on modified land (old lands) within 5km of a protected area (PA). The main potential impact is the loss of vegetation and associated fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small and it is located on modified land.	Medium	Site	Negative Direct Indirect	Permanent	Definite	<p>The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). No RDL biota is present or prominent trees will be affected.</p> <p>The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.</p>	Low
	3.3	Raw water reservoir	The site is located in a critical biodiversity area (CBA) and within 5km of a protected area (PA). The main potential impact is the loss of vegetation and associated fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small.	Medium	Site	Negative Direct Indirect	Permanent	Definite	<p>The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). No RDL biota is present or prominent trees will be affected.</p> <p>The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.</p>	Low
	3.4	Connecting pipeline	The site is located in a critical biodiversity area (CBA) and ecological support area (ESA). The main potential impact is the loss of vegetation and associated fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small and of a linear nature.	Medium	Site	Negative Direct Indirect	Permanent	Definite	<p>The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). No RDL biota is present or prominent trees will be affected.</p> <p>The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.</p>	Low

	3.5	WTW	The site is located on heavily modified land within a critical biodiversity area (CBA). The main potential impact is the loss of vegetation and associated fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small and it is located on modified land.	Medium	Site	Negative Direct Indirect	Permanent	Definite	The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). No RDL biota is present or prominent trees will be affected. The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.	Low	
	3.6	Watercourse crossings	Construction related impacts on riparian and wetland vegetation. The main potential impact is the loss of vegetation and associated fragmentation of habitat. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small and of a linear nature.	Medium	Site	Negative Direct Indirect	Permanent	Definite	The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). No RDL biota is present or prominent trees will be affected. The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.	Low	
	3.7	Irrigation canal road servitude	The main potential impact is the loss of vegetation during construction. This may include large and protected trees. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small and it is located on the road adjacent to the canal.	High	Site	Negative Direct Indirect	Permanent	Definite	The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). Construction must be supervised and if trees are affected the ECO will have to make recommendations. The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.	Medium	
			Impacts on freshwater ecosystems								
	3.7	Watercourse crossings	Construction related impacts on sensitive aquatic ecosystems. The main potential impact is the loss of vegetation and changes to the ecosystems. The activity will not require extensive site preparation and vegetation clearing will be minimal as the footprint is small and of a linear nature.	High	Site	Negative Direct Indirect	Permanent	Definite	The least sensitive site footprint must be identified by specialist input during the design phase (this has been done). No RDL biota is present or prominent trees will be affected. The construction phase must be monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed.	Medium	
4. SOCIAL			Social impacts								
	4.1	All sites	It is not anticipated that the proposed activity will have negative social consequences. By using local labour the, local people will benefit from employment opportunities.	Low	Local	Positive Direct	Long term	Definite	Use of local labour is recommended.	High	

	4.2	End product	It is not anticipated that the proposed activity will have negative social consequences. Positive impacts related to the completion of the total pipeline project will be the long term improvement of living conditions of mainly the poorer section of the public.	Low	Local	Positive Direct	Long term	Definite	No mitigation necessary.	High
5. ECONOMIC			Economic impact							
	5.1	All sites	It is not anticipated that the proposed activity will have negative economic consequences. Positive impacts that are foreseen are short and long term job creation as well as using local service providers.	Low	Local	Positive Direct	Long term	Definite	Use local labour and service providers are recommended.	Medium
	5.2	End product	It is not anticipated that the proposed activity will have negative economic consequences. The main objective of the project will be to provide an essential service to the community which will have major positive economic consequences.	Low	Local	Positive Indirect	Long term	Definite	No mitigation necessary.	High
6. CULTURAL & HERITAGE			Cultural, heritage and palaeontological risks							
	6.1	All sites	Construction activities may result in the loss of heritage sites and cultural activities.	Medium	Local	Negative Direct	Long term	Unlikely	No heritage sites or cultural activities have been identified by the specialist investigations. Any "chance" finds or potential sites will be investigated by a specialist.	Low
	6.2	All sites	Construction activities may result in the loss of palaeontological features.	Low	Local	Negative Direct	Long term	Probable	No high potential palaeontological features have been identified by the specialist investigations. Any "chance" finds or potential sites will be investigated by a specialist.	Low

Table 2.2 Assessment of impacts related to the planning and pre-construction phases related to the preferred alternative sites

Aspect	Reference	Site Reference	Nature of the Impact	Significance before mitigation	Extent	Consequence	Duration	Probability	Recommendations to avoid, reverse, manage and mitigate the impact	Significance after Mitigation
1. Geographical, topography and geology			The site and activity alternatives are located in sensitive geographical areas and have the potential to have direct and indirect impacts on sensitive environments							
	1.1	Pump stations; reservoir; pipelines: WTW	These sites are located in CBA's and ESA's and within a protected area (PA). The activity may have negative impacts on site that will have negative consequences on the integrity of these biodiversity areas and the PA. The main potential impact is the loss of vegetation and associated fragmentation of habitat.	High	Local	Negative Direct Indirect	Permanent	Probable	The least sensitive site footprints must be identified by specialist input during the design phase (this has been done).	Medium
	1.2	Watercourse crossings	These sites will have construction related impacts on sensitive riparian and wetland areas. The main potential impact is the loss of vegetation, modification of watercourse characteristics and consequently fragmentation of habitat.	High	Local	Negative Direct Indirect	Permanent	Probable	The least sensitive site footprints must be identified by specialist input during the design phase (this has been done).	Low
			Topographical and landscape features may pose constraints that result in negative consequences							
	1.3	All sites	Excavations / construction on slopes and through stream channels which may have indirect negative environmental consequences (e.g. loss of vegetation and habitat, erosion, stream flow reduction, et.).	High	Site	Negative Direct Indirect	Permanent	Probable	The design must consider these features and be formulated along the least difficult terrain and to make use of existing development footprints such as road reserves and road crossings over watercourses. In order to achieve this objective, the preferred alternative sites were selected upon specialist advice.	Low
	1.4	Pump stations; reservoir; pipelines: WTW	Construction on unstable geological features will result in soil erosion and structural damage to infrastructure.	Medium	Site	Negative Indirect	Permanent	Probable	Site selection must consider the geology of the locality and sites with unstable soils must be avoided for the construction of pump stations, reservoir and purification plant. In order to achieve this objective, the preferred alternative sites were selected upon engineering investigation.	Low
2. Biodiversity and ecology			Fragmentation of sensitive ecological areas and loss of biota							
	2.1	All sites	The critical biodiversity areas and ecological support areas as well as sensitive aquatic/wetland habitats will be negatively affected.	High	Site	Negative Direct	Permanent	Probable	Specialist recommendations must be followed for site selection and to minimize potential negative impacts on these habitats. In order to achieve this objective, the preferred alternative sites were selected upon specialist investigation.	Low

	2.2	All sites	Uneducated site selection will result in the loss of vegetation and fauna.	High	Site	Negative Direct	Permanent	Definite	In order to minimize the loss of biodiversity and important species, site selection must consider the biota that is present on the sites. In order to achieve this objective, the preferred alternative sites were selected upon specialist investigation. Where possible prominent trees must not be affected or removed and the layout must be designed to accommodate these. In event that prominent and protected trees are affected the ECO must be consulted to make recommendations.	Low
	2.3	All sites	Site preparation, vegetation clearing, temporary structures, construction camp and temporary roads will lead to the loss of vegetation and fauna (including important taxa).	High	Site	Negative Direct	Permanent	Probable	The site footprints must be investigated by a specialist prior to construction in order to identify and to relocate important biota that may not have been identified during the first screening and to recommend on vegetation that must remain on site. Temporary roads, stockpile sites and temporary structures must be approved by the ECO before commencement.	Low
3. Soil and water resources			Negative impacts on soil and water quality; Environmental pollution							
	3.1	All sites	Inadequate planning for storm water management will lead to erosion of soil and watercourses as well as siltation of watercourses.	High	Site	Negative Direct Indirect	Long term	Probable	The natural drainage lines and areas susceptible to erosion must be identified prior to construction and be included in the planning as areas that are not to be disturbed.	Low
	3.2	All sites	Inadequate waste management and sanitation will lead to environmental pollution (soil, water and air pollution)	High	Site	Negative Direct	Permanent	Probable	Sufficient waste management and sanitation facilities must be planned or the construction and operational phases.	Low
4. Heritage & cultural			Loss of heritage sites, palaeontological features and cultural aspects							
	4.1	All sites	Uneducated site selection will result in the loss of- or damage to significant sites.	Medium	Local	Negative Direct	Long term	Probable	The development sites must be investigated by a specialist during the planning phase to ensure that significant sites are not at risk. This has been done and no sites of significance have been identified on any of the sites.	Low
5. Social & Legal			Failure of compliance with legal matters							
	5.1	All sites	Inadequate management guidelines and non-compliance with environmental, labour and health legislation will result in negative environmental and social consequences for personnel.	Low	Local	Negative Direct	Long term	Unlikely	Contractors and personnel must be initiated on the legal requirements and conditions of the environmental authorization prior to commencement of construction.	Low
6. Rehabilitation & maintenance			Inadequate rehabilitation will have negative environmental consequences							
	6.1	All sites	Inadequate planning and resources for the purpose of rehabilitation and maintenance will have negative environmental consequences.	Medium	Site-Local	Negative Direct Indirect	Long term	Probable	The contractors and owner must plan to have sufficient resources and funds available in order for rehabilitation of the environment after construction and maintenance during the operational phase.	Low

Table 2.3 Assessment of impacts anticipated for the construction and rehabilitation phases related to the preferred alternative sites

Aspect	Reference	Site Reference	Nature of the Impact	Significance before mitigation	Extent	Con-sequence	Duration	Probability	Recommendations to avoid, reverse, manage and mitigate the impact	Significance after Mitigation	
1. Topography & geology			Topographical and geological constraints may result in negative consequences								
	1.1	All sites	Excavations / construction on slopes and through stream channels which may have indirect negative consequences (e.g. loss of vegetation and habitat, erosion, stream flow reduction, et.).	High	Site	Negative Direct Indirect	Permanent	Probable	<ul style="list-style-type: none"> Excavations for the pipeline on slopes must be protected by berms from filling with water. Berms must direct water away at a moderate angle from the excavations and slopes. Excavations through wetlands must be completed in a short time period during the low flow season. 	Low	
	1.2	All sites	Excavations / construction in unstable alluvial and wetland soil and steep slopes will result in erosion and siltation of the streams.	High	Site	Negative Indirect	Permanent	Probable	<ul style="list-style-type: none"> Where excavations are necessary, the soil that must be removed in layered sequence and must be backfilled in the same sequence. Beds and embankments must be protected during construction and restored to original shape at completion. 	Low	
2. Biodiversity and ecology			Loss of vegetation & fauna and fragmentation of habitat								
	1.1	All sites	Indiscriminate site preparation, vegetation clearing, temporary structures and roads will lead to the loss of vegetation and fauna (including important taxa).	High	Site	Negative Direct	Permanent	Definite	Construction activities must be respectful of the environment. Damage and disturbance to vegetation must be limited to the necessary minimum only.	Low	
	1.2	All sites	Sourcing of firewood from the natural environment by personnel will lead to loss of vegetation (especially hardwood trees).	High	Site	Negative Direct	Short term	Probable	Firewood may not be sourced from trees in the surrounding area.	Low	
	1.3	All sites	Loss of fauna.	High	Site	Negative Direct	Short term	Unlikely	<ul style="list-style-type: none"> Excavations must be monitored daily (early morning) in order to assist fauna that may have become trapped. Animals may not be hunted, snared or purposefully disturbed or harmed. Problem animals and snakes that create problems must be removed or managed by a specialist. 	Low	
	1.4	All sites	Disturbance and clearing of natural vegetation and habitat will lead to the invasion of natural habitats by alien invasive vegetation and bush encroachment.	High	Site	Negative Direct	Short term	Likely	Alien invasive vegetation, weeds and bush encroachment must be monitored and managed.	Low	
				Loss of important biota							
	1.5	All sites	Site preparation may negatively affect protected flora.	High	Site	Negative Direct	Short term	Unlikely	<ul style="list-style-type: none"> Potential removal of protected trees must be consulted with the ECO and DAFF. The construction phase at the irrigation canal section must be closely supervised and monitored in order to ensure that no unnecessary vegetation clearing and excavations are done. Complete rehabilitation of disturbed surfaces must be performed. 	Low	

	1.6	All sites	Sourcing of medicinal plants by personnel from the natural environment will lead to a loss of important/rare flora.	High	Site	Negative Direct	Short term	Probable	Plants or plant material may not be sourced from the sites or surrounding area for medicinal or any other use.	Low
			Impacts on riparian and wetland ecosystems							
	1.7	Watercourse crossings	Activities within the wetland & aquatic ecosystems will lead to loss of specialist biota and modification / fragmentation of sensitive habitat	High	Site	Negative Direct	Short term	Probable	<ul style="list-style-type: none"> Vegetation removal must be limited to the absolute minimum. Excavations must be completed and backfilled in as short a period of time as possible. Beds and embankments must be protected during construction and restored to original shape at It is important that hydraulic continuity is maintained at a level approximating that at which the E horizon was encountered. This can be achieved by providing a layer of permeable material of equivalent depth to the depth of the E horizon exposed in the trench. It is also important to recognize that the soil profile reflects seasonal saturation, and if voids in the trench fill with water, the pipe may, depending on its specific gravity, float. If this is likely to occur, then it might be advisable to consider placing saddles or other anchoring devices over the pipe. Complete rehabilitation must be conducted. Alien invasive vegetation monitoring and management will be necessary. 	Low
2. Soil and water resources			Pollution of soil, water quality and loss of these resources							
	2.1	All sites	Improper storage, handling, use and spillage of hazardous substances will pollute soil, surface and ground water.	High	Site	Negative Direct	Short term	Probable	Hazardous substances, including chemicals, paint, fuel and lubricants must be stored and handled according to standards. Any spills that may occur must be contained and cleaned up immediately after occurring.	Low
	2.2	All sites	Refueling and servicing of vehicles and equipment will lead to pollution.	High	Site	Negative Direct	Short term	Probable	Refueling and servicing of vehicles and equipment must be performed at designated areas with protected surfaces that will contain spills and can be cleaned easily.	Low
	2.3	All sites	Improper storage, handling, preparation and spillage of cement and concrete will pollute the environment.	High	Site	Negative Direct	Short term	Probable	Cement must be stored under cover and prepared on lined or hardened surfaces in order to protect the environment. Handling and application of cement substances and concrete must be carefully done in order to prevent spills. Spills must be cleaned up immediately after occurring.	Low
	2.4	All sites	Removal of vegetation and site preparation will lead to soil erosion and siltation of watercourses.	High	Site	Negative Direct	Short term	Probable	Vegetation clearing must be limited to the minimum and must not be removed within 30m of any watercourse (excluding the footprints intended for structures within the watercourses, e.g. pipeline crossings). The occurrence of erosion and siltation must be constantly monitored and corrective or preventive action must be taken to address the occurrence thereof.	Low
	2.5	All sites	Loss of topsoil will lead to an impoverished environment.	High	Site	Negative Direct	Long term	Probable	Removal or disturbance of topsoil must be limited to the minimum and must not be allowed within 15m of any watercourse (excluding the footprints intended for structures within the watercourses, e.g. boardwalks and stream crossings).	Low

	2.6	All sites	Inadequate storm water management will lead to erosion of soil and watercourses as well as siltation of watercourses.	High	Site	Negative Direct	Short term	Probable	The natural drainage lines and areas susceptible to erosion must be protected and are not to be disturbed. Surface water lead-offs from roads must not create erosion and must be altered if it does.	Low
	2.7	All sites	Construction of pipelines across watercourses / wetlands will impede flow and will alter the morphology of the watercourse.	High	Site	Negative Direct	Short term	Unlikely	Construction of these structures must be conducted during the dry season. All disturbances must be fully rehabilitated in order to prevent erosion and siltation.	Low
	2.8	All sites	Use of surface water from the stream for construction purposes will affect the availability of water for downstream users.	High	Site	Negative Direct	Short term	Unlikely	No surface water may be used for construction or any other purpose.	Low
	2.9	All sites	Inadequate waste management and sanitation will lead to pollution of soil and water.	High	Site	Negative Direct	Short term	Unlikely	Waste must be correctly managed and disposed. Waste may not be buried or burned. Adequate sanitation facilities must be available.	Low
	2.10	All sites	Irresponsible use of water for construction and domestic purposes will lead to a loss of this resource.	High	Site	Negative Direct	Short term	Unlikely	Water must be used sparingly and storing and reticulation infrastructure must be maintained to prevent leaks.	Low
3. Atmosphere and sound			Air and noise pollution							
	3.1	All sites	Construction activities will generate dust.	High	Site	Negative Direct	Short term	Probable	Activities that create dust must be monitored and must not be conducted on windy days. Dust suppressants must be used on roads if there is heavy traffic of construction vehicles on gravel roads.	Low
	3.2	All sites	Construction activities will generate noise.	High	Site	Negative Direct	Short term	Probable	Activities that create noise must be monitored and must not be conducted on windy days.	Low
	3.3	All sites	Burning of waste material and litter will lead to air pollution.	High	Site	Negative Direct	Short term	Probable	Strict waste management must be enforced and the burning of waste will not be allowed.	Low
4. Visual			Visual impact							
	4.1	All sites	Untidy and poorly managed construction sites will have a negative visual impact on the local residents and passersby.	High	Site	Negative Direct	Short term	Probable	The construction sites and stockpiles must be kept tidy and litter free. The construction camp must be well managed and organized. Waste must be stored at a central collection area and must be regularly disposed.	Low
5. Heritage Resources			Loss of heritage sites and items							
	5.1	All sites	Construction activities may result in the loss of heritage and archeological items.	High	Site	Negative Direct	Permanent	Unlikely	Archeological finds and artefacts of heritage importance that are found must be reported to the ECO and verified by a specialist.	Low

6. Social & legal			Negative interaction							
	6.1	All sites	Poorly disciplined personnel will have a negative social impact on the local population.	High	Site	Negative Direct	Short term	Probable	Contractors and personnel must be managed in an orderly fashion in order to avoid disturbing the local residents.	Low
	6.2	All sites	Inadequate management guidelines and non-compliance with labour and health legislation will result in negative social consequences for personnel.	High	Site	Negative Direct	Permanent	Unlikely	Personnel must be employed and managed according to relevant labour legislation. Normal working hours must be employed.	Low
7. Economic Development			Increased employment opportunity							
	7.1	Regional	Employment opportunities will be created for the local population.	Low	Local	Positive Direct	Permanent	Likely	The owner and contractors must employ local contractors and personnel wherever possible.	Medium
	7.2	Regional	Local businesses will be strengthened if building materials and consumables are sourced locally.	Low	Local	Positive Direct	Permanent	Likely	The owner and contractors must make use of local businesses and companies wherever possible.	Medium
8. Rehabilitation			Inadequate rehabilitation will have negative environmental consequences							
	8.1	All sites	Inadequate rehabilitation of disturbed areas will result in soil erosion and the establishment of alien invasive vegetation.	High	Site	Negative Direct	Permanent	Unlikely	Exposed soil surfaces must be appropriately planted, re-vegetated, covered or stabilized as soon as practically possible after completion of construction.	Low
	8.2	All sites	Incomplete or no cleanup of spoil material, construction waste, spillages will lead to environmental pollution and negative visual impacts.	High	Site	Negative Direct	Permanent	Unlikely	All temporary structures, spoil material, waste and spillages must be removed and cleaned up after completion of construction.	Low

Table 2.4 Assessment of impacts anticipated for the operational phase related to the preferred alternative sites

Aspect	Reference	Site Reference	Nature of the Impact	Significance before mitigation	Extent	Con- sequence	Duration	Probability	Recommendations to avoid, reverse, manage and mitigate the impact	Significance after Mitigation
1. Biodiversity and ecology			Loss of biota and fragmentation of habitat							
	4.1	All sites	Maintenance activities within sensitive environments e.g. grassland, riparian & aquatic ecosystems will disturb sensitive fauna and removal of flora.	High	Site	Negative Indirect	Short term	Probable	Personnel must be initiated with the sensitivity of the sites and the value of biodiversity. No fauna & flora may be disturbed on purpose or removed.	Low
	4.2	All sites	Disturbed surfaces will lead to the invasion of natural habitats by alien invasive vegetation and bush encroachment.	High	Site	Negative Direct	Short term	Likely	Alien invasive vegetation, weeds and bush encroachment must be monitored and managed.	Low
2. Soil and water resources			Pollution of soil and water quality							
	4.3	Watercourse crossings	Poor maintenance of watercourse crossings and structures will negatively affect the watercourses (e.g. erosion, impeding flow).	High	Site	Negative Direct	Permanent	Probable	All structures within the delineated watercourses must be monitored to ensure that the watercourses are not negatively affected. Routine and emergency maintenance must be employed to prevent or correct negative impacts on the watercourses.	Low
3. Visual			Visual impact							
	4.4	All sites	If the completed infrastructure is not well maintained it will have a negative visual impact.	High	Site	Negative Direct	Permanent	Probable	The infrastructure must be maintained in a good functional and visual condition.	Low
4. Social & Legal			Negative interaction							
	4.5	N/A	The completed project will provide an essential service to the region.	High	Regional	Positive Direct	Long term	Definite	No mitigation necessary.	High (Positive)
5. Economic Development			Increased business and employment opportunity							
	4.6	N/A	Business and employment opportunities will be created as indirect positive impact by the provision of the infrastructure and water in the region.	Low	Local/Regional	Positive Direct	Long term	Probable	No mitigation necessary.	Medium (Positive)