FRESHWATER ECOLOGICAL IMPACT ASSESSMENT

PROPOSED VREDEBES STORMWATER WEIR CONSTRUCTION, CERES

Prepared for: Witzenberg Municipality

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TABLE OF CONTENTS

1. INTRODUCTION AND BACKGROUND 3
2. LEGISLATIVE REQUIREMENTS 5
3. METHOD OF ASSESSMENT, ASSUMPTIONS AND LIMITATIONS OF THE STUDY 5
4. RESULTS OF THE LITERATURE REVIEW 8
5. FRESHWATER ECOLOGICAL ASSESSMENT RESULTS 11
6. IMPACT ASSESSMENT OF THE ACTIVITIES 16
7. CONCLUSION 21
8. REFERENCES 22
APPENDIX A: ABBREVIATED CURRICULUM VITAE AND DECLARATION OF INDEPENDENCE OF FRESHWATER SPECIALIST 24

1. INTRODUCTION AND BACKGROUND

Eco Impact Legal Consulting (Pty) Ltd (Eco Impact) is appointed by the Witzenberg to assess the impacts of the proposed weir construction on the Freshwater Ecology.

The property is located north of the road between Ceres and Nduli. The proposed development is to construct a weir to manage storm water. The site is situated on old cultivated lands with no indigenous vegetation. The weir will cross an earthen channelled that used to be a non-perennial river. The whole non-perennial river was channelized and no to limited ecological functioning exists. A stormwater weir will be constructed in the non-perennial drainage line at the site where an old weir wall was constructed upstream of the sewer pipeline crossing. The weir will be constructed using rock gabions and concrete pipes and construction material, which will be constructed on a concrete foundation platform. The length of the weir wall through the drainage line will be 9 m. The weir wall will be approximately 9.7 m wide and will consist of 4m wide gabion wall structure and 300mm rock mattresses upstream and downstream of the gabion wall and weir. Two concrete pipes, one 1050mm and the other 900mm will be laid in the weir to allow for normal stream flow. An overflow is designed in the gabion weir wall to allow for the 1 in 50 and 1 in100 years flood overflow.

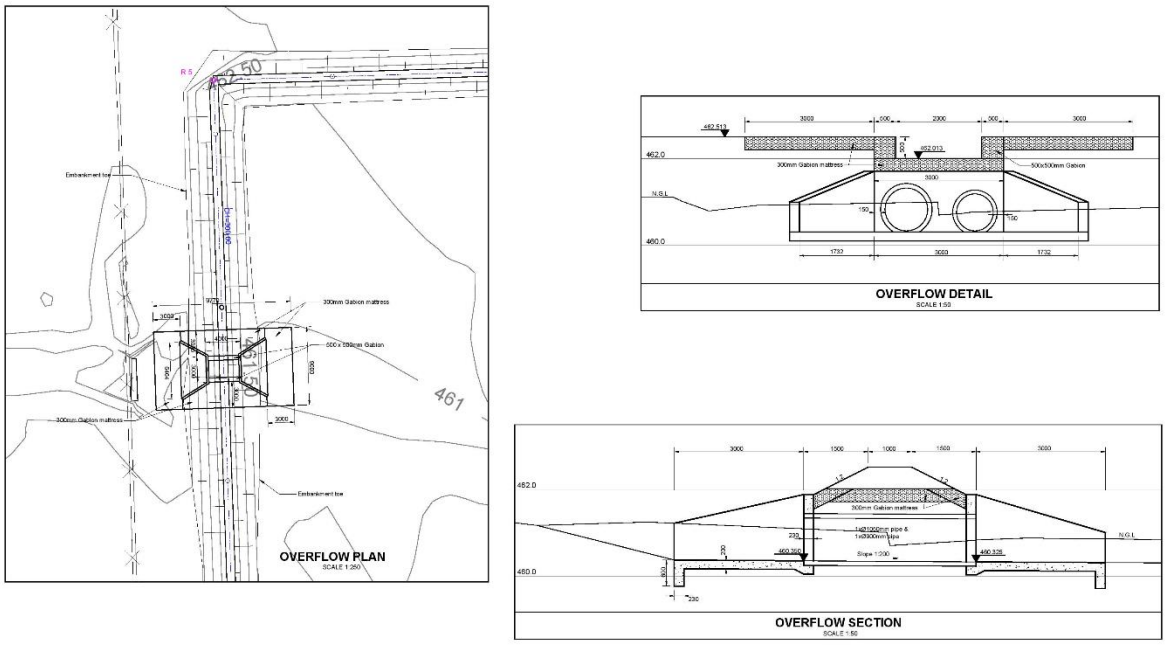

Figure 1: Diagram depicting proposed drainage line crossing upgrade.

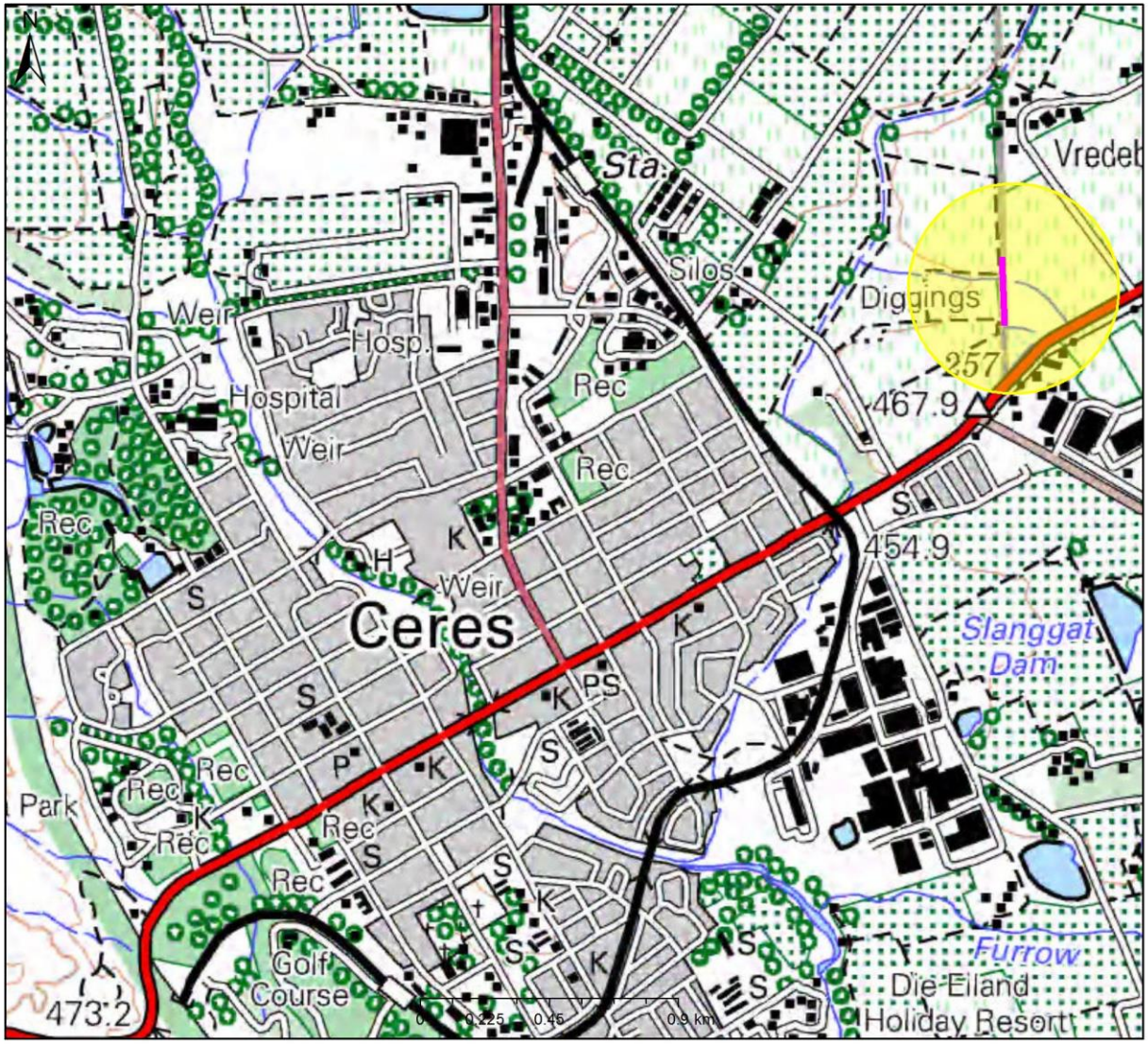

Figure 2: The 1 in 50 000 topographical map for the study area. Study area indicated by yellow circle and weir with pink line.

2. LEGISLATIVE REQUIREMENTS

National Water Act, 1998 (Act No. 36 of 1998)

The National Water Act guides the management of water in South Africa. The Act aims to regulate the use of water and activities that may impact on water resources through the categorisation of "listed water uses" encompassing water extraction and flow attenuation within catchments as well as the potential contamination of water resources, where the Department of Water and Sanitation (DWS) is the administering body in this regard. In terms of the proposed development and its nature, a specialist assessment is needed to provide Breede Gouritz Catchment Management Agency (BGCMA) as DWS administrator with the necessary information related to the proposed projects water uses and the potential impacts on the water resources of the area. It is the client's intention to register and license all water uses related to this project.

3. METHOD OF ASSESSMENT, ASSUMPTIONS AND LIMITATIONS OF THE STUDY

Input into the overall project was driven by the following Terms of Reference, which required the specialist to:

- Identify and describe freshwater ecosystems in the study area based on existing data and an onsite survey;
- Place freshwater ecosystems in a regional context and describe freshwater ecosystem-dependent fauna and flora species present;
- Classify, describe and map freshwater ecosystems in terms of their ecological sensitivity and functional value;
- Comment on and map freshwater ecosystem sensitivity in terms of ecologically important habitats, ecological corridors and linkages with other ecological systems;
- Undertake a site walk-down with other specialists,
- Identify potential impacts of the proposed project on freshwater ecosystems;
- Assess the direct, indirect and cumulative impacts (pre and post-mitigation) of the final location of infrastructure (and alternatives, if applicable) on freshwater ecosystems in the study area using the prescribed impact assessment methodology;
- Recommend practicable mitigation measures to avoid and/or minimise/reduce impacts and enhance benefits; and

3.1. Freshwater Ecological Assessment sites and site selection

The site was visually assessed. Intermediate Habitat Assessment Integrity Assessment (IHIA), the Riparian Vegetation Response Assessment (VEGRAI) and the Ecological Importance and Sensitivity (EIS) were used to assess the risks to the freshwater ecology at the impact area.

3.2. Visual Assessment of Aquatic Assessment Points

Each site was selected in order to identify current conditions, with specific reference to impacts from surrounding activities where applicable. Both natural constraints placed on ecosystem structure and function, as well as anthropogenic alterations to the systems identified, was identified by observing conditions and relating them to professional experience. Photographs of each site were taken to provide visual records of the conditions at the time of assessment. Factors which were noted in the site-specific visual assessments included the following:

- Upstream and downstream significance of each point, where applicable;
- Significance of the point in relation to the study area;
- stream morphology;
- instream and riparian habitat diversity;

- stream continuity;
- erosion potential;
- depth flow and substrate characteristics;
- signs of physical disturbance of the area; and
- other life forms reliant on aquatic ecosystems.

3.3. Intermediate Habitat Integrity Assessment (IHIA)

It is important to assess the habitat of riverine systems in order to aid in the interpretation of the results of the community integrity assessments by taking habitat conditions and impacts into consideration. The general habitat integrity of the sites was assessed based on the application of the Intermediate Habitat Integrity Assessment for (Kemper; 1999). The Intermediate Habitat Integrity Assessment (IHIA) protocol, as described by Kemper (1999), was used using the site specific application protocols. This is a simplified procedure, which is based on the Habitat Integrity approach developed by Kleynhans (1996). The IHIA is conducted as a first level exercise, where a comprehensive exercise is not practical. The Habitat Integrity of each site was scored according to 12 different criteria which represent the most important (and easily quantifiable) anthropogenically induced possible impacts on the system. The instream and riparian zones were analysed separately, and the final assessment was then made separately for each, in accordance with Kleynhans' (1999) approach to Habitat Integrity Assessment. Data for the riparian zone is, primarily interpreted in terms of the potential impact on the instream component. The assessment of the severity of impact of modifications is based on six descriptive categories with ratings. Analysis of the data was carried out by weighting each of the criteria according to Kemper (1999). By calculating the mean of the instream and riparian Habitat Integrity scores, an overall Habitat Integrity score can be obtained for each site. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitats of the sites. The method classifies Habitat Integrity into one of six classes, ranging from unmodified/natural (Class A), to critically modified (Class F).

Table 1: Classification of Present State Classes in terms of Habitat Integrity [Based on Kemper 1999]

Ecological Category	**Description**	**Score (% of total)**
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with almost complete loss of natural habitat and biota. In worst instances basic ecosystem functions have been destroyed and changes are irreversible.	0-19

3.4. Riparian Vegetation Response Assessment Index (VEGRAI)

Riparian vegetation is described in the NWA (Act No 36 of 1998) as follows: "riparian habitat"

includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

VEGRAI is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results[1]. Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

Table 2: Descriptions of the A-F ecological categories

Ecological Category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with almost complete loss of natural habitat and biota. In worst instances basic ecosystem functions have been destroyed and changes are irreversible.	0-19

The level of aquatic assessment undertaken was considered to be adequate for this study.

Ecological Importance and Sensitivity (EIS)

The Ecological Importance and Sensitivity (EIS) of riparian areas is an expression of the importance of the aquatic resource for the maintenance of biological diversity and ecological functioning on a local scale to a more broader scale; whilst Ecological Sensitivity (or fragility) refers to a system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (Kleynhans & Louw, 2007).

Table 3: List of the EIS categories used in the assessment tool (Kleynhans & Louw, 2007)

EISC	General description	Range of median
Very high	Quaternaries/delineations that are considered to be unique on a national and international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations that are considered to be unique on a national scale based on their biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but in some	>2-≤3

[1] Kleynhans et al, 2007

	cases may have substantial capacity for use.	
Moderate	Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are not usually very sensitive to flow modifications and often have substantial capacity for use.	>1-≤2
Low/marginal	Quaternaries/delineations which are not unique on any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

Table 4: Rating scheme used for the assessment of riparian EIS (Kleynhans & Louw, 2007)

Score	Channel Type	Conservation context			Vegetation and Habitat Integrity	Connectivity	Threat status of Vegetation Type
0	Ephemeral Stream	Non-FEPA river	No status	None/ Excluded	No natural remaining	None	No Status
1	Stream non-perennial		Upstream management area	Available	Very poor	Very poor	Least threatened
2	Stream-perennial flow		Rehab FEPA		Poor	Low	Vulnerable
3	Minor river-non-perennial flow		Fish corridor	Earmarked for conservation	Moderately modified	Moderate	Near Threatened
4	Minor river-perennial flow		Fish support area		Largely natural	High	Endangered
5	Major river-perennial flow	FEPA river	River FEPA	Protected	Unmodified / natural habitat	Very high	Critically Endangered

4. RESULTS OF THE LITERATURE REVIEW

The site is located in the Upper Breede River catchment (Department of Water and Sanitation (DWS) Primary Drainage Region H), within the Breede-Gouritz Water Management Area (WMA). This WMA falls under the administration of the BGCMA. The weir would pass through sections of the H10C quaternary catchment. H10C is drained primarily by the Koekedou River, which passes into Ceres town from the west, and joins the Dwars River within the town boundaries. The natural vegetation on site used to be Ceres Shale Renosterveld, (Vulnerable conservation status). The impacted and surrounding area is however totally transformed and disturbed as a result of previous agricultural activities.

Two biodiversity conservation mapping initiatives are of relevance to the freshwater ecosystems within the study area; the Western Cape Biodiversity Spatial Plan mapping initiatives that were undertaken on a regional basis and the National Freshwater Ecosystem Priority Areas (NFEPA) mapping initiative. The non-perennial river that will be impacted was identified as an Ecological Support Areas (ESAs) in the latest Western Cape Biodiversity Spatial Plan (2017). ESA's are supporting zones required to prevent the degradation of Critical Biodiversity Areas and Protected Areas. A natural valley floor depression wetland was identified in the NFEPA study.

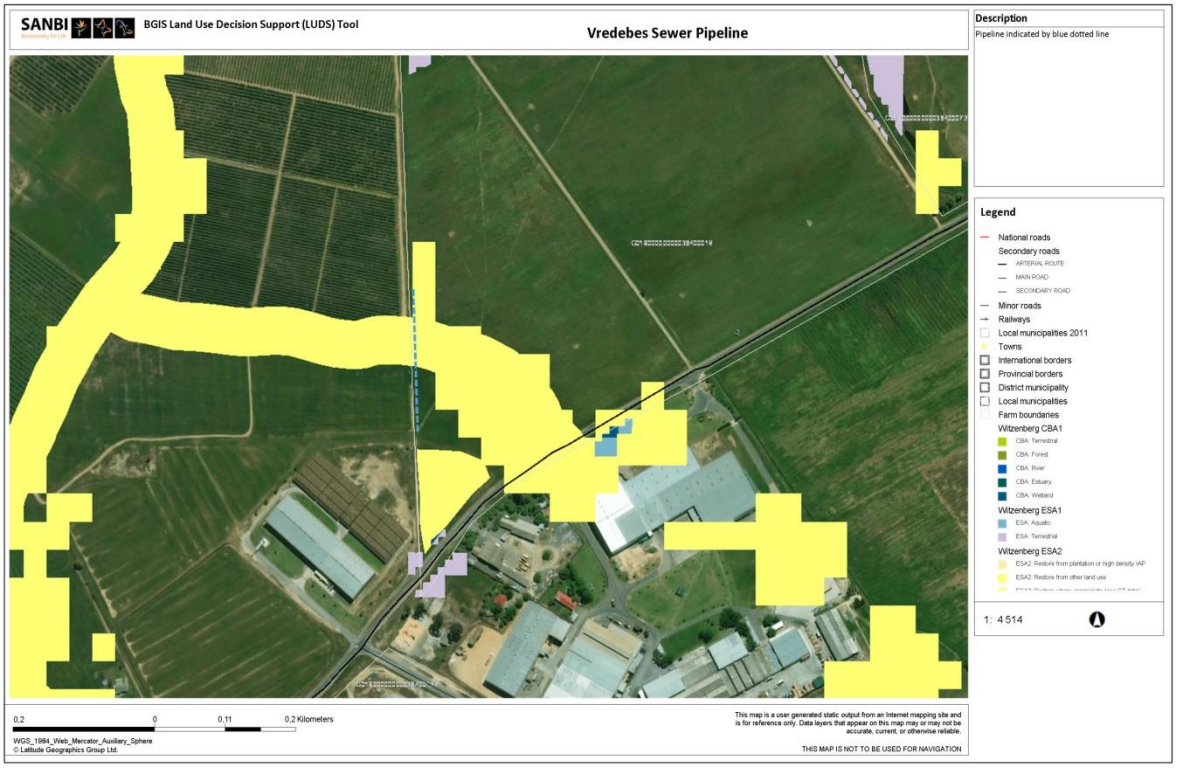

Figure 3: Western Cape Biodiversity Spatial Plan and the National Freshwater Ecosystem Priority Areas (NFEPA) mapping initiative.

The non-perennial river starts south of the R 46 road at a pack store.

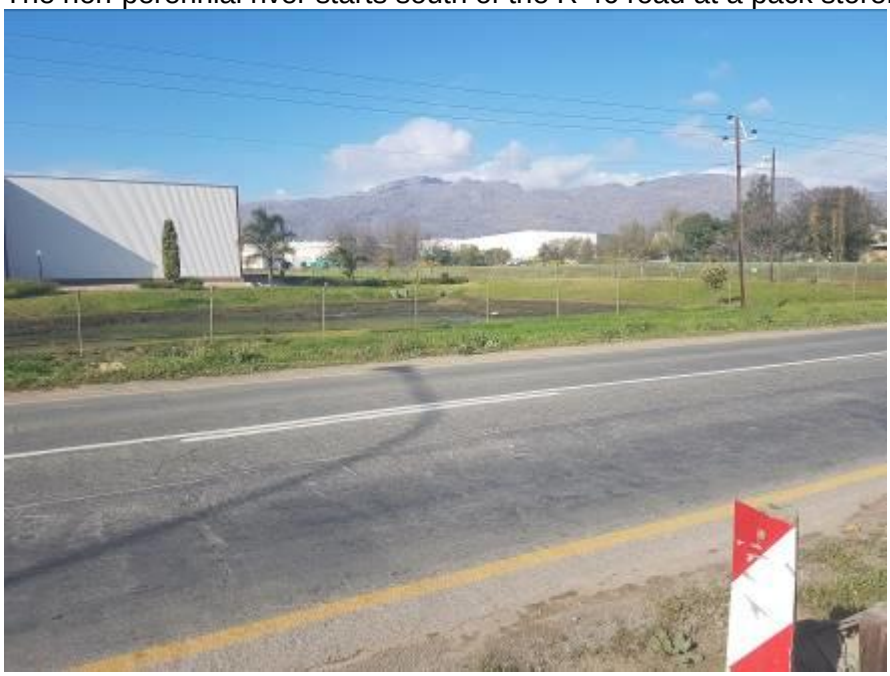

Figure 4: Start of the non-perennial river

The non-perennial river at this point is channelled into constructed ponds at the pack store. From the ponds, the water flows in a north westerly direction underneath the R 46 in an earth channel for 250m until it reached the point where the weir will cross the non-perennial river.

Figure 5: Non-perennial river upstream from weir crossing.

The non-perennial river continue flowing in a earth channel for another 400m between orchids and agricultural lands until it meets up with a non-perennial river that flows in a south western direction back towards the centre of the town of Ceres.

Figure 6: Non-perennial river downstream from weir crossing.

Figure 7: Tributary of the non-perennial river downstream from weir crossing.

The tributary non-perennial river flows underneath the R 46 road west of the site in between the Ceres industrial area and residential area where it flows into the Dwars River which is a tributary of the Bree River.

Figure 8: Tributary of the non-perennial river that flow into the Dwars River.

5. FRESHWATER ECOLOGICAL ASSESSMENT RESULTS

A photographic record of each site was made in order to provide a visual record of the condition of each assessment site as observed during the field assessment. The photographs taken are presented, followed by a table summarising the observations for the various criteria made during the visual assessment undertaken at each point.

5.1. Valley bottom wetland.

Figure 9: Existing weir and valley bottom wetland identified in NFEPA.

Figure 10: Mapped valley bottom wetland.

Table 3: Descriptions of the location of weir in relation to mapped valley bottom wetland

Characteristics	Weir site	Surrounding area
Significance of the point	This point is to be used as a reference point for the site. Any degradation from this point would serve as an indication of impacts on the surrounding area.	This point is to be used as a reference point for the site. Any degradation from this point would serve as an indication of impacts on the surrounding area.
Surrounding anthropogenic activities	The site is situated on the edge of the mapped wetland. Take note that none of the wetland indicators are on site and the area can therefore not be regarded as a wetland. However, BGCMA as the custodians of the water resources has the final decision with regards to the presence of wetlands. A wetland is defined by three characteristics (wetland vegetation, topography – inundation and wetland soils)	The site is situated on the edge of the mapped wetland. Take note that none of the wetland indicators are on site and the area can therefore not be regarded as a wetland. However, BGCMA as the custodians of the water resources has the final decision with regards to the presence of wetlands. A wetland is defined by three characteristics (wetland vegetation, topography – inundation and wetland soils)
Vegetation habitat characteristics	None. Totally degraded. The site is dominated by annual grasses and *Moraea flaccida*. None of the wetland indicator plant species or riverine riparian plant species was noted in or around the pipeline route. The species recorded on the pipe line route, excluded the river and its bank is all xerophyte, entirely the opposite of hydrophytes of wetland	None. Totally degraded. The site is dominated by annual grasses and *Moraea flaccida*. None of the wetland indicator plant species or riverine riparian plant species was noted in or around the pipeline route. The species recorded on the pipe line route, excluded the river and its bank is all xerophyte, entirely the opposite of hydrophytes of wetland habitats.

	habitats.	
Erosion potential	The area is flat with little to no potential for erosion	The area is flat with little to no potential for erosion

5.2. Non-perennial river where weir will cross

Figure 11: Upstream view of non-perennial river.

Figure 12: Weir crossing area and downstream view of non-perennial river.

Figure 13: Weir crossing area cross section of non-perennial river.

Table 4: Descriptions of the location of weir in relation to mapped valley bottom wetland

Characteristics	Weir site	Upstream area	Downstream area
Significance of the point	This point is to be used as a reference point for the site. Any degradation from this point would serve as an indication of impacts on the surrounding area.	This point is to be used as a reference point for the site. Any degradation from this point would serve as an indication of impacts on the surrounding area.	This point is to be used as a reference point for the site. Any degradation from this point would serve as an indication of impacts on the surrounding area.
Surrounding anthropogenic activities	The site is situated at the point where the weir will cross the non-perennial river.	The site is situated upstream where the weir will cross the non-perennial river.	The site is situated downstream where the weir will cross the non-perennial river.

Riparian zone characteristics	The riparian zone at this point is narrow and steep as a result of the previous channelization.	Limited riparian at this point and it is characterised by a narrow and steep bank as a result of the previous channelization. *Typha capensis* and *Zantedeschia aethiopica* were recorded. *Populus alba* was recorded upstream.	Limited riparian zone at this point and it is narrow and steep as a result of the previous channelization.
Depth characteristics	The water at this point was flowing moderately at the present time	The water at this point was flowing moderately at the present time	The water at this point was flowing moderately at the present time
Flow conditions	The water at this point was flowing moderately at the present time	The water at this point was flowing moderately at the present time	The water at this point was flowing moderately at the present time
Water clarity	Water at this point was clear at the time of the assessment.	Water at this point was clear at the time of the assessment.	Water at this point was clear at the time of the assessment.
Stones habitat characteristics	None as result of channelization. Mud and sandy substrate.	None as result of channelization. Mud and sandy substrate.	None as result of channelization. Mud and sandy substrate.
Vegetation habitat characteristics	Bankside vegetation consists mostly of grasses. There is little potential for erosion at this point.	Bankside vegetation consists mostly of grasses. There is little potential for erosion at this point. *Populus alba* was recorded upstream.	Bankside vegetation consists mostly of grasses. There is little potential for erosion at this point.
Other habitat characteristics	None as result of channelization.	None as result of channelization.	None as result of channelization.
Erosion potential	Banks at this point are relatively stable and there is little potential for erosion.	Banks at this point are relatively stable and there is little potential for erosion.	Banks at this point are relatively stable and there is little potential for erosion.

5.3. Habitat Assessment

Instream Habitat Integrity

Weights	14	13	13	13	14	10	9	8	6		
REACH	Water abstraction	Flow modification	Bed modification	Channel modification	Water quality	Inundation	Exotic macrophytes	Exotic fauna	Solid waste disposal	Total Score (%)	Classification

Impacted Site	7	24	24	24	7	24	24	24	4	72.16	E: The loss of natural habitat, biota and basic ecosystem functions is extensive.

None	Small	Moderate	Large	Serious	Critical

Riparian Zone Habitat Integrity

Weights	13	12	14	12	13	11	12	13		
REACH	Vegetation removal	Alien encroachment	Bank erosion	Water abstraction	Flow modification	Channel modification	Water quality	Inundation	Total Score (%)	Classification
Impacted Site	22	24	12	7	24	24	24	24	80.68	F: Modification has reached critical level.

None	Small	Moderate	Large	Serious	Critical

From the results of the application of the IHIA to the impacted site, it is evident that the rivers reach is modified and that the loss of natural habitat, biota and basic ecosystem functions is extensive. Instream impacts included a large impact from flow modifications, inundation as well as bed and channel modifications. Overall, the site achieved a 72.16 % score for instream integrity.

Riparian impacts included a large impact from flow modifications, inundation, alien vegetation encroachment as well as bed and channel modifications. Overall, the site achieved an 80.68 % score for instream integrity.

The site obtained an overall IHIA rating of 76.42%, which indicates the loss of natural habitat, biota and basic ecosystem functions is extensive. (Class E conditions).

5.4. Riparian Vegetation Response Assessment Index (VEGRAI)

Table 5: The overall VEGRAI score of the impacted area

LEVEL 3 ASSESSMENT					
METRIC GROUP	CALCULATED RATING	WEIGTED RATING	CONFIDENCE	RANK	% WEIGHT
MARGINAL	43,3	16,3	2,7	2,0	60,0
NON MARGINAL	3,8	2,3	3,3	1,0	100,0
2.0					160.00
LEVEL 3 VEGRAI (%)				18.6	
VEGRAI EC				E/F	
AVERAGE CONFIDENCE				3.0	

The score attained for the VEGRAI indicated that the riparian system falls into the category E/F. This indicates that the loss of natural habitat, biota and basic ecosystem functions is

extensive. Modifications have reached a critical level and the system has been modified completely with almost complete loss of natural habitat and biota. In worst instances basic ecosystem functions have been destroyed and changes are irreversible.

5.5. Ecological Importance and Sensitivity (EIS)

Table 6: Results of the EIS assessment for the affected watercourse

Component	Score	Confidence	Comments/description
Channel type	1	5	Channelled non-perennial river.
Conservation context	0	5	No Status
Vegetation and habitat Integrity	1	5	Largely modified
Connectivity	0	5	Not connected. Downstream connection is lost.
Threat Status of Vegetation Type	0	5	Vegetation has endangered conservation status
EIS Category	**0.4**		**Low/marginal Importance**

EIS considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale. The median of the resultant score is calculated to derive the EIS category.

The non-perennial river is considered to be of low to marginal ecological importance.

6. IMPACT ASSESSMENT OF THE ACTIVITIES

Nature of impact: Loss of freshwater ecology habitat
Discussion: Habitat destruction is the alteration of a natural habitat to the point that it is rendered unfit to support the species dependent upon it as their home territory. Many organisms previously using the area are displaced or destroyed, reducing biodiversity. Globally modification of habitats for agriculture is the chief cause of such habitat loss. Other causes of habitat destruction include surface mining, deforestation, slash-and-burn practices and urban development. Habitat destruction is presently ranked as the most significant cause of species extinction worldwide. Additional causes of habitat destruction include water pollution, introduction of alien species, overgrazing and overfishing. Riverine systems and particularly ephemeral riverine systems or river systems that have very low flows as part of their annual hydrological cycles are particularly susceptible to changes in habitat condition. The proposed development project has the potential to lead to habitat loss and/or alteration of the aquatic and riparian resources on the study area. It is however important to note that the freshwater ecology, and especially aquatic habitats of most of the systems has been seriously to critically impaired and as such the risk to the receiving environment as a result of the proposed project is reduced to some degree.

Cumulative impacts:

Riparian zone

Earthworks in the vicinity of drainage systems leading to increased runoff and erosion and altered runoff patterns.
Construction of the weir altering stream flow patterns and water velocities.
Alien invasive vegetation encroachment.
Erosion and incision of riparian zone.

Instream zone

Loss of aquatic refugia.
Altered substrate conditions due to the deposition of silt
Altered depth and flow regimes in the major drainage systems
Alien vegetation proliferation

Mitigation:

Essential mitigation measures:

- Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of aquatic habitats in the area.
- Keep all demarcated sensitive zones outside of the construction area off limits during the construction phase of the project;
- On-going aquatic ecological monitoring must take place on a 6 monthly basis by a suitably qualified assessor.

Recommended mitigation measures

- Permit only essential construction personnel within 32m of all riparian systems;
- No infrastructure should encroach into any major drainage lines;
- Restrict construction activities to the drier summer months, if possible, to avoid sedimentation and siltation of riparian features in the vicinity of the proposed development and aim for completion in early spring at which time revegetation should take place allowing for a full summer growing season to become established.

Criteria	Without Mitigation	With Mitigation	No-Go Alternative Without Mitigation	With Mitigation
Extent	2	1	Not Applicable (No construction activities to take place during the No-Go Alternative)	
Duration	5	5		
Magnitude	2	2		
Probability	4	2		
Significance	36-Medium	16-Low		
Status	Medium significance if not mitigated	No significance if mitigated		
Reversibility	0%			
Irreplaceable loss of resources	2- Partly Replaceable			
Can impacts be mitigated?	2-Partly, but impact on subsurface geological layers during excavations is inevitable.			

Nature of impact:

Disturbance to subsurface geological layers.

Discussion:

Construction and excavation activities will affect the underlying geological layers on site to some extent.

Cumulative impacts:
It is not anticipated that the impact will be high as the affected substrata is very shallow and the integrity of the underlying ground structures will thus not be sacrificed.

Mitigation:
Due to the nature of the impacts, not much can be done to mitigate the impact, only the severity of it can be managed. Mitigation and management for affecting geology is to ensure that removal of soil is kept to a minimum – removal of soil should only be in areas where infrastructure will be established. Disturbance through the river must preferably be in summer and definitely not when the river flows. The pipe must be laid and the area compacted in the water course and its banks in one time and the area must be immediately filled, shaped, compacted and rehabilitated.

Criteria	Without Mitigation	With Mitigation	No-Go Alternative Without Mitigation	No-Go Alternative With Mitigation
Extent	2	1	Not Applicable (No construction activities to take place during the No-Go Alternative)	
Duration	5	5		
Magnitude	2	2		
Probability	4	2		
Significance	36-Medium	16-Low		
Status	Medium significance if not mitigated	No significance if mitigated		
Reversibility	0%			
Irreplaceable loss of resources	2- Partly Replaceable			
Can impacts be mitigated?	2-Partly, but impact on subsurface geological layers during excavations is inevitable.			

Nature of impact:
Degradation / loss of naturally occurring / indigenous flora and habitats.

Discussion:
Although the area is considered as mostly transformed or degraded. Special precaution is to be taken during the construction of weir portion that falls within the regulated area as determined in the NWA. Construction activities must be controlled to ensure that the river and its buffer areas are not negatively impacted.

Cumulative impacts:
Loss of significantly impacted upon vegetation and habitat.

Mitigation:
- Undertake construction activities only in identified and specifically demarcated areas.
- Invasive vegetation to be removed during construction to be disposed of at landfill site in such a manner that seeds must not be able to spread from the disposal site or during transportation.

Criteria	Without Mitigation	With Mitigation	No-Go Alternative Without Mitigation	No-Go Alternative With Mitigation
Extent	3	2	Not Applicable (No construction activities to take place during the No-Go Alternative)	
Duration	2	1		
Magnitude	4	2		
Probability	4	2		
Significance	36 - Medium Significance	10 - Low Significance		

Status	Medium significance if not mitigated	No significance if mitigated	
Reversibility	30%	70%	
Irreplaceable loss of resources	2 - Resource may be partly destroyed		
Can impacts be mitigated?	2 - Partly mitigable		

Nature of impact:
Damage to existing infrastructure.

Discussion:
Construction activities will impact upon existing sewer pipelines that may occur along the pipeline route as well as when connected to the existing sewer line. Damage to private property of adjacent landowners may potentially occur.

Cumulative impacts:
Damage or loss of existing infrastructure. Damage and loss of private property adjacent to the proposed activity. Spillage of sewerage into the natural environment.

Mitigation:

- Care should be taken when conducting construction activities in close proximity to infrastructure and private property;
- Should any damage occur to existing infrastructure or private property as a result of construction activities; the relevant service provider / landowner must be contacted and the repair/replacement must be commissioned to the satisfaction of the service provider / landowner. Should spillage occur, the BGCMA and DEA&DP: Pollution and chemical management directorate must be informed immediately.

Criteria	**Without Mitigation**	**With Mitigation**	**No-Go Alternative**	
			Without Mitigation	**With Mitigation**
Extent	3	2	Not Applicable (No construction activities to take place during the No-Go Alternative)	
Duration	1	1		
Magnitude	2	0		
Probability	4	3		
Significance	24 - Low Significance	9 - Low Significance		
Status	Low Significance if not mitigated	No significance if mitigated		
Reversibility	90%			
Irreplaceable loss of resources	1 - Resource will not be lost			
Can impacts be mitigated?	1 - Completely mitigable			

Nature of impact:
Waste management.

Discussion:
General construction waste will be generated during the construction phase. Poor waste management practices on site may lead to dumping and windblown litter creating a negative visual impact and nuisance for adjacent landowners / users as well as impacting the natural environment.

Cumulative impacts:

- Dumping;
- Windblown litter causing nuisance;
- Pollution / degradation of the natural environment.

Mitigation:

- All waste generated on site shall be collected and disposed of at a registered landfill facility;
- All safe disposal certificates and waste manifests from service providers to be kept and maintained;
- All staff to receive training on correct waste management practices.

Criteria	Without Mitigation	With Mitigation	No-Go Alternative	
			Without Mitigation	With Mitigation
Extent	2	1	Not Applicable (No construction activities to take place during the No-Go Alternative)	
Duration	2	1		
Magnitude	2	2		
Probability	3	2		
Significance	18 - Low Significance	8 - Low Significance		
Status	Low Significance if not mitigated	No significance if mitigated		
Reversibility	90%			
Irreplaceable loss of resources	1 - Resource will not be lost			
Can impacts be mitigated?	1 - Completely mitigable			

Nature of impact:
Infrastructure failure.

Discussion:
Infrastructure failure will result in the spillage of raw sewerage into the receiving environment.

Cumulative impacts:
Pollution of the receiving environment as well as offensive odours from the spillage causing a nuisance to adjacent landowners / users.

Mitigation:

- Regular inspection and maintenance of the weir.
- Infrastructure failure reported or identified to be fixed as a priority.
- Spillage of raw sewerage to be mitigated and remediated where required.
- Should any damage occur to existing infrastructure or private property as a result of construction activities; the relevant service provider / landowner must be contacted and the repair/replacement must be commissioned to the satisfaction of the service provider / landowner. Should spillage occur, the BGCMA and DEA&DP: Pollution and chemical management directorate must be informed immediately.

Criteria	Without Mitigation	With Mitigation	No-Go Alternative	
			Without Mitigation	With Mitigation
Extent	3	2	Not Applicable (No construction activities to take place during the No-Go	
Duration	2	1		
Magnitude	4	4		

Probability	2	2	Alternative)
Significance	18 - Low Significance	14 - Low Significance	
Status	Low Significance	Low Significance	
Reversibility	60%		
Irreplaceable loss of resources	2 - Resources may be partly destroyed		
Can impacts be mitigated?	2 - Partially		

Cumulatively, if adequately mitigated the potential impacts of the proposed activities to be undertaken will be of low negative significance and will in the short term just require some rehabilitation of the disturbed areas and longer term monitoring and control of the growth of alien invasive plants, erosion and waste accumulation.

7. CONCLUSION

Eco Impact Legal Consulting (Pty) Ltd were appointed to undertake a Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) analysis of the freshwater and riparian resources as part of the Water Use Authorization application.

The proposed project form part of service delivery.

Based on the impact assessment it is evident that there are six possible impacts on the freshwater ecology of the area observed. In considering the impacts and mitigation, it is assumed that a high level of mitigation will take place without high prohibitive costs. From the table it is evident that prior to mitigation, the impacts on the loss of freshwater ecology habitat, disturbance to subsurface geological layers, degradation / loss of naturally occurring / indigenous flora and habitats are medium level impacts, which can be mitigated and will be reduced to low and very- low level impacts. The other tree impacts identified all has low impacts that is reduce to very low with the proposed mitigation measures.

Habitat Assessment

From the results of the application of the IHIA to the impacted site, it is evident that the rivers reach is modified and that the loss of natural habitat, biota and basic ecosystem functions is extensive. Instream impacts included a large impact from flow modifications, inundation as well as bed and channel modifications. Overall, the site achieved a 72.16 % score for instream integrity. Riparian impacts included a large impact from flow modifications, inundation, alien vegetation encroachment as well as bed and channel modifications. Overall, the site achieved an 80.68 % score for instream integrity. The site obtained an overall IHIA rating of 76.42%, which indicates the loss of natural habitat, biota and basic ecosystem functions is extensive. (Class E conditions).

Riparian Vegetation Response Assessment Index (VEGRAI)

The score attained for the VEGRAI indicated that the riparian system falls into the category E/F. This indicates that the loss of natural habitat, biota and basic ecosystem functions is extensive. Modifications have reached a critical level and the system has been modified completely with almost complete loss of natural habitat and biota. In worst instances basic ecosystem functions have been destroyed and changes are irreversible.

Based on the findings of this study it is the opinion of the freshwater ecologists that the proposed construction of the weir be considered favourably, from a freshwater ecological point of view, provided that the mitigatory measures presented in this report are strictly adhered to.

Ecological Importance and Sensitivity (EIS)

EIS considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale. The median of the resultant score is calculated to derive the EIS category.

The non-perennial river is considered to be of low to marginal ecological importance.

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APPENDIX A: ABBREVIATED CURRICULUM VITAE AND DECLARATION OF INDEPENDENCE OF FRESHWATER SPECIALIST

Name:	Nicolaas Willem Hanekom (Pri.Sci.Nat)
Profession:	Ecological Scientist
Nationality:	South African
Years experience	26 Years
Academic Qualifications	• National Diploma, Nature Conservation (Cape Technikon) • B. Tech Degree in Nature Conservation (Cape Technikon) • M.Tech in Nature Conservation (Cape Peninsula University of Technology) • Completed various Environmental Management Courses • Qualified Environmental Management System ISO 14001: 2004 Audit: Internal Auditor Course Based on ISO 19011:2002 (Centre for Environmental Management North West University)
Areas of specialisation:	• Ecosystem (terrestrial and aquatic) monitoring and assessments • Design of monitoring programmes for ecosystems (terrestrial and aquatic) • Environmental Impact Assessments • River classification and environmental water requirements • Wetlands Delineation • River and Wetlands management • Water Use Authorization Applications • Water quality management • River Health Assessments
Countries of Work Experience:	South Africa (Northern Cape, Western Cape, Free State, Mpumalanga, Gauteng)
Employment Record	• Student at Bontebok National Park (1992) • Assistant Reserve Manager at Gariep Dam Nature Reserve, Free State (1993 - 1998) • Reserve Manager, Conservation Services Manager for Western Cape Nature Conservation Board (1998 - 2006) • External Lecturer at Cape Peninsula University of Technology (2003 - 2005) • Director: Environmental Management at Cape Lowlands Environmental Services (2006 – 2010) • Director, Environmental Management and lead Environmental Impact Assessment Practitioner at Eco Impact (Pty) Ltd (2010 – to date)
Professional membership, accreditations and courses	• South African Council for Natural Scientists Professions Pri.Sci.Nat (Ecological Science) • Riparian vegetation identification and health assessment. Internal Western Cape Nature Conservation short course presented by Dr C Boucher (Stellenbosch University) in 2000. • SASS5 Aquatic Biomonitoring Training Course. 2 to 5 September 2013. Ground Truth Water and Environmental Engineering consultancy in partnership with the Department of Water Affairs. • Workshop on “Section 21(c) and (i) Water Use Training: Understanding Watercourses and Managing Impacts to their Characteristics”. 10 May 2017. Presented by Dr Wietsche Roets of the Department of Water and Sanitation (Sub-Directorate: Instream Water Use).
Summary of	1992: South African National Parks. Student at Bontebok National Park

experience	with management and monitoring actions related to the Breede River. 1993 -1998: Free State Nature Conservation. Ecological management and monitoring actions related to the Gariep Dam, Orange and Caledon Rivers. 1998 -2006: CapeNature. Ecological management and monitoring actions related to the Berg River Estuary, Verlorenvlei, Lamberts bay's Jackalsvlei, Wadrift Soutpanne, Oliphant's River mouth, Rocherpan Nature Reserve, etc. Review and assessment of EIA applications, inclusive of Freshwater ecology. Did some site visits with Department of Water Affairs and Forestry (Hester Lyons) to confirm the presence of aquatic ecological features during EIA water use registration applications. 2006 to date: Cape Lowland Environmental Services and Eco Impact Legal Consultant. Ecological (Freshwater and aquatic) Specialist input, assessment, monitoring and reports.
Publications and assessment reports	Just to name a few. Was involved in many Ecological Assessments, monitoring and inputs in EIA applications. • Elandskloof Farm 475 Citrusdal Biodiversity Baseline Survey. August 2010. This Biodiversity Assessment Covering Terrestrial and Aquatic Aspects to Inform Decisions Regarding The Proposed Elandskloof Weir Flood Damage Project On Farm 475, In The Citrusdal Area. • Cape Solar Energy Electricity Generation Facility. Farm 187/3 & 187/13 Kenhardt. Biodiversity And Ecological Baseline Survey. January 2011. (Included Terrestrial and aquatic ecological assessments and water use authorization applications) • Prieska Photvoltaic Power Generation Project. Prieska Commonage Northern Cape. Biodiversity And Ecological Baseline Survey. July 2011. (Included Terrestrial and aquatic ecological assessments and water use authorization applications) • Witteklip Erf 123 Extension, Vredenburg. Biodiversity Baseline Survey. Updated - October 2012 (Included Terrestrial and aquatic ecological assessments and water use authorization applications) • Baseline Biodiversity Survey And Wetland Delineation for ECCA Holdings: Cape Bentonite Mine on Erf 1412 Near Heidelberg. Prepared for: Shangoni Management Services Pry (Ltd). October 2014. • Freshwater Impact Assessment Laingsburg Flood Damage Repairs & Storm Water Infrastructure. 18 February 2016. • Ecological Assessment for Swartland Municipality - Upgrades To Voortrekker/Bokomo Road And Voortrekker/Rozenburg Road Intersections and Upgrade to the Diep River Bridge, Malmesbury on A Portion Of Erf 327, Malmesbury (Road) Erf 1530, Diep River Bridge Crossing, and Erf 1528, Property South of Diep River where Road Widening and Turning Circle Will Be Constructed. March 2016. (Freshwater Ecology Inputs and Water Use Registration) • Freshwater Impact Assessment. McGregor Bridge, Robertson Bridge and Willem Nels River Maintenance Management Plan. 24 June 2016. (Freshwater Ecology assessment and input as well as Water Use Registration) • Water Use Authorization Application Risk Matrix. Orange Grove Trust Vegetation Clearing and Agricultural Development on Portion 4 of Farm Glen Heatlie No 316, Worcester. 12 June 2017. (Freshwater ecological inputs in EIA process and Water Use

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