



**ENVIRONMENTAL MANAGEMENT
PROGRAMME FOR PIPE CRACKING: PERTH
EMPIRE SEWER PIPE REPLACEMENT IN
WESTDENE, CITY OF JOHANNESBURG.**

REF No.

ABBREVIATIONS

EMPr:	Environmental Management Programme
NEMA:	National Environmental Management Act
EIA:	Environmental Impact Assessment
I&APs:	Interested and Affected Parties
DEO:	Designated Environmental Officer
ECO:	Environmental Control Officer
SDC:	Safe Disposal Certificate
MSDS:	Material Safety Data Sheets
SAHRA:	South African Heritage Resource Agency
SANS:	South African National Standards
DWS:	Department of Water and Sanitation

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1 INTRODUCTION

The Bill of Rights – Chapter 2 of the Constitution Act No. 108 of 1996, includes an environmental right (Section 24) according to which, “*everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and the sustainable use of natural resources while promoting justifiable economic and social development*”. In addition, Section 28 of the National Environmental Management Act No 107 of 1998 (NEMA), requires, “*every person causing significant pollution or degradation of the environment, to take reasonable measures to prevent it from occurring, continuing or recurring*”. Therefore, in order to promote effective environmental management throughout the life-cycle of a project, it is important that management actions arising from Environmental Impact Assessments (EIAs) are clearly defined and translated into an Environmental Management Programme (EMPr) for the design, construction, operation and/or decommissioning phases of a project.

According to the Western Cape Department of Environmental Affairs and Development Planning (2005), an Environmental Management Programme (EMPr) can be defined as, “*an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented; and that the positive benefits of the project are enhanced*”.

1.1 Purpose of the EMPr

The purpose of an EMPr is therefore to:-

- Encourage good management practices through planning and commitment to environmental issues;
- Define how the management of the environment is reported and performance evaluated;
- Provide rational and practical environmental guidelines to:
 - Minimise the extent of environmental impacts and to manage environmental impacts and where possible, to improve the condition of the environment;
 - Prevent long-term or permanent environmental degradation.
 - Comply with all applicable laws, regulations, standards and guidelines for the protection of the environment;
 - Provide guidance regarding method statements which are required to be implemented to achieve environmental specifications;
 - Define the corrective actions which must be taken in the event of non-compliance with the specifications of the EMPr;
 - Describe all monitoring procedures required to identify impacts on the environment, and;

- Train employees and contractors with regard to environmental obligations.

1.2 Project Location

The project is located at the Westdene Dam in Westdene, which falls under Regions B of the City of Johannesburg (COJ) Regions.



2 PROJECT DESCRIPTION

The activity involves the replacement and upgrade of sewer pipes using pipe cracking method.

Pipe Cracking Method Explained

a) Preparation

- HDPE pipes on will be inspected for defects.
- All house connection along the section will be identified from design maps and on preconstruction CCTV footage and reports.
- Sewer pumps (with standby pumps) will be tested, and hoses inspected for leaks.
- Excavation for launch and receiving, and house connection will commence.
- HDPE pipes will be butt welded to the required length

b) Pipe Cracking Sequence

- When butt welding and excavation is complete, the manholes, upstream and downstream of the section will be plugged and over pumping will commence.
- Existing sewer pipe will be cut at house connections and the sewer from affected houses will be blocked.
- The newly butt-welded HDPE pipe will then be pulled through to replace the existing pipe.
- As soon as the whole length has been pulled through, the HDPE pipe will be cut at house connections and the HDPE Y-Junctions will be jointed for house connections using the electrofusion method.
- Air testing will be conducted in accordance with Clause 7.2 of SANS 1200LD. No water level drop will be allowed for these types of joints, as they are expected to be airtight.
- On acceptance and approval, house connections will commence. Bedding and backfilling will be done on launch and receiving pits, and on house connections.
- Compaction tests will be done on the bedding and on backfill.

On completion, post CCTV inspection will be conducted and a report will be submitted to the Employer.

3 LEGISLATIVE FRAMEWORK

3.1 Environmental Policy

The Contractor is required to compile an environmental management policy, which must consider the following:

- The Contractor's mission, vision and core values;
- Guiding principles;
- Requirements of, and communication with interested and affected parties (I&APs);
- The need to work towards continual improvement;
- The obligation to prevent pollution and ecological degradation;
- The importance of coordination with other organisational policies (e.g. quality, occupational health and safety, etc.);
- Reference to specific local and/or regional conditions; and
- A commitment to compliance with relevant environmental laws, regulations, by-laws and other criteria to which the Contractor subscribes.

3.2 Legislative Framework

Construction must be according to the best industry practices, as identified in the project documents. This EMPr, which forms an integral part of the contract documents, informs the contractor as to his duties in the fulfilment of the project objectives, with particular reference to the prevention and mitigation of environmental impacts caused by construction activities associated with the project. The Contractor should note that obligations imposed by the EMPr are legally binding in terms of environmental statutory legislation and in terms of the additional conditions to the general conditions of contract that pertain to this project. In the event that any rights and obligations contained in this document contradict those specified in the standard or project specifications then the latter shall prevail.

3.2.1 Statutory and Other Applicable Legislation and Standards

The Contractor shall identify and comply with all South African national and provincial environmental legislation, including associated regulations and all local by-laws relevant to the project. Key legislation currently applicable to the design, construction and implementation phases of the project must be complied with. The list of applicable legislation provided below is intended to serve as a guideline only and is not exhaustive:-

- The Constitution of the Republic of South Africa Act 108 of 1996
- National Environmental Management Act 107 of 1998

- National Environmental Management: Protected Areas Act 57 of 2003
- National Environmental Management: Biodiversity Act 10 of 2004
- National Water Act 36 of 1998
- Hazardous Substances Act 15 of 1973
- National Heritage Resources Act 25 of 1999
- Atmospheric Pollution Prevention Act 45 of 1965
- National Environmental Management: Air Quality Act 39 of 2004
- National Environmental Management: Waste Management Act 59 of 2008
- Occupational Health and Safety Act 85 of 1993
- South African National Roads Agency Limited Act 7 of 1998
- All relevant provincial legislation, Municipal by-laws and ordinances.

4 ADMINISTRATION AND REGULATION OF ENVIRONMENTAL OBLIGATIONS

4.1 Management Structure

The Contractor must compile an organogram illustrating the management structure for inclusion within the final EMPr. This organogram should depict the organisation structure of the Contractor and must contain supporting documentation to demonstrate the environmental responsibilities, accountability and liability of the Contractor's employees. The Contractor should assign responsibilities for the following:

- Reporting structures.
- Actions to be taken to ensure compliance.
- Overall design, development and implementation of the EMPr.
- Documenting the environmental policy and strategy.
- Implementing the EMPr in all stages/phases of the project.
- All the aspects which require action under the other core elements and sub-elements of the EMPr.

All official communication and reporting lines including instructions, directives and information shall be channelled according to the organisation structure.

4.2 Roles and Responsibilities

4.2.1 Johannesburg Water

Johannesburg Water (JW) is the client and will therefore be the entity monitoring the implementation of the EMPr. However, if JW appoints a Contractor to implement the project and

hence implement the proposed mitigation measures documented in this EMPr on their behalf, then the successful contractor's responsibilities are outlined in Section 4.2.2 that follows.

4.2.2 Contractor

The successful Contractor shall:

- Be responsible for the overall implementation of the EMPr in accordance with the requirements of JW;
- Ensure that all third parties who carry out all or part of the Contractor's obligations under the Contract comply with the requirements of this EMPr

4.2.3 Designated Environmental Officer

The Contractor shall appoint a nominated representative of the contractor as the Designated Environmental Officer (DEO) for the contract. The DEO will be site-based and shall be the responsible person for implementing the environmental provisions of the construction contract. There shall be an approved DEO on the site at all times.

The DEO's duties will include, *inter alia*, the following:

- Ensuring that all the permits required in terms of the applicable legislation have been obtained prior to construction commencing.
- Reviewing and approving construction method statements with input from the ECO and Engineer, where necessary, in order to ensure that the environmental specifications contained within the construction contract are adhered to.
- Assisting the Contractor in finding environmentally responsible solutions to problems.
- Keeping accurate and detailed records of all activities on site.
- Keeping a register of complaints on site and recording community comments and issues, and the actions taken in response to these complaints.
- Ensuring that the required actions are undertaken to mitigate the impacts resulting from non-compliance.
- Reporting all incidences of non-compliance to the ECO and Contractor.

The DEO shall submit regular written reports to the ECO, but not less frequently than once a month.

The DEO must have:

- The ability to manage public communication and complaints;
- The ability to think holistically about the structure, functioning and performance of environmental systems; and
- The DEO must be fully conversant with the Environmental Management Programme and all relevant environmental legislation.

The ECO shall have the authority to instruct the contractor to replace the DEO if, in the ECO's opinion, the appointed officer is not fulfilling his/her duties in terms of the requirements of the construction contract. Such instruction will be in writing and shall clearly set out the reasons why a replacement is required and within what timeframe.

4.2.4 Environmental Control Officer

For the purposes of implementing the conditions contained herein, JW shall appoint an Environmental Control Officer (ECO) for the contract. The ECO shall be the responsible person for ensuring that the provisions of the EMPr are complied with. The ECO will be responsible for issuing instructions to the contractor and where environmental considerations call for action to be taken. The ECO shall submit regular written reports to JW, but not less frequently than once a month. The ECO will be responsible for the monitoring, reviewing and verifying of compliance with the EMPr by the Contractor. The ECO's duties in this regard will include, *inter alia*, the following:

- Confirming that all the environmental permits required in terms of the applicable legislation have been obtained prior to construction commencing.
- Monitoring and verifying that the EMPr and Contract are adhered to at all times and taking action if specifications are not followed.
- Monitoring and verifying that environmental impacts are kept to a minimum.
- Reviewing and approving construction method statements with input from the DEO and Engineer, where necessary, in order to ensure that the environmental specifications contained within this EMPr are adhered to.
- Inspecting the site and surrounding areas on a regular basis regarding compliance with the EMPr and Contract.
- Monitoring the undertaking by the Contractor of environmental awareness training for all new personnel on site.
- Ensuring that activities on site comply with all relevant environmental legislation.
- Ordering the removal of or issuing spot fines for person/s and/or equipment not complying with the specifications of the EMPr.
- Undertaking a continual internal review of the EMPr and submitting any changes to JW for review and approval.
- Checking the register of complaints kept on site and maintained by the DEO and ensuring that the correct actions are/were taken in response to these complaints.
- Checking that the required actions are/were undertaken to mitigate the impacts resulting from non-compliance.

- Reporting all incidences of non-compliance to the JW.
- Conducting annual environmental performance audits in respect of the activities undertaken relating to the project.
- Keeping a photographic record of progress on site from an environmental perspective.
- Recommending additional environmental protection measures, should this be necessary.
- Providing report back on any environmental issues at site meetings

The ECO must have:

- A good working knowledge of all relevant environmental policies, legislation, guidelines and standards;
- The ability to conduct inspections and audits and to produce thorough, readable and informative reports;
- The ability to manage public communication and complaints;
- The ability to think holistically about the structure, functioning and performance of environmental systems; and
- Proven competence in the application of the following integrated environmental management tools:
 - Environmental Impact Assessment.
 - Environmental management plans/programmes.
 - Environmental auditing.
 - Mitigation and optimisation of impacts.
 - Monitoring and evaluation of impacts.
 - Environmental Management Systems.

The ECO must be fully conversant with the Environmental Management Programme and all relevant environmental legislation. JW shall have the authority to replace the ECO if, in their opinion, the appointed officer is not fulfilling his/her duties in terms of the requirements of the EMPR or this specification. Such instruction will be in writing and shall clearly set out the reasons why a replacement is required and within what timeframe.

4.3 Emergency Preparedness

The Contractor shall compile and maintain environmental emergency procedures to ensure that there will be an appropriate response to unexpected or accidental actions or incidents that will cause environmental impacts, throughout the life cycle of the project. Such activities may include, *inter alia*:

- Accidental discharges to water and land.

- Accidental exposure of employees to hazardous substances.
- Accidental veld or forest fires.
- Accidental spillage of hazardous substances.
- Specific environmental and ecosystem effects from accidental releases or incidents.

These plans should include:

- Emergency organisation (manpower) and responsibilities, accountability and liability.
- A list of key personnel.
- Details of emergency services applicable to the various areas along the route (e.g. the fire department, spill clean-up services, etc.).
- Internal and external communication plans, including prescribed reporting procedures where required by legislation.
- Actions to be taken in the event of different types of emergencies.
- Incident recording, progress reporting and remediation measures required to be implemented.
- Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release.
- Training plans, testing exercises and schedules for effectiveness.

The Contractor shall comply with the emergency preparedness and incident and accident-reporting requirements, as required by the Occupational Health and Safety Act, 1993 (Act No 85 of 1993), the National Environmental Management Act, 1998 (Act No 107 of 1998), the National Water Act, 1998 (Act No 36 of 1998) and the National Veld and Forest Fire Act, 1998 (Act No 101 of 1998) as amended and/or any other relevant legislation.

4.4 Checking and Corrective Action

4.4.1 Non-Compliance

Non-compliance with the specifications of the EMPr and/or conditions of any environmental permits, both of which will be present on-site at all times, constitutes a breach of Contract for which the Contractor may be liable to pay penalties. The Contractor is deemed not to have complied with the EMPr if:

- There is evidence of contravention of the EMPr specifications within the boundaries of the construction site, site extensions and haul/access roads;
- There is contravention of the EMPr specifications which relate to activities outside the boundaries of the construction site.
- Environmental damage ensues due to negligence;

- Construction activities take place outside the defined boundaries of the site; and/or
- The Contractor fails to comply with corrective or other instructions issued by the Engineer and/or ECO within a specific time period.

The contractor shall act immediately when a notice of non-compliance is received and correct whatever was the cause for the issuing of the notice.

Any non-compliance with the agreed procedures of the EMPr is a transgression of the various statutes and laws that define the manner by which the environment is managed therefore any avoidable non-compliance, dependant on severity, shall be considered sufficient grounds for contact to be made with relevant provincial or national authorities.

The engineer's decision with regard to what is considered a violation, its seriousness and the action to be taken against the contractor shall be final. Failure to redress the cause shall be reported to the relevant authority. The responsible provincial or national authorities shall ensure compliance and impose penalties relevant to the transgression as allowed for within its statutory powers.

4.4.2 Monitoring

A monitoring programme will be implemented for the duration of the construction phase of the project. This programme will include:

- **Performance Audits:** Monthly inspection reports which are performance based compiled by the ECO. This must also incorporate monitoring of compliance issues as well as permits, licenses, the EMPr and all contract documentation's conditions. These audits can be conducted randomly and do not require prior arrangement with the project manager.
- **Compliance Audits:** The auditor will initially undertake compliance audits every month. Compilation of an audit report with a rating of the compliance with the EMPr. This report will be submitted to the relevant authorities as and when required.

The following will also assist with monitoring:-

Complaints Register

The Contractor will ensure that a dedicated Complaints Register is kept on site at all times. The register will contain the details of the person who made the complaint, the nature of the complaint received, the date on which the complaint was made and the response noted with the date and action taken. The Complaints register will be kept in accordance with the requirements of the

ECO. This record shall be submitted with the monthly reports and an oral report given at the monthly site meetings.

Inspections

On-going visual inspections will be conducted daily by the DEO. The DEO will spend the bulk of his/her time on site on the lookout for any unsafe acts and activities that transgress the requirements as specified in the EMP. The DEO compiles the site register and the ECO maintains the complaints register and any other records required (the DEO would also have input into this as well, as he/she would be site-based).

Incident Reporting and Remedy

If a leakage or spillage of hazardous substances occurs on site, the local emergency services must be immediately notified of the incident (within 24 hours). The following information must be provided:

- The location;
- The nature of the load; and
- The status at the site of the accident itself (i.e. whether further leakage is still taking place, whether the vehicle or the load is on fire).

Written records must be kept on the corrective and remedial measures decided upon and the progress achieved therewith over time. Such progress reporting is important for monitoring and auditing purposes. The written reports may be used for training purposes in an effort to prevent similar future occurrences.

Public Communication and Liaison with Interested and Affected Parties

The Contractor shall comply with the requirements for public consultation as required by the Constitution Act, 1996 (Act No 108 of 1996) and the National Environmental Management Act, 1998 (Act No 107 of 1998). During the construction phase of the project, the Contractor shall be responsible for erecting information boards, in the position, quantity, design and dimensions approved by the Engineer.

The information boards shall contain relevant information regarding the construction activity and the relevant contact details to assist persons who wish to submit complaints regarding construction activities.

Information distribution

Copies of the EMPr will be made available to I&APs at appropriate locations. Copies will also be distributed to all senior contract personnel. All senior personnel on the construction site will be required to familiarize themselves with the contents of the document.

4.5 Management Review

A formal management review needs to be conducted on a regular basis in which the monthly internal audit reports written by the ECO and based on frequent inspections and interactions with the DEO based on the latter's daily reports, audit reports by the independent external auditor will be reviewed. The purpose of the review is to critically examine the effectiveness of the EMPr and its implementation and to decide on potential modifications to the EMPr as and when necessary. The process of management review is in keeping with the principle of continual improvement. Management review will take place monthly for the duration of the project.

5 DETAILED ENVIRONMENTAL MANAGEMENT PROGRAMME

The EMPr forms part of the Contract Documentation and is thus a legally binding document. It is also necessary for the Contractor to make provisions as part of their budgets for the implementation of the EMPr. In terms of the NEMA an individual responsible for environmental damage must pay costs both to the environment and human health and the preventative measures to reduce or prevent additional pollution and/or environmental damage from occurring. This is referred to as the Polluter Pays Principle. Section 28 of the NEMA embodies the Polluter Pays Principle. The Contractor is deemed not to have complied with the Environmental Specifications/EMPr if:

- Environmental damage ensues due to negligence;
- The Contractor ignores or fails to comply with corrective or other instructions issued by JW, the Engineer or ECO within a specified time; and
- The Contractor fails to respond adequately to complaints from the public.

5.1 Pre-Construction Phase

5.1.1 Permits and Licenses

All necessary permits and licences must be obtained by JW prior to the commencement of construction

5.1.2 Appointment of Contractor

- JW must ensure that this EMPr forms part of any Contractual agreements with the Contractor(s) and sub-Contractors for the execution of the proposed project. The Contractor must make adequate provision in their budgets for the implementation of the EMPr.
- The Principal Contractor (including sub-Contractors and suppliers) must comply with the relevant provisions of the EMPr, applicable environmental legislation, by-laws and associated regulations promulgated in terms of these laws.

- Tender documents should include statements to include the use of local communities or local community organisation where possible in supplying services and labour to the construction activities.
- Local labourers should be used for such methods

5.1.3 Preparation of Method Statements

- Method Statements must be submitted by the Contractor to the ECO and must be adhered to by the Contractor and Project Engineer for the duration of the Project. These relate to water and storm water management requirements, traffic requirements, solid waste management requirements, and hydrocarbon spills, contaminated water treatment, the storage of hazardous materials, standard emergency procedures, and biohazard control, and any further activities which the ECO and Project Engineer deem necessary.
- The ECO will monitor the implementation of the Method Statements. All copies of the statements and plans must be submitted to the appointed ECO.

5.1.4 Project Required Method Statements

a) Working within watercourses

As part of the finalisation of the EMPr, detailed Method Statements must be compiled for all construction activities confirmed to occur within the watercourses. The Method Statements must provide detail on the following, where applicable:

- Working area extent and demarcation;
- Vegetation and soil clearing / grubbing / stripping and stockpiling;
- Access and running track establishment and decommissioning;
- Method of excavation;
- Temporary flow diversion measures;
- Infrastructure placement measures; and
- Rehabilitation – reshaping, soil preparation, stabilisation / erosion control and revegetation

b) Pipeline Replacement and Erosion Control

- Competent site investigation, sampling and relevant testing to build up an informed picture of the task.
- Demarcate the construction servitude where construction works occur within or in close proximity to a watercourse.
- Ensure that the design of watercourse workings complies with best-practice guidelines and recommendations.

- Ensure that site workers are well versed in the Method Statement and any other mitigation and management guidelines.
- Ensure that 'standard mitigation' measures to limit impacts on water resources are complied with (refer to all relevant sections of the Environmental Management Programme, EMPr and specialist reports).
- Ensure that appropriate mitigation measures for site establishment are implemented.
- Ensure that mitigation measures for access control are implemented.
- Ensure that appropriate mitigation measures for site clearing & vegetation stripping are implemented.
- Ensure that appropriate storm water management and erosion control measures are implemented.
- Backfill according to the specifications indicated on the construction drawings with material approved by the engineer to the height of the fill.
- Perform required compaction tests on all backfill material.

5.2 Planning and Pre-Construction Phase Activities

5.2.1 Site Establishment

Careful planning of the construction camp can ensure that the time and costs associated with environmental management and rehabilitation are reduced

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Layout</p> <p>a) The choice of the Contractor’s camp requires the Project Manager’s permission and must ensure that the camp is located in an area that will ensure a minimum impact on the environment and surrounding residents.</p> <p>b) The contractor should submit plans of exact location, extent and construction details of the temporary construction camp facilities to the Project Manager for approval, prior to establishment of the camp.</p> <p>c) The layout plans should reflect the proposed camp’s location in relation to any existing infrastructure (water mains, electricity cables, sewage mains, etc.) on site.</p> <p>d) Access to the construction camp must be through an existing route or one that is clearly demarcated and agreed upon</p>	Contractor & Project Manager	Prior to moving on site
<p>Provision for waste disposal</p> <p>a) Bins and skips shall be provided at convenient intervals for disposal of waste within the construction camp / site.</p> <p>b) Waste bins should be stored in a clearly demarcated area (i.e. not in close proximity to wet areas or drainage lines).</p>		Ongoing

5.2.2 Establishing Storage Areas

Storage areas can be hazardous and unsightly. These storage areas can also cause environmental pollution if not designed and managed properly

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>General Substances and Materials</p> <p>a) When deciding on the location of temporary stockpiles, the following needs to be considered:</p> <ul style="list-style-type: none"> o road access, o length of time the stockpile will exist. <p>b) Additionally, all stockpiles should be located away from sensitive ecosystems and protected from the prevailing winds.</p> <p>c) Storage areas must be designated, demarcated and fenced if necessary.</p> <p>d) Storage areas should be secured, to minimize the risk of crime and contamination.</p>	ECO	During site set up
<p>Hazardous Substances and Materials</p> <p>a) Hazardous chemical working/refuelling areas must be banded with an impermeable liner.</p> <p>b) Ensure that there is always a supply of absorbent material readily available to absorb/break down any hydrocarbon spillage.</p> <p>c) In the case of a spill, contaminated material must be removed from the site immediately and disposed of at an appropriate hazardous waste facility.</p> <p>d) All Material Safety Data Sheets (MSDS) should be available on site for the stored hazardous materials.</p>	Eco Approval	During site set up

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
e) All site staff that work with hazardous substances should be trained on the handling and use of hazardous substances		

5.2.3 Education of Site Staff on General Environmental Conduct

These points must be communicated to all staff before the project commence on site

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Environmental Education and Awareness</p> <p>Ensure that all site personnel have a basic level of environmental awareness training. Topics covered should include:</p> <ul style="list-style-type: none"> a) What is meant by ‘Environment’? b) Why do we have to protect the environment? c) How construction activities can impact on the environment. d) How can these impacts be mitigated? e) Awareness of emergency and spills response provisions. f) Awareness on waste management g) Social responsibility during construction e.g. being considerate to local residents. <p>It is the contractor’s responsibility to provide the site foreman with no less than 1 hour’s environmental training and to ensure that the foreman has sufficient understanding to pass the information onto the construction staff.</p> <ul style="list-style-type: none"> a) Translators are to be used where necessary. 	ECO	During induction

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>b) The use of pictures and real-life examples is encouraged as these are easier to remember.</p> <p>c) The need for a 'clean site' policy also needs to be explained to the construction workers</p>		
<p>Worker Conduct on Site</p> <p>Under no circumstances may open areas or surrounding bush be used as toilet facilities. A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules:</p> <p>a) No alcohol/drugs to be present on site.</p> <p>b) No firearms allowed on site or in vehicles transporting staff to/from the site (unless by security personnel.)</p> <p>c) No trespassing on adjacent properties.</p> <p>d) Construction staff is to make use of facilities provided for them, as opposed to ad hoc alternatives</p>	PM/Contractor	During induction and also on-going monitoring
<p>Waste Management</p> <p>a) Individual waste skip or wheelie bins for different types of waste should be provided.</p> <p>b) Adhere to and practice good housekeeping to ensure that construction camps and sites are well organised, material is neatly stacked, and waste is regularly removed.</p> <p>c) All litter throughout the site should be picked up and placed in the appropriate bins provided</p>	PM/ECO	During site set up

5.2.4 Security and Safety

Security and safety should be in line with JW's Safety Policy and By-Law Requirements

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Risks Associated with Materials on Site</p> <p>a) Material stockpiles or stacks such as cement, steel, bricks, corrugated iron sheeting, plastic piping, etc. must be stable and well packed to avoid collapse and possible injury to site workers, stockpiles must also be covered to avoid seepage and ground water pollution (where applicable).</p> <p>b) No materials are to be stored in unstable or high-risk areas such as in close proximity of the entrance road, excavated areas, etc</p>	PM/Contractor	On-going

5.3 Construction Phase Activities

5.3.1 Site Access

Access road

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Access to the site</p> <p>a) Ensure that access to the site is via the approved access road.</p> <p>b) Clearly communicate access policy for the properties to the staff and public, using notice boards on access gates and by directly communicating with the nearby residents.</p>	PM/Contractor	Monthly

5.3.2 Maintenance of Construction Camp

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Ablution</p> <p>a) Provide adequate temporary chemical toilets on site:</p> <ul style="list-style-type: none"> ○ Provide for a suitable ratio of toilets per number of employees (usually at least 1 toilet per 12 employees) ○ Provide for toilets to have hand wash facility either within the toilet cubicle or adjacent thereto ○ Locate toilets (porta loos) outside the 1:100 year floodline and preferably away and/or hidden from public roads, residential areas and other public places ○ Secure toilets (porta loos) firmly to prevent them from toppling over due to wind or any other cause ○ Appoint a service provider to remove sewage from the chemical toilets and/or sewage sludge from package plants on a regular basis; and provide and ensure for this sewage / sewage sludge to be disposed of at a municipal sewage treatment plant or alternatively on an appropriately designed on-site sewerage treatment plant ○ Clean the sewage system out regularly and immediately before long weekends, builders holidays and work breaks; and disposed the sewage to the municipal sewage system ○ Ensure that no spillage occurs when the toilets are cleaned or emptied and that the contents is properly stored and removed from site 	<p>ECO/Contractor</p>	<p>Weekly</p>

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> ○ Keep toilets locked after working hours. b) Prohibit staff from abluting anywhere other than in toilets 		
<p>Eating Areas</p> <ul style="list-style-type: none"> a) Eating areas (if applicable) should be serviced and cleaned regularly to ensure the highest possible standards of hygiene and cleanliness. b) All litter throughout the site should be picked up and placed in the appropriate recycling bins provided 	Contractor	Weekly Inspection
<p>Housekeeping</p> <p>Adhere to and practice good housekeeping to ensure that construction camps and sites are well organised, material is neatly stacked, and waste is regularly removed</p>	Contractor	Weekly Inspection

5.3.3 Fire Prevention and Response

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Fire Prevention and Response</p> <ul style="list-style-type: none"> a) Responsible parties will be liable for any damage caused by fires resulting from their operation, negligence or lack of protection of the site from fires. b) Include a fire emergency preparedness plan for fighting accidental fires in the Emergency Response Plan. 	Contractor/ECO	Weekly

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>c) Fire-fighting equipment for each construction / operational / demolition team and/or area must be readily available on site; bearing in mind that these should be approved by the local Fire Prevention Officer, ECO, Safety and/or Health Officer.</p> <p>d) Avail and maintain appropriate fire-extinguishers on all vehicles carrying flammable materials.</p> <p>e) Keep a register and inspection log of all fire- fighting equipment; and inspect and check fire- fighting equipment regularly and record such inspection on the inspection log that is retained on-site.</p> <p>f) Prevent accidental fires through proper sensitisation of staff towards the associated risks, dangers and damage of property.</p> <p>g) Prohibit the use of open fires and random “braais” on-site, strictly, unless they are effectively contained and designated areas far away from vegetation.</p> <p>h) Inform and/or involve neighbouring landowners/ users/ managers should there be a risk of a fire spreading to their property</p>		

5.3.4 Site Clearing Affecting at the Launch Site

Exposure of soils, leading to possible increased runoff and erosion, and thus increased sedimentation of the dam;

- Possible increase sedimentation of the dam, leading to smothering of biota and potentially altering surface water quality; and
- Potential decrease in ecoservice provision

Soil contamination.

- Spillage of fuel or oil leaks from construction vehicle may result in the contamination of the soil and groundwater.

- Storm water runoff may cause erosion of topsoil.

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> • Contractor laydown areas and stockpiles to be established outside of the delineated riparian habitat and the applicable setback zone in consultation with the appropriate authority. • All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential • Retain as much indigenous vegetation as possible. • Contaminated soil must be treated on site using a spillage kit. • All earthworks must be adequately controlled and managed • Any excavations must be clearly marked and demarcated. • Only topsoil in the footprint should be removed and soil disturbance to areas outside the construction footprint must be avoided. • Bare areas must be revegetated as soon as works in that area is completed. 	Contractor/ECO	Weekly

5.3.5 Waste and Stormwater Management

Activities in the construction site such as office work, usage of construction materials, etc., generate different types of waste that requires to be managed properly. These wastes could result in environmental pollution such as soil contamination/ pollution or health hazards to employees working on-site, if not managed properly

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Care should be taken not to dump waste indiscriminately this could have a negative impact on the ecosystem and may lead to injury to humans and animals.</p> <p>Construction Rubble:</p> <ul style="list-style-type: none"> a) All rubble must either be used on site as part of the existing development or must be taken off the site and disposed of at an approved site. b) Rubble must not be dumped on the ground but must be placed in a skip bin for regular removal as possible. <p>Litter management:</p> <ul style="list-style-type: none"> a) Refuse bins must be placed at strategic positions to ensure that litter does not accumulate within the construction site. These should be kept covered and arrangements made for them to be collected regularly from the site. b) A housekeeping team should be appointed to regularly maintain the litter and rubble situation on the construction site. c) Waste disposal will need to take place in terms of section 20 of the Environment Conservation Act (Act N0.73 of 1998). 	<p>Contractor/PM/ECO</p>	<p>Weekly</p>

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
d) Littering by the employees of the Contractor shall not be allowed under any circumstances. The ECO shall monitor the neatness of the construction site.		
<p>Stormwater Management</p> <p>a) A suitable stormwater drainage system and containment must be implemented by the PM to prevent soil and silt erosion, protect storage areas, to prevent uncontrolled stagnant ponds forming and avoid siltation of water resources</p> <p>b) The PM shall take reasonable measures to control stormwater and the erosive effects thereof and shall provide a Method Statement for this.</p> <p>c) Measures shall be implemented to effectively contain and treat any stormwater contaminated with silt, soil or any other substance in order to protect the aquatic environment.</p> <p>d) Where erosion does occur on any completed work/working areas, the PM shall reinstate such areas and areas damaged by the erosion at his own cost and to the satisfaction of the ECO.</p>	ECO/Contractor/PM	Weekly

5.3.6 Construction Vehicles/Equipment

Engine machines such as compressors, pumps, etc. can have small leaks (usually oil) that can accumulate to become spills, which require clean-up. These leaks become more evident if the equipment remains in the same place for an extended period of time. Damaged fuel tanks, fuel hoses, and fuel pumps can be sources of significant fuel leaks. Hydraulic systems can blow gaskets or hoses resulting in large quantities of hydraulic fluid spilled to the ground

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Construction Equipment</p> <p>a) Vehicles and machinery are to be kept in good working order and to meet manufactures specification for safety, fuel consumption and emission.</p> <p>b) Should excessive emissions be observed, the site manager needs to implement an effective vehicle and equipment service and maintenance plan.</p> <p>c) Vehicle parking and equipment storage must be done on a hardened and sealed surface area such that oil, fuel and other fluid leaks do not pollute soil or ground water sources.</p>	Contractor/ECO	Ongoing

5.3.7 Geology and Soils

- Loss of soil from excavations due to erosion.
- Soil erosion due to ineffective storm water management. It is anticipated that erosion incidences might occur during wet seasons especially on the stockpiles (Topsoil and Subsoil).

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> • Implementation of anti-erosion measures such as the construction of berms to reduce the water velocity. 	Contractor/ECO	Ongoing

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> • Storm water runoff shall be considered, and its flow controlled on the construction site. • Stockpiles should not be higher than 1.5 meters. • Excavation must not be left open for longer than four weeks. • Proper storm water management measures must be put in place. • No ponding of water must be allowed on site 		

5.3.8 Emergency Response to Spillages

This section aims to provide measures to manage spillages from equipment used on site and measures for other construction materials handled on site.

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Emergency Response to Spillages</p> <p>The contractor shall take into account the following prevention measures to be applied during spillages.</p> <ol style="list-style-type: none"> a) Immediately repair all leaks of hydrocarbons, oil, etc. b) Take reasonable measure to prevent the spills or leaks. c) Dispose contaminated materials to a location designated thereto. d) The contractor shall have its own spill response plan in the event of any spills (oil, fuel, hazardous materials) from machinery or equipment used on site. 	Contractor/ECO	During Spillages

5.3.9 Construction Specific Activities

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Site Clearance</p> <p>a) Restrict the area to be cleared to a minimum, and clear areas sequentially as needed; to benefit from the stormwater absorption, erosion protection and dust control properties of the vegetation cover.</p> <p>b) Demarcate all areas to be cleared and those not to be cleared (e.g. “No-go” areas) clearly and effectively, prior to clearing</p>	<p>PM/ECO</p>	<p>On-going throughout the Construction phase</p>
<p>Working Areas and No-go Areas</p> <p>a) The Site shall be divided into working areas and ‘no-go’ areas and shall be marked on appropriate plans for reference.</p> <p>b) Working areas are those areas required by the construction staff for their site maintenance works.</p> <p>c) No-go’ areas are generally those large areas outside the designated working areas, and may include, but not be limited to:</p> <ul style="list-style-type: none"> o Existing services and infrastructure o Privately owned land and residences (unless a formal agreement has been signed for access, use or impact) <p>d) The PM shall ensure that all “no go” areas are demarcated and that no unauthorised entry, litter, stockpiling, dumping or storage of equipment or materials shall be allowed within the demarcated “no go” areas.</p>	<p>PM/ECO</p>	<p>On-going throughout the Construction phase</p>

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
In the event that any damage is caused to the 'no-go' areas, the PM will be required to repair, restore, reinstate and/or rehabilitate these areas at their own cost.		
<p>Soil Stockpiling</p> <p>a) Store the topsoil separately (from general fill, rubble, etc.), effectively and securely for later use in rehabilitation in stockpiles in a manner that would limit erosion and dust.</p> <p>b) Locate all soil stockpiles (topsoil and fill) as follows:</p> <ul style="list-style-type: none"> ○ Sufficiently away from seepage zones, flood lines, water courses and other ecological sensitive area ○ Preferably in areas that were already disturbed before the project activities commenced on site 	PM/ECO	On-going throughout the Construction

5.3.10 Surface Water

- Disturbances of soils leading to increased alien vegetation proliferation, and in turn to further altered freshwater habitat;
- Erosion of the exposed trench at the launch site;
- Possible contamination of freshwater soils and surface water, leading to reduced ability to support biodiversity

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
a) Should it be necessary to clear any areas of vegetation, these areas, including contractor laydown areas, must remain as small as possible, to reduce the risk of further proliferation of alien vegetation,	PM/ECO	On-going throughout the Construction phase

<p>and to retain a level of protection to the dam during construction (e.g. sediment trapping, slowing of storm water runoff etc.);</p> <p>b) Restrict construction activities to the drier months wherever possible, so as to limit the possibility of permanent changes to the system.</p> <p>c) All exposed soils must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian sheeting) in order to prevent erosion and sedimentation of the dam.</p>		
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5.3.11 Impact on Biophysical Environment

Incorrect disposal of substances and materials and polluted run-off can cause serious negative impacts on the dam.

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Control of Erosion, Sedimentation and Surface Water Quality</p> <p>a) Prohibit the use of natural surface water sources for potable and other water use, as only municipal water (or from another legal source) may be used on site.</p>	<p>PM/ECO</p>	<p>Biweekly monitoring</p>

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>b) Minimise impacts on natural surface water areas, by taking all necessary precautions to ensure that construction activities do not alter natural ground and surface water quality or flows in areas identified as sensitive.</p> <p>c) Develop, implement and maintain a Stormwater Management Plan and associated stormwater management system</p> <p>d) Equipment and machinery must be in good operation condition, clean (power washed), free of leaks, excess oil and grease.</p> <p>e) Ensure that machinery is operated by a skilled driver who has been trained to use it correctly and who will be able to identify if something is wrong with the engine and conduct regular inspections identifying engine related leaks.</p>		
<p>Impacts on Fauna</p> <p>a) Any fauna directly threatened by the construction activities should be removed to a safe location by a suitably qualified person.</p> <p>b) The collection, hunting or harvesting of any animals at the site should be strictly forbidden.</p> <p>c) Fires should only be allowed within fire-safe demarcated areas.</p> <p>d) Vegetation clearing should be kept minimal and only area to be used for construction should be cleared.</p> <p>e) Where soil disturbance is required for the laying of service infrastructure, the topsoil should be put aside and replaced after the infrastructure has been installed.</p>	PM/ECO	Biweekly monitoring

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>f) Areas to be cleared should be demarcated.</p> <p>g) Ensure that all activities impacting on the wetlands are managed per the relevant DWS Licensing regulations;</p>		
<p>Impacts on Flora</p> <p>a) Where possible, cut vegetation to ground-level rather than removing it completely, leaving root systems intact to ensure rapid re-colonization.</p> <p>b) Any exotic vegetation (trees and plants) encountered should be removed from the site and properly disposed of.</p> <p>c) Inform site staff that under no circumstance may firewood or medicinal plants be harvested.</p> <p>d) The success of natural regeneration should be monitored. In areas requiring further intervention, a suitable replanting /re-vegetation programme should be implemented. This should comprise a mix of rapidly germinating indigenous grasses, shrubs and trees naturally occurring in the affected habitat and adapted to stabilizing areas. Locally occurring, indigenous runner grasses are typically most useful for rehabilitation purposes.</p> <p>e) No open fires shall be allowed on site under any circumstances, fires will only be permitted in adequate facility within the crew camp.</p> <p>f) Minimise scarring of the soil surface and land features.</p> <p>g) Minimise disturbance and loss of topsoil.</p>	PM/ECO	Biweekly monitoring

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
h) Re-vegetation of the area should be allowed to proceed naturally or be re-instated through a suitable replanting / re-vegetation programme where necessary		
Water Contamination and Pollution a) All maintenance vehicles and equipment shall be kept in good working order, are serviced regularly. b) Portable toilets must be regularly emptied and secured. c) Refuse bins must be regularly emptied by an appropriate licensed waste contractor and secured d) Drip trays (where appropriate) must be emptied regularly and secured	ECO	Biweekly

5.3.12 Impacts on Socio-Economic Environment

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
Public Health and Safety a) Take appropriate and effective precautions and all reasonable measures to ensure the safety of people in the surrounding area. b) Control access to the site and prohibit unsupervised public access to the site. c) Use all public roads responsibly. d) Deal with transgressions by staff with regard to public health and safety severely (fines and dismissals).	PM/ECO	Ongoing
Public and Service Infrastructure Use and Impact	PM/ECO	Ongoing

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>a) Liaise closely with the relevant authorities on all matters related to potential use of or impact on public services or service infrastructure, e.g. roads, pipelines, telecommunication, waste facilities, health services, emergency services, law enforcement services, etc.; including development and mitigation plans.</p> <p>b) Liaise closely with the relevant servitude/land owners / operators on access to, use of or impact on servitudes owned / used by other parties.</p> <p>c) Keep the disruption of essential services as short as possible to minimise public inconvenience for both planned and unforeseen events.</p> <p>d) Ensure that all affected communities and stakeholders are kept well informed of the process and of all significant dates attached to the development process.</p> <p>e) Protect all public and private service infrastructures (e.g. pipelines, cables) by clearly marking these or incorporating the relevant servitudes into “No-go” areas.</p> <p>f) Ensure that the implementation process is carefully monitored and that any disruptions are immediately identified and appropriately managed.</p>		
<p>Community Relationship and Influx of Job Seekers</p> <p>a) Make use of local labour and local suppliers of material for the construction as far as reasonably possible.</p> <p>b) Train staff to respect the property and needs of the adjacent landowners and public areas to minimise any unnecessary disturbance.</p>	PM/ECO	Ongoing

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
c) Ensure that adequate lines of communication are established between JW, the contractors, landowners, neighbouring landowners and the public at large to deal with any public grievances. d) Formulate a rapid response plan to deal with security matters.		
Creation and Securing of Employment Opportunities Meet the requirements of the JW policies for procurement and employment, to take care of and avoid potential conflict between people in the immediate surroundings seeking employment and those from elsewhere	PM/ECO	Ongoing

5.3.13 Noise

Construction noise will mainly result from the use of vehicles during construction activities. However, noise from site activities is considered of low significance

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
Noise a) Restrict very noisy construction activities to daytime, if feasible; and if not, obtain authorisation from the local authority for alternative arrangements. b) Refrain from operations during the night as sound may travel to residential areas, businesses, and communities. c) Provide affected parties with prior knowledge of scheduling for ultra-heavy-duty vehicles and advise on the frequency and day periods of exposure to such noise	PM/ECO	Biweekly

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>d) Ensure that all vehicles and where possible noisy equipment are fitted with silencers that are regularly and properly maintained</p> <p>e) Meet regulatory requirements in terms of site boundary noises (in terms of municipal requirements).</p> <p>f) Construction activities should be restricted to between 07H00 and 17H00, Monday to Friday, and 08H00 – 13H00 on Saturdays. No work must be undertaken on Sundays and Public Holidays</p> <p>g) SANS 10103 and the National Noise Control Regulation should be used as the main guidelines for addressing the potential noise impact on this project.</p> <p>h) Regarding unavoidable very noisy construction activities in the vicinity of noise sensitive areas, these should be screened off with acoustic screens, where possible. If no acoustic screening is used during exceptionally noisy construction times, warning to community members would be extremely important.</p>		

5.3.14 Air Quality

Minimal dust and vehicle emissions will be generated during the construction phase

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Air Emissions and Adour Control</p> <p>a) Minimise the surface area of exposed soil and fine construction materials to wind erosion (construction phase)</p>	PM/ECO	Biweekly

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>b) Sprinkle water from the municipal supply on exposed areas or soil mounds (e.g. from trenching) as and when dust problems arise (construction phase)</p> <p>c) Maintain vehicles and other driven machinery regularly to ensure that no smoke is emitted from exhausts (construction and operational phase)</p> <p>d) Prevent any uncontrolled fires (construction and operational phase)</p> <p>e) Prohibit burning of wastes/refuse (construction and operational phase)</p> <p>Dust control</p> <p>a) Excavations and other clearing activities must only be done during agreed working times and permitting weather conditions to avoid drifting of sand and dust into adjacent areas.</p> <p>b) Any complaints or claims emanating from the lack of dust control shall be attended to immediately by the contract and ECO.</p>		

5.3.15 Safety and Security

A construction site can act as a magnet to the unemployed, resulting in large numbers of people gathering around the site, thereby posing a security risk in the area

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>a) The site camp to be fenced off to prohibit unauthorized entry.'</p> <p>b) Strict control of personnel accessing the site must be implemented.</p> <p>c) No loitering around the site for people seeking temporary employment is to be allowed</p>	PM/ECO	Biweekly

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>d) Health and Safety Officer to be appointed to continuously monitor the safety conditions during construction.</p> <p>e) All construction staff must have the appropriate PPE.</p> <p>f) Staff handling chemicals or hazardous materials must be trained in the use of the substances and the environmental, health and safety consequences of incidents.</p> <p>g) Access to fuel and other equipment stores is to be strictly controlled</p> <p>h) Record and report any environmental, health and safety incidents to the responsible person.</p> <p>i) Signs should be erected to warn of construction activities.</p> <p>j) The site and crew are to be managed in strict accordance with the Occupational Health and Safety Act (Act No. 85 of 1993) and the National Building Regulations</p> <p>k) All structures that are vulnerable to high winds must be secured.</p> <p>l) Potentially hazardous areas such as trenches are to be cordoned off and clearly marked at all times.</p> <p>m) The basic spill control kit must be available at each construction camp within the site.</p> <p>n) The Contractor is to ensure traffic safety at all times, and shall implement road safety precautions for this purpose.</p> <p>o) All vehicles and equipment used on site must be operated by appropriately trained and / or licensed individuals in compliance with all safety measures</p>		

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>as laid out in the Occupational Health and Safety Act (Act No. 85 of 1993) (OHSA).</p> <p>p) An environmental awareness training programme for all workers shall be put in place by the Contractor. Before commencing with any work, all workers shall be appropriately briefed about the EMPr and relevant occupational health and safety issues.</p> <p>q) Adequate emergency facilities must be provided for the treatment of any emergency on the site. Emergency procedures must be available on site and communicated to all.</p> <p>r) The nearest emergency service provider must be identified, and Emergency contact numbers are to be displayed conspicuously at prominent position.</p>		

5.3.16 Disruption of Nearby Residents' Movements Through Access Road

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>a) Access to the construction area must be predetermined and used during constructions.</p> <p>b) The working area and all exposed trenches must be fenced off with barrier netting, danger tape & droppers.</p> <p>c) Warning signage must be erected as appropriate to warn residents of the presence of construction workers and construction vehicles.</p>	PM/ECO	Biweekly

5.3.17 Heritage

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<p>Heritage Control</p> <p>a) Cease all construction within a radius of at least 20m of any heritage features or artefacts, or skeletons or bones that are found during construction. This distance should be increased at the discretion of supervisory staff if heavy machinery could cause further disturbance to the suspected heritage resource.</p> <p>b) Mark this area using clearly visible means, such as barrier tape, and all personnel should be informed that it is a no-go area.</p> <p>c) Appoint a guard to enforce this no-go area if there is any possibility that it could be violated, whether intentionally or inadvertently, by construction staff or members of the public.</p> <p>d) No measures should be taken to cover up the suspected heritage resource with soil, or to collect any remains such as bone or stone.</p> <p>e) If a heritage practitioner has been appointed to monitor the project, s/he should be contacted and a site inspection arranged as soon as possible.</p> <p>f) Respect the potentially sensitive and confidential nature of the heritage resources, particularly human remains, and refrain from making public statements until a mutually agreed time.</p> <p>g) Any extension of the project beyond its current footprint involving vegetation and/or earth clearance should be subject to prior assessment by a qualified</p>	<p>PM/ECO</p>	<p>Biweekly</p>

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
heritage practitioner, taking into account all information gathered during this initial heritage impact assessment		

5.4 Operational Activities

5.4.1 Aquatic Environment

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
Regular maintenance should be undertaken to ensure no leakages from the pipeline and ensure that erosion control measures are effective	PM/ECO	During breakdowns or maintenance

5.4.2 Fauna and Flora

The establishment of vegetation after rehabilitation

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> a) Replace all plant failures within a three-month period after planting. b) Upon completion of construction and rehabilitation the ECO should assess and approve the adequacy of the rehabilitation and ensure that sufficient levels of rehabilitation have been undertaken to allow re-establishment of the necessary vegetation. c) Rehabilitation works should be monitored until 80 % of vegetation has established 	PM/ECO	During breakdowns or maintenance

5.4.3 Surface Water Contamination

Contamination due to pipe and pump house failure and leaks

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
a) Regular inspections and maintenance of the pipeline must be undertaken during the operational phase, with any leaks repaired immediately. b) Any damage/erosion caused by pipe failure must be repaired immediately following the event	PM/ECO	During breakdowns or maintenance

5.5 Recommendations from Specialists

5.5.1 Wetland Specialist

a) Site Establishment

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> • The footprint area of the working area should be kept a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas; • All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”; • Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation); 	Environmental Control Officer & Site Foreman	Weekly

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> • Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems 		

b) Excavation, construction, and pipeline construction

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> • The recommended buffer zones must be strictly adhered to during the construction phase of the project, with exception of the activities and structures required to traverse a watercourse. Any supporting aspects and activities not required to be within the buffer area must adhere to the buffer zone; • All construction activities and access must make use of the existing road and any access to be established must be beyond the wetland area; • A suitable storm water management plan must be compiled for the construction phase. This plan must attempt to displace and divert storm water and discharge the water into adjacent areas without eroding the receiving areas. It is preferable that run-off velocities be reduced with energy dissipaters and flows discharged into the local watercourses; • Laydown yards, camps and storage areas must be beyond the aquatic areas. Where possible, the construction of the crossings must take place from the existing road and not from within the watercourse and associated buffer; 	Environmental Control Officer & Site Foreman	Weekly

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> • The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly. • It is preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces; • Prevent uncontrolled access of vehicles through the water resources system that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas; • All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site; • Temporary storm water channels should be filled with aggregate and/or logs (branches included) to dissipate flows. • The pipeline must be aligned as close to the road as possible; • Pipeline trenches and sandy bedding material may produce preferential flow paths for water across the project area perpendicular to the general direction of flow instead of angle. This risk can be reduced by installing clay plugs at intervals down the length of the trench to force water out of the trench and down the natural topographical gradient; • Contamination of aquatic systems with unset cement or cement powder should be negated as it is detrimental to aquatic biota. Pre-cast structures should be made use of (where possible) to avoid the mixing of these materials on site, reducing the likelihood of cement in the river system 		

c) Operational Phase, Maintenance and Monitoring

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> • Residents should be educated and informed of how to dispose of waste including hydrocarbon waste; and • Stormwater infrastructure should be maintained regularly; • No sewer connections over watercourse areas, the sewer line must be connected to the existing outfall sewer manholes 	Environmental Control Officer & Site Foreman	During breakdowns or maintenance

5.5.2 Ecological Specialist

a) Manhole Operations

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> • All operations to be guided by the EMPr and the mitigation measures stipulated in this report; • The ECO to monitor all activities • No batching or chemical / fuel storage areas to be laid on unprotected ground; and • All waste from the operations site to be deposited into marked and protected areas like bins depending on their sizes and or nature eg organic waste on their own etc; 	Environmental Control Officer & Site Foreman	Weekly

b) Operation Phase

MITIGATION MEASURES	RESPONSIBILITY	MONITORING FREQUENCY
<ul style="list-style-type: none"> • Ensure that waste management services are provided to service crew men. Safety Health and Environmental (SHE) representative to assist in ensuring service areas are clear from litter and other kinds of waste before moving to the next station; and • Mark the existing invasive plant species for destruction on a continuous process via use of a monitoring plan 	Environmental Control Officer & Site Foreman	During breakdowns or maintenance

6 Ecological Management Plan

The JW sewer pipeline replacement and modification project if properly managed will have almost insignificant impacts to the existing buffer zone of the Westdene dam ecosystem especially during operation. In most cases, ecological management plans are designed for once off projects, it would be advisable to develop an ecological monitoring schedule and/or system to frequently check and advice on the condition of the ecologically sensitive parts within the peripheries of the project for instance water quality of the water-way and drainage system. The area requires development of an active ecological buffer zone which should be managed with an active invasive species eradication, monitoring and management plan. This ecological management guideline will assist in setting up a proper management system for the project. The area's rehabilitation plan is discussed properly in the subsection that follows.

6.1 Rehabilitation Plan

As for rehabilitation, this activity should not wait until operational stage of the project but should continue as a concurrent activity from construction stage right through to operation. This stage is mainly meant to ensure that as the construction process will be taking place, there will be minimum impacts on the environment till the operational stage. After each stage of construction, the affected area should therefore be cleared of waste and if heavily compacted, it must be ripped and a seed-mix is broadcast on top to allow regeneration (secondary succession) the area should also drain to minimise stagnation of water during operation. The above sensitivity maps will assist significantly when trying to identify the zones which should not be impacted by both replacement and operational activities.

The riparian area is a sensitive habitat for sensitive species, there proper handling of such is of uttermost importance during all stages of the project. Flood lines should also not be affected in this instance.

In real terms, all affected areas within project development site should be rehabilitated to suit the original state before development thus to blend the new environment with the old and surrounding environs. The project budget under most cases includes the rehabilitation planning and costs. This report defines rehabilitation as the reinstatement of the temporarily disturbed areas affected by project development and in this case "construction or construction related activities" to a state that resemble the conditions prior to the disturbances. The ECO will also assist in identifying other areas that might require rehabilitation and include them during the process so as to ensure that all the footprints (external) caused by the project are addressed.

These additional points will definitely affect budget and should be expected, therefore when planning for every development, the rehabilitation related costs should be flexible.

It is highly recommended that rehabilitation around the construction footprint takes place immediately after disturbances in order to limit detrimental effects resulting from for example, rainfall events after removal or clearing of the existing material especially storm-water drainage towards the existing stream. They are supposed to blend well with the existing ecological buffer of the area as proposed in the above chapters or sub-sections. It is therefore imperative that rehabilitation of disturbed areas takes places after each construction phase. This will minimise costs and time at the end.

The final stage of rehabilitation requires that local and/or indigenous plant species be planted to enable the area to naturally recover (natural succession) as well as blending with the already existing natural vegetation for the area. Sloping areas will be terraced or benched and top-soil covered (at least 30cm) to assist in encouraging natural growth of plants, a local agricultural expert will be consulted to assist in the determination of what plant species seed-mix should be applied. Proper care and maintenance should therefore be done with independent supervision from the ECO. Monitoring of the rehabilitation process from each phase should be emphasised and the ECO should assist with the blending mechanisms as promulgated in this report. The table below lists the rehabilitation measures that should be undertaken when monitoring post-construction with corrective actions. Please note that each impact is followed by the corrective measure which in this instance is the rehabilitation and the time frames will act as a guide, which can be altered depending on the on-site activities.