water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Private Bag X313, Pretoria, 0001, Sedibeng Building, 185 Francis Baard Street, Pretoria,
Tel: (012) 336-7500 Fax: (012) 323-4472 / (012) 326-2715

WATER USE LICENCE APPLICATION SUMMARY

NAME OF APPLICANT
JOHANNESBURG WATER SOC LTD
P.O. Box 61542
Marshalltown
2107

Compiled by:
Zitholele Consulting (Pty) Ltd
Building 1
Maxwell Office Park
Magwa Crescent West
Waterfall City
Midrand
1685

Signature:
Date: 13 March 2025

1. Applicant details

Name of applicant: Johannesburg Water SOC Ltd
Contact Person: Ms. Joyce Ngobele
Postal address: P.O. Box 61542, Marshalltown, 2107
Cell phone number: 071 609 7328
Office number: 011 688 1443
E-mail address: joyce.ngobele@jwater.co.za

2. Person submitting application

Name	Ms. Natasha Lalie	Dr. Mathys Vosloo
Company	Zitholele Consulting (Pty) Ltd	Zitholele Consulting (Pty) Ltd
Designation	Senior Environmental Assessment Practitioner	Senior Environmental Assessment Practitioner
Postal address	P O Box 6002, Halfway House, 1685	P O Box 6002, Halfway House, 1685
Physical address	Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall City, Midrand, RSA	Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall City, Midrand, RSA
Telephone:	011 207 2060	011 207 2060
Cell phone	082 828 6832	084 748 3018
Fax	086 674 6121	086 674 6121
E-mail	natashal@zitholele.co.za	mathysv@zitholele.co.za
Qualifications	MSc. Environment and Society *(Registered EAP – EAPASA (2021/3611)*	PhD Zoology, Nelson Mandela Metropolitan University (SACNASP Registered – Pr.Sci.Nat – 400136/12)
Preferred means of communication	E-mail	Email

3. Background and purpose

Johannesburg Water SOC Ltd (JW) proposes the development of a new Wastewater Treatment Works (WwTW) located adjacent to the Jukskei River within the Lanseria area. The preferred and approved site is located immediately adjacent to Northern Farm in Lanseria. The WwTW will consist of three phases that will each be 50 Mℓ/d modules, thereby providing a total capacity of 150 Mℓ/d. The project area falls within the Jukskei River Catchment, quaternary catchment A21C, in the Limpopo Water Management Area. An Environmental Authorisation (EA) dated 17 November 2017 was obtained from the Gauteng Department of Agriculture and Rural Development (GDARD). However, a Part 2 amendment of the EA is underway, to authorise changes to the Site Layout Plan that was approved in the EA. A decision for the amendment of the EA is awaited as GDARD is currently reviewing the amendment application.

A Water Use License (WUL) was obtained for the proposed construction of the Lanseria WwTW on 22 July 2020. Several water use activities in terms of Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) was authorised for the proposed Lanseria WwTW, as follows: 21(a), 21(c), 21(f), 21(g) and 21(i) in terms of the WUL. An amendment of the WUL for the WwTW was submitted to the DWS in September 2021 as a separate WULA process and a decision by DWS is awaited.

The proposed Lanseria WwTW is located at the northern edge of the City of Johannesburg jurisdiction, to service new development areas and to provide additional treatment capacity for the existing and growing northern suburbs of the city. Diepsloot and Lanseria are earmarked for urban development and bulk municipal infrastructure is already established or being established in the area. The City of Johannesburg has earmarked the land to the south of the proposed WwTW on Northern Farm for future mass housing development. This area will be serviced by the new WwTW. Plans are also underway to develop the area around Lanseria Airport which is termed Aerotropolis. Lanseria Airport has a small WwTW which will become redundant after the proposed development. The new WwTW is planned to service this area as well.

This project is in support of the City of Johannesburg's Integrated Development Plan for 2012-2016 and Spatial Development Framework.

This WULA is relevant to the proposed additional stormwater infrastructure and road bridge that is proposed at the WwTW site. The proposed infrastructure development falls within a 500m wetland buffer, 100m regulated area of the riparian zone of the Jukskei River and within the wetlands. In terms of Section 21 of the National Water Act (No. 36 of 1998) (NWA), the proposed additional infrastructure triggers the following water uses for which an Integrated Water Use License Application (IWULA) is required:

Table 1: Water use activities that are triggered in terms of the National Water Act, 1998 (Act No. 107 of 1998)

Water Use	Description	Applicable Water Uses to this project
S21 (c)	Impeding or diverting the flow of water in a water course.	There will be several new infrastructure occurring within the 500m regulated area of the wetlands, in the wetlands and in the 100m regulated area of the riparian zone as follows: • Stormwater side drain outlets along access road to the WwTW (8) • Road bridges (2) • Re-alignment of road bridge • Pipe bridges (4) • Pipe crossings (2) • Stormwater culvert crossings along access road to the WwTW (11) • Permanent attenuation ponds (4) • Temporary attenuation ponds (11) • Stormwater infrastructure and ponds (27)
S21 (i)	Altering the bed, banks, course, or characteristics of a watercourse. This includes altering the course of a watercourse (previously referred to as a river diversion).	

As such, Zitholele Consulting (Pty) Ltd was appointed to undertake the IWULA for the proposed additional infrastructure. Zitholele have been in consultation with Mr. Vongani Mhinga from the Department of Water and Sanitation (DWS) and noted their recommendations and requirements when compiling this WULA.

The WULA was lodged with the DWS via the EWULAAS portal on 8 November 2023.

The purpose of the WULA is to highlight all relevant water uses associated with the proposed activity, as well as demonstrate the impacts and mitigation measures to minimise the impacts on the receiving environment.

4. Location of water uses

The additional stormwater infrastructure associated with the proposed WwTW site is situated in Lanseria, north of Johannesburg, within the City of Johannesburg Metropolitan Municipality in the Gauteng Province (refer to Appendix 1).

The site for the additional stormwater infrastructure is located adjacent to the Jukskei River, adjacent to the northern boundary of Northern Farms. Lanseria International Airport is approximately 2.5 km south-west of the project site. Lanseria and parts of Diepsloot are located downstream of the existing wastewater and sewage collection and drainage network, feeding the Northern WwTW. Refer to Appendix 1 for the Master Layout Plan of the proposed additional stormwater infrastructure.

The proposed site for the additional infrastructure falls on Portions 28, 29, 30 and 31 of the Farm Rietfontein No. 532 JQ, and all properties of which are owned by the Applicant, Johannesburg Water (JW), a municipal entity that forms part of the City of Johannesburg (CoJ). The project area falls within the Jukskei River Catchment, quaternary catchment A21C, in the Limpopo Water Management Area.

The geographic location at the centre of the site where the water uses will take place are 25°54’48.25" S; 27 57’31.24" E.

Table 2: Property details

Property description	Title Deed number	Owner
Portion 28 of the Farm Rietfontein No. 532 JQ	T3025/2023	City of Johannesburg Metropolitan Municipality
Portion 29 of the Farm Rietfontein No. 532 JQ		
Portion 30 of the Farm Rietfontein No. 532 JQ		
Portion 31 of the Farm Rietfontein No. 532 JQ		
Portion 131 of Farm Rietfontein No. 532 JQ (Consolidated from Portions 28, 29, 30 and 31)	T3025/2023	City of Johannesburg Metropolitan Municipality

5. Administrative documents and technical reports submitted by applicants

5.1 Administrative documents

5.1.1 The following administrative forms were completed and uploaded on the EWULAAS portal:

- DW758 form
- DW901 forms
- DW902 forms
- DW763 forms
- DW786 forms

5.2 Reports and other technical documents

5.2.1 The following technical documents were uploaded on the EWULAAS portal:

- Section 27 Motivation (dated 12 March 2025)
- Public Participation Advertisement Notices (dated 13 March 2025)
- WULA Summary Report (dated 2 November 2023)
- Environmental Management Programme (dated 2 November 2023)
- Proof of payment of administrative fees (dated 17 July 2024)

- Wetland Assessment Report (dated 9 September 2022)
- Updated Wetland Rehabilitation Plan (dated December 2024)
- Stormwater Infrastructure Maintenance Management Plan (dated June 2024)
- Original Integrated WULA and IWWMP Report (dated 17 August 2017)
- Final Environmental Impact Assessment Report for the Proposed Development of a Wastewater Treatment Works at Lanseria, Gauteng Province (dated August 2017)

6. Project Description

With the construction of the WwTW and associated infrastructure, there will be vegetation clearance on site, and increased hardened infrastructure, and as a result, stormwater runoff must therefore mimic pre-development flows to ensure erosion on site, on the wetlands and watercourses are minimised. There are two wetland types on the site i.e. valley bottom wetlands and hillslope seep wetlands. There is a riparian zone occurring on the western boundary of the site. As a result of the proposed upgrade of the main access road leading to the proposed WwTW, several stormwater culverts will be upgraded across tributaries of the Jukskei River. There will be several new infrastructure occurring within the 500m regulated area of the wetlands, in the wetlands and in the 100m regulated area of the riparian zone as follows:

- Stormwater side drain outlets along the main access road to the WwTW (8)
- Road bridges (2)
- Re-alignment of road bridge
- Pipe bridges (4)
- Pipe crossings (2)
- Stormwater culvert crossings along the main access road to the WwTW (11)
- Permanent attenuation ponds (4)
- Temporary attenuation ponds (12)
- Stormwater infrastructure and ponds (27)

Three attenuation ponds will be constructed on site to delay storm water entering the natural water courses. Several small temporary attenuation ponds will be constructed in open areas on site where future structures will be built.

7. Methods statement (only for c and i activity) and mining method/ industrial process

The proposed water uses do not relate to mining and industrial purposes.

This construction method statement highlights the key measures that will be implemented during the construction of the works to limit unnecessary disturbance of the environment. An Environmental Management Programme (EMPr) will be issued to the contractor before the start of the construction, and monitoring will be done during construction by an Environmental Control Officer (ECO). The key activities associated with the proposed additional infrastructure are as follows:

- Upgrading of culverts along the main access road to the Lanseria WwTW;
- Internal stormwater infrastructure to be constructed at the Lanseria WwTW; and
- Construction of permanent and temporary attenuation ponds.

The construction methodology for the upgrade of the culverts along the main access road is described below:

The existing Falkirk Road that starts at the R114 provincial road will be used as the main access road to the Lanseria WwTW. The start of Falkirk Road is a tarred road, until after the bridge over the N14. Falkirk Road will be surfaced from the end of the tarred section until the crossing with Koedoe Road. The section of Koedoe Road from this crossing until the entrance to the Lanseria WwTW property will also be surfaced. The road will be a 7m wide road with single lane traffic in each direction.

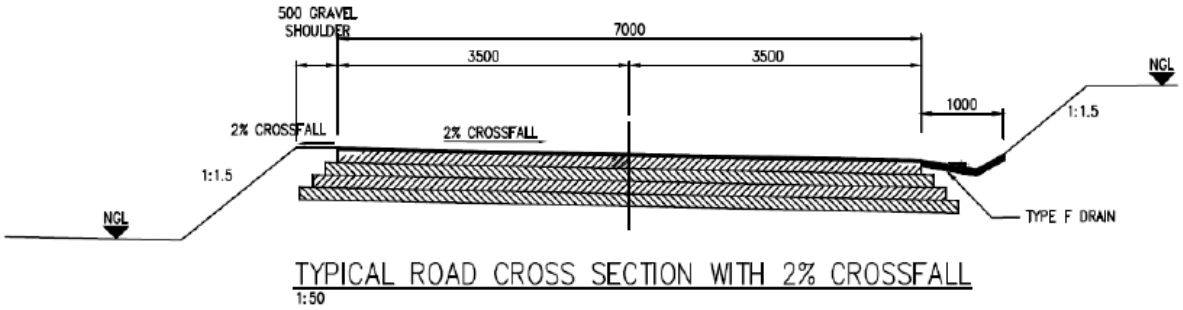

Figure 1: Typical Access Road Cross Section

The two main culverts in Falkirk Road were analysed and found to be inadequate for the class of the road and will therefore be upgraded to larger precast concrete box culverts with wingwalls at the entrance and exit ends.

All other existing small pipe culverts in Falkirk Road will be replaced and upgraded during the construction of the road with concrete pipes of minimum diameter of 600mm and class 100D. Wingwalls will be constructed on both ends of the pipes to ease the entrance and exit of the runoff and to prevent standing of water.

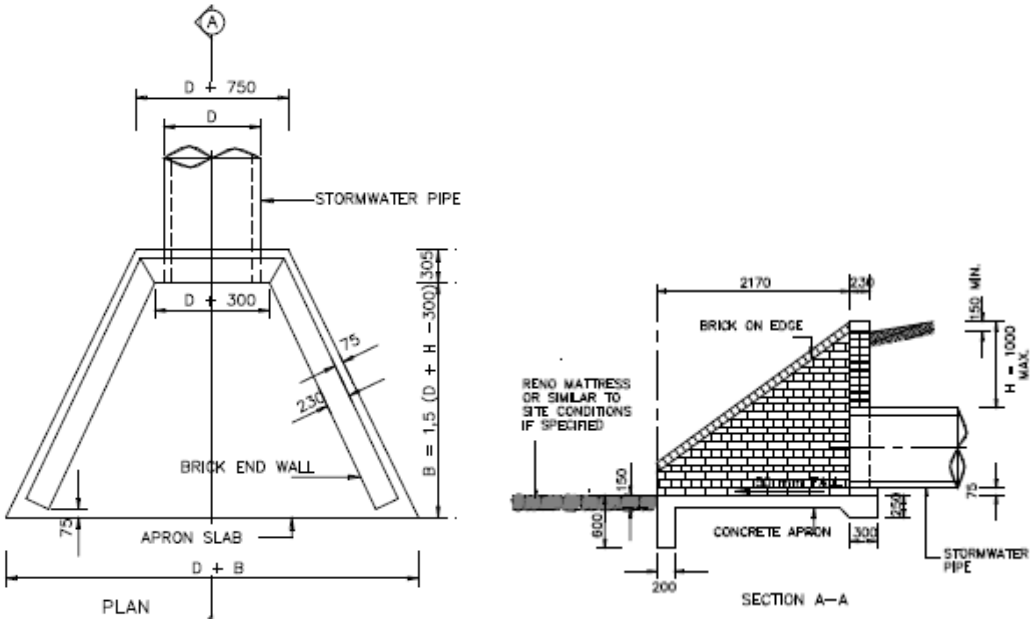

Figure 2: Detail of Wingwalls at Culverts

The main culvert in Koedoe Road was found to be adequate and will therefore not be altered only the small pipe culverts will be upgraded and replaced with the construction of the upgraded portion of the road.

(a) Internal Stormwater Handling

All internal roads from the main entrance gate will be paved using 80mm thick concrete paving blocks, with precast concrete kerbing used as restraining edges.

All areas around structures and buildings will also be covered with 80mm concrete block paving for access during maintenance and motoring of the process units.

As requested by the Johannesburg Roads Agency (JRA) stormwater handling on the site was designed by installing temporary and permanent attenuation ponds. Temporary ponds will be installed when the full Works is not constructed in the open areas where future structures will be constructed. Permanent ponds will be installed in available open areas where no structures will be built.

Stormwater will be canalised by either 500mm wide concrete channels covered with steel grating or concrete pipes of minimum diameter of 450mm towards the attenuation ponds and with concrete pipes from the ponds.

(b) Attenuation Ponds

The Permanent and Temporary Attenuation Ponds will be constructed as unlined earth ponds with planted vegetation on the basin and on the slopes of the embankments. The vegetation on the basin will be selected for water absorption and to prevent standing water from going stale, to act similarly to a wetland. The vegetation on the slopes will be grassing, to prevent erosion during floods. The outlet of all ponds will be done with a concrete outlet box, with a weir to delay the outlet of the water from the pond but to enable emptying of the pond through a small opening on the floor of the weir wall.

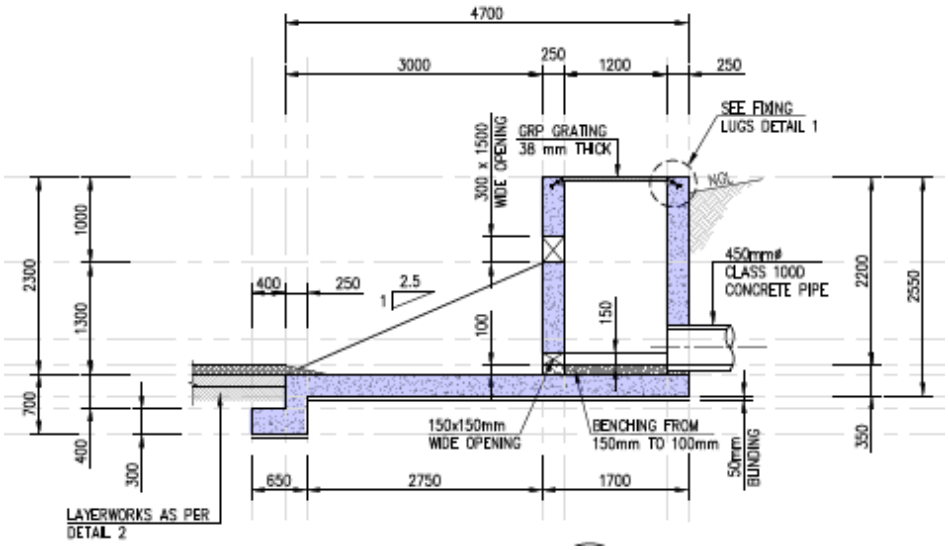

Figure 3: Section through Pond Outlet

(c) Importing of material

Importing of construction materials may be required, such as material that will be used for bedding of pipes, should the in-situ material not be sufficient or of a suitable quality. Care will be taken to not allow this material to contaminate the wetland areas.

(d) Stockpiling of excavated material

As large volumes of excavated material will be handled on site, stockpiling of excavated material will most likely be required. Stockpile areas will be sited at areas that are at a relatively high elevation on the site, and as far as possible from the water courses. Erosion protection measures will be implemented, and maintained on a regular basis.

(e) Fauna and Flora

Vegetation in the wetland area that might be affected by unavoidable construction activity in that area will be relocated to other wetland areas.

Before clearing of the site is undertaken, any endangered flora species will be temporarily relocated, and will be replanted when construction has been completed.

(f) Construction vehicles

All construction vehicles will be kept outside the wetland areas, as far as possible, to avoid any damage to the wetland. Wetlands will be clearly demarcated.

(g) Ablution facilities

Only chemical toilets will be allowed on the construction site, to prevent any contamination of surface or groundwater.

(h) Hazardous Chemicals

Areas that will be used to store and handle hazardous chemicals (such as oil and diesel) will be bunded to contain spillages.

8. Stormwater Management Plan

A Storm Water Management Plan has been designed for Lanseria WwTW as indicated in the sections below.

The principal objectives of the Stormwater Management Plan are as follows:

- To outline mitigation measures in managing increased stormwater run-offs due to the development of the new WwTW.
- To establish a stormwater management strategy compliant with the Johannesburg Roads Agency (JRA) requirements.

The following table highlights the design criteria used in the storm water design for the Lanseria WwTW:

Table 3: Storm water Design Criteria

Design Parameter	Guideline
Design Flood Determination Method	Alternative Rational Method & Standard Design Flood
Mean Annual Precipitation	659 mm
Design Flood Recurrence Interval	Minor System – 5 Years Major System – 25 Years
Minimum Pipe Diameter	450 mm
Minimum Velocity	0.8 m/s
Maximum Velocity	3.5 m/s
Pipe Capacity	80 % of flow depth
Minimum Slope for pipes	0.4%
Minimum Slope for concrete channels	1%
Pipe & Channel material	Precast or cast in situ concrete
Minimum Cover to pipes (Roads)	1.0 m
Minimum Cover to pipes (Servitudes)	0.8 m

(a) Pipes and Channels Sizing

The range of pipe sizes and channel sizes for the proposed stormwater network are summarised in Table 4.

Table 4: Proposed Pipe and Channel Sizes

Description	Dimension	Total Length (m)
Concrete Stormwater Pipes	450 mm diameter	2990
	525 mm diameter	270
	600 mm diameter	180
	675 mm diameter	80
	750 mm diameter	390
	825 mm diameter	330
	900 mm diameter	30
Rectangular Channels	600 mm x 450 mm (Width x Height)	1900

(b) Proposed Attenuation Facilities

(i) <u>Attenuation Facility Design Criteria</u>

The design of the attenuation ponds was guided by the JRA's policy for all new developments regarding stormwater management on site. The requirements of the policy are as follows:

- All developments on land exceeding 8 500 m² are subject to stormwater attenuation on site.

- The preferred means of attenuation is on the surface.
- Attenuating off-site is acceptable to compensate for the lack of an on-site facility.
- The run-off associated with the development is to be attenuated such that the pre-development flows for the 1: 5 and the 1:25 year storm events are not exceeded. The attenuation structure must be able to withstand a 1:50-year storm event.
- Discharge from the attenuation facility is subject to approval by the landowner downstream (where applicable).
- A storage volume of 350 m^3/ha is required for a pond subjected to a 1:50-year storm event.
- In most instances, a pre-development run-off factor greater than 0,28 requires special motivation. The same applies to a post-development factor less than 0,8.

(ii) Model Selection

The Environmental Protection Agency's Stormwater Management Model (EPA SWMM) was used to analyse the stormwater run-off and design the attenuation ponds for this development. EPA SWMM was chosen because of its ability to simulate pre- and post-development stormwater run-off and accurately approximate the site's run-off characteristics.

The pre-and post-development stormwater run-off simulation for 1:5, 1:25, and 1:50 return periods was undertaken and verified using hand calculations based on the Rational method. EPA SWMM also produced the performance hydrographs of the proposed stormwater infrastructure.

From the developed area (30 ha), as mentioned earlier, the total catchment area draining to ponds is 24.87 ha. No ponds will be provided for the remaining 5.13 ha catchment, because of wetlands buffers in the vicinity. Hence, the 5.13 ha catchment area will drain directly into the adjacent natural stream via underground stormwater pipes. Therefore, since the total catchment area of the ponds on the proposed development is 24.87 ha, the expected required volume is approximately 8 705 m^3 (24.87 ha x 350 m^3/ha) as per JRA's policy of storage volume of 350 m^3/ha.

For this development, ten attenuation ponds are proposed, of which three ponds on the terraces adjacent to the Balancing Tanks (Temporary Pond 1A & 1B), Biological Reactor (Temporary Pond 2A & 2B), and Clarifiers (Temporary Pond 3A & 3B) respectively are temporary and will be moved accordingly during the phasing of the construction of the new WwTW. Furthermore, the other three ponds in the sludge handling area (adjacent to the Sludge Drying Beds, Lime Clarifiers, and Digesters) and one (1) pond in the Primary Sedimentation Tank (PST) are also temporary.

8.1 Pre-Development

8.1.1 Modelling Parameters

The pre-development modelling parameters for this development are presented in Table 5.

Table 5: Pre-Development Modelling Parameters

Catchment Designation		Catchment Area (ha)	Longest Watercourse (m)	Average Slope (m/m)	Run-off Coefficient
Permanent Pond 1		1.18	188	0.04	0.28
Permanent Pond 2		1.90	400	0.01	0.28
Permanent Pond 3		2.10	393	0.07	0.28
Temporary Pond 1A		1.77	325	0.0041	0.28
Temporary Pond 2A		2.84	388	0.02	0.28
Temporary Pond 3A		2.09	278	0.01	0.28
Temporary Pond 1B		1.77	325	0.0041	0.28
Temporary Pond 2B		2.84	388	0.02	0.28
Temporary Pond 3B		2.09	273	0.01	028
Temporary Pond 4(A & B)		2.42	169	0.06	0.28
Temporary Pond 5A		0.54	200	0.07	0.28
Temporary Pond 6A		0.89	170	0.07	0.28
Temporary Pond 7(A&B)		2.44	200	0.08	0.28
Total Catchment Area (ha)		**24.87**			

Table 6: Rainfall Intensity for Specified Storm Duration

Intensity (mm/hour)												
Return Period (Years)	Storm Duration (mins)											
	5	10	15	20	25	30	35	40	45	50	55	60
5	60	94	114	97	84	74	67	61	56	52	49	46
25	103	162	196	166	144	128	115	105	97	90	84	79
50	121	191	232	195	170	151	136	124	114	106	99	93

8.1.2 Model Results

The pre-development results are presented in Table 7.

Table 7: Pre-Runoff for Specified Storm Duration

Pre-Runoff (m^3/s)													
Catchment Designation	**Return Period (Years)**	**Storm Duration (mins)**											
		5	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**
Permanent Pond 1	**5**	0.06	0.09	0.11	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.04
	25	0.09	0.15	0.18	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07
	50	0.11	0.18	0.21	0.18	0.16	0.14	0.13	0.11	0.11	0.10	0.09	0.09
Permanent Pond 2	**5**	0.09	0.14	0.17	0.14	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.07
	25	0.15	0.24	0.29	0.24	0.21	0.19	0.17	0.16	0.14	0.13	0.12	0.12
	50	0.18	0.28	0.34	0.29	0.25	0.22	0.20	0.18	0.17	0.16	0.15	0.14
Permanent Pond 3	**5**	0.10	0.15	0.19	0.16	0.14	0.12	0.11	0.10	0.09	0.09	0.08	0.07
	25	0.17	0.26	0.32	0.27	0.24	0.21	0.19	0.17	0.16	0.15	0.14	0.13
	50	0.20	0.31	0.38	0.32	0.28	0.25	0.22	0.20	0.19	0.17	0.16	0.15
Temporary Pond 1A	**5**	0.08	0.13	0.16	0.13	0.12	0.10	0.09	0.08	0.08	0.07	0.07	0.06
	25	0.14	0.22	0.27	0.23	0.20	0.18	0.16	0.14	0.13	0.12	0.12	0.11
	50	0.17	0.26	0.32	0.27	0.23	0.21	0.19	0.17	0.16	0.15	0.14	0.13
Temporary Pond 2A	**5**	0.13	0.21	0.25	0.21	0.19	0.16	0.15	0.14	0.12	0.12	0.11	0.10
	25	0.23	0.36	0.43	0.37	0.32	0.28	0.25	0.23	0.21	0.20	0.19	0.17
	50	0.27	0.42	0.51	0.43	0.38	0.33	0.30	0.27	0.25	0.23	0.22	0.20
Temporary Pond 3A	**5**	0.10	0.15	0.19	0.16	0.14	0.12	0.11	0.10	0.09	0.09	0.08	0.07
	25	0.17	0.26	0.32	0.27	0.23	0.21	0.19	0.17	0.16	0.15	0.14	0.13
	50	0.20	0.31	0.38	0.32	0.28	0.24	0.22	0.20	0.19	0.17	0.16	0.15

Pre-Runoff (m^3/s)													
Catchment Designation	**Return Period (Years)**	**Storm Duration (mins)**											
		5	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**
Temporary Pond 1B	**5**	0.08	0.13	0.16	0.13	0.12	0.10	0.09	0.08	0.08	0.07	0.07	0.06
	25	0.14	0.22	0.27	0.23	0.20	0.18	0.16	0.14	0.13	0.12	0.12	0.11
	50	0.17	0.26	0.32	0.27	0.23	0.21	0.19	0.17	0.16	0.15	0.14	0.13
Temporary Pond 2B	**5**	0.13	0.21	0.25	0.21	0.19	0.16	0.15	0.14	0.12	0.12	0.11	0.10
	25	0.23	0.36	0.43	0.37	0.32	0.28	0.25	0.23	0.21	0.20	0.19	0.17
	50	0.27	0.42	0.51	0.43	0.38	0.33	0.30	0.27	0.25	0.23	0.22	0.20
Temporary Pond 3B	**5**	0.10	0.15	0.19	0.16	0.14	0.12	0.11	0.10	0.09	0.09	0.08	0.07
	25	0.17	0.26	0.32	0.27	0.23	0.21	0.19	0.17	0.16	0.15	0.14	0.13
	50	0.20	0.31	0.38	0.32	0.28	0.24	0.22	0.20	0.19	0.17	0.16	0.15
Temporary Pond 4 (A&B)	**5**	0.11	0.18	0.22	0.18	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.09
	25	0.19	0.30	0.37	0.31	0.27	0.24	0.22	0.20	0.18	0.17	0.16	0.15
	50	0.23	0.36	0.44	0.37	0.32	0.28	0.26	0.23	0.21	0.20	0.19	0.17
Temporary Pond 5A	**5**	0.03	0.04	0.05	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02
	25	0.04	0.07	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03
	50	0.05	0.08	0.10	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04
Temporary Pond 6A	**5**	0.04	0.07	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03
	25	0.07	0.11	0.14	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05
	50	0.08	0.13	0.16	0.14	0.12	0.10	0.09	0.09	0.08	0.07	0.07	0.06
Temporary Pond 7 (A&B)	**5**	0.11	0.18	0.22	0.18	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.09
	25	0.19	0.31	0.37	0.31	0.27	0.24	0.22	0.20	0.18	0.17	0.16	0.15
	50	0.23	0.36	0.44	0.37	0.32	0.29	0.26	0.24	0.22	0.20	0.19	0.18

Table 8: Summary of Peak Discharges (Pre-Runoffs)

Catchment Designation	Return Period (Years)		
	Peak Run-off (m^3/s)		
	1:5	1:25	1:50
Permanent Pond 1	0.11	0.18	0.21
Permanent Pond 2	0.17	0.29	0.34
Permanent Pond 3	0.19	0.32	0.38
Temporary Pond 1A	0.16	0.27	0.32
Temporary Pond 2A	0.25	0.43	0.51
Temporary Pond 3A	0.19	0.32	0.38
Temporary Pond 1B	0.16	0.27	0.32
Temporary Pond 2B	0.25	0.43	0.51
Temporary Pond 3B	0.19	0.32	0.38
Temporary Pond 4(A & B)	0.22	0.37	0.44
Temporary Pond 5A	0.05	0.08	0.10
Temporary Pond 6A	0.08	0.14	0.16
Temporary Pond 7(A & B)	0.21	0.38	0.56

The pre-development modelling results above were compared to those from the hand calculations using the Rational method and were found to correspond.

8.2 Post-Development

8.2.1 Modelling Parameters

The post-development modelling parameters for this development are presented in Table 9.

Table 9: Post-Development Modelling Parameters

Catchment Designation	Catchment Area (ha)	Longest Watercourse (m)	Average Slope (m/m)	Run-off Coefficient
Permanent Pond 1	1.18	188	0.04	0.82
Permanent Pond 2	1.90	400	0.01	0.82
Permanent Pond 3	2.10	393	0.07	0.82
Temporary Pond 1A	1.77	156	0.0041	0.82
Temporary Pond 2A	2.84	196	0.02	0.82
Temporary Pond 3A	2.09	116	0.01	0.82
Temporary Pond 1B	1.77	226	0.0041	0.82
Temporary Pond 2B	2.84	274	0.02	0.82
Temporary Pond 3B	2.09	187	0.01	0.82
Temporary Pond 4(A & B)	2.42	132	0.06	0.82
Temporary Pond 5A	0.54	150	0.07	0.82
Temporary Pond 6A	0.89	154	0.07	0.82
Temporary Pond 7(A&B)	2.44	159	0.09	0.82
Total Catchment Area (ha)	**24.87**			

8.2.2 Model Results

The post-development modelling results are presented in **Tables 10** and **11**.

Table 10: Post-Runoff for Specified Storm Duration

Post-Runoff (m^3/s)													
Catchment Designation	**Return Period (Years)**	**Storm Duration (mins)**											
		5	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**
Permanent Pond 1	**5**	0.16	0.25	0.30	0.26	0.22	0.20	0.18	0.16	0.15	0.14	0.13	0.12
	25	0.27	0.43	0.52	0.44	0.38	0.34	0.30	0.28	0.26	0.24	0.22	0.21
	50	0.32	0.50	0.61	0.52	0.45	0.40	0.36	0.33	0.30	0.28	0.26	0.25
Permanent Pond 2	**5**	0.25	0.40	0.48	0.41	0.35	0.31	0.28	0.26	0.24	0.22	0.21	0.19
	25	0.43	0.68	0.83	0.70	0.61	0.54	0.49	0.44	0.41	0.38	0.35	0.33
	50	0.51	0.81	0.98	0.83	0.72	0.64	0.57	0.52	0.48	0.45	0.42	0.39
Permanent Pond 3	**5**	0.28	0.44	0.53	0.45	0.39	0.35	0.31	0.29	0.26	0.24	0.23	0.21
	25	0.48	0.75	0.92	0.77	0.67	0.60	0.54	0.49	0.45	0.42	0.39	0.37
	50	0.56	0.89	1.08	0.91	0.79	0.70	0.63	0.58	0.53	0.49	0.46	0.43
Temporary Pond 1A	**5**	0.24	0.37	0.45	0.38	0.33	0.29	0.26	0.24	0.22	0.21	0.19	0.18
	25	0.40	0.64	0.77	0.65	0.57	0.50	0.45	0.41	0.38	0.35	0.33	0.31
	50	0.48	0.75	0.91	0.77	0.67	0.59	0.53	0.49	0.45	0.42	0.39	0.37
Temporary Pond 2A	**5**	0.38	0.60	0.72	0.61	0.53	0.47	0.42	0.39	0.36	0.33	0.31	0.29
	25	0.65	1.02	1.24	1.05	0.91	0.81	0.73	0.66	0.61	0.57	0.53	0.50
	50	0.76	1.20	1.46	1.23	1.07	0.95	0.86	0.78	0.72	0.67	0.62	0.59
Temporary Pond 3A	**5**	0.28	0.44	0.53	0.45	0.39	0.35	0.31	0.28	0.26	0.24	0.23	0.21
	25	0.48	0.75	0.91	0.77	0.67	0.59	0.53	0.49	0.45	0.42	0.39	0.37
	50	0.56	0.89	1.08	0.91	0.79	0.70	0.63	0.58	0.53	0.49	0.46	0.43

Post-Runoff (m^3/s)												
Catchment Designation	**Return Period (Years)**	**Storm Duration (mins)**										
		5	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**
Temporary Pond 1B	**5**	0.24	0.37	0.45	0.38	0.33	0.29	0.26	0.24	0.22	0.21	0.19	0.18
	25	0.40	0.64	0.77	0.65	0.57	0.50	0.45	0.41	0.38	0.35	0.33	0.31
	50	0.48	0.75	0.91	0.77	0.67	0.59	0.53	0.49	0.45	0.42	0.39	0.37
Temporary Pond 2B	**5**	0.38	0.60	0.72	0.61	0.53	0.47	0.42	0.39	0.36	0.33	0.31	0.29
	25	0.65	1.02	1.24	1.05	0.91	0.81	0.73	0.66	0.61	0.57	0.53	0.50
	50	0.76	1.20	1.46	1.23	1.07	0.95	0.86	0.78	0.72	0.67	0.62	0.59
Temporary Pond 3B	**5**	0.28	0.44	0.53	0.45	0.39	0.35	0.31	0.28	0.26	0.24	0.23	0.21
	25	0.48	0.75	0.91	0.77	0.67	0.59	0.53	0.49	0.45	0.42	0.39	0.37
	50	0.56	0.89	1.08	0.91	0.79	0.70	0.63	0.58	0.53	0.49	0.46	0.43
Temporary Pond 4 (A&B)	**5**	0.32	0.51	0.62	0.52	0.45	0.40	0.36	0.33	0.30	0.28	0.26	0.25
	25	0.55	0.87	1.06	0.89	0.77	0.69	0.62	0.56	0.52	0.48	0.45	0.42
	50	0.65	1.03	1.25	1.05	0.91	0.81	0.73	0.67	0.61	0.57	0.53	0.50
Temporary Pond 5A	**5**	0.07	0.11	0.14	0.12	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.06
	25	0.12	0.19	0.24	0.20	0.17	0.15	0.14	0.13	0.12	0.11	0.10	0.09
	50	0.15	0.23	0.28	0.23	0.20	0.18	0.16	0.15	0.14	0.13	0.12	0.11
Temporary Pond 6A	**5**	0.12	0.19	0.23	0.19	0.17	0.15	0.13	0.12	0.11	0.10	0.10	0.09
	25	0.20	0.32	0.39	0.33	0.28	0.25	0.23	0.21	0.19	0.18	0.17	0.16
	50	0.24	0.38	0.46	0.39	0.34	0.30	0.27	0.25	0.23	0.21	0.20	0.18
Temporary Pond 7 (A&B)	**5**	0.32	0.51	0.62	0.52	0.46	0.40	0.36	0.33	0.31	0.28	0.27	0.25
	25	0.56	0.88	1.07	0.90	0.78	0.69	0.62	0.57	0.52	0.49	0.45	0.43
	50	0.66	1.04	1.26	1.06	0.92	0.82	0.74	0.67	0.62	0.57	0.54	0.50

Table 11: Summary of Peak Discharges (Post-Runoffs)

Catchment Designation	Return Period (Years)		
	Peak Run-off (m^3/s)		
	1:5	1:25	1:50
Permanent Pond 1	0.30	0.52	0.61
Permanent Pond 2	0.48	0.83	0.98
Permanent Pond 3	0.53	0.92	1.08
Temporary Pond 1A	0.45	0.77	0.91
Temporary Pond 2A	0.72	1.24	1.46
Temporary Pond 3A	0.53	0.91	1.08
Temporary Pond 1B	0.45	0.77	0.91
Temporary Pond 2B	0.72	1.24	1.46
Temporary Pond 3B	0.53	0.91	1.08
Temporary Pond 4(A & B)	0.62	1.06	1.25
Temporary Pond 5A	0.14	0.24	0.28
Temporary Pond 6A	0.23	0.39	0.46
Temporary Pond 7(A&B)	0.61	1.12	1.47

The post-development modelling results above were compared to the results from the hand calculations using the Rational method and were found to be similar.

8.3 Attenuation and Routing through Attenuation Ponds

The characteristics of the proposed attenuation facilities in this development are provided in Table 12.

Table 12: Pond Characteristics

Characteristics of the Attenuation Ponds								
Pond Designation	Rectangular Ponds						Outlet Structure	
	Length (m)	Width (m)	Surface Area (m^2)	Depth (m)	Required Stored Volume (m^3)	Design Storage Volume (m^3) – Freeboard	Outlet Pipe Diameter (m)	Weir (L x H)
Permanent Pond 1	50	25	1 250	0.5	417	667	0.375	0.5 m x 0.3 m
Permanent Pond 2	60	30	1 800	0.6	647	1 008	0.375	0.5 m x 0.3 m
Permanent Pond 3	68	34	2 306	0.5	772	954	0.400	0.5 m x 0.3 m
Temporary Pond 1A	59	29	1 738	0.6	621	1 008	0.350	0.5 m x 0.3 m
Temporary Pond 2A	59	29	1 738	0.8	1 002	1 356	0.375	0.5 m x 0.3 m
Temporary Pond 3A	59	29	1 738	0.6	740	1 095	0.375	0.5 m x 0.3 m
Temporary Pond 1B	59	29	1 738	0.6	621	973	0.350	0.5 m x 0.3 m
Temporary Pond 2B	59	29	1 738	0.8	1 002	1 356	0.375	0.5 m x 0.3 m
Temporary Pond 3B	59	29	1 738	0.6	740	1 095	0.375	0.5 m x 0.3 m
Temporary Pond 4(A & B)	38	19	736	1.5	852	1 075	0.300	0.5 m x 0.2 m
Temporary Pond 5A	19	10	188	1.4	206	263	0.110	0.3 m x 0.2 m
Temporary Pond 6A	19	10	184	2.0	286	432	0.200	0.3 m x 0.2 m
Temporary Pond 7(A&B)	36	18	648	2.0	908	1 296	0.400	0.5 m x 0.3 m
Total Storage Volume (m^3)					**8 814**	**12 634**		

The 1:5 and 1:25-year storm events were designed to be fully attenuated within the ponds, while the 1:50-year storm event was designed to overflow through a weir without overtopping the pond. Each pond is drained through an outlet pipe located at the invert of the headwall. The outlet pipes were sized to restrict pond discharge to match pre-development flows. The pipes daylight and discharge into the Jukskei River.

The performance of the attenuation ponds is presented in **Table 13,** which shows that the attenuated run-off (Pond-Discharge) from the ponds approximately matches or is less than the pre-development run-off (Pre-Runoff). From the hydrographs, it is evident that the proposed attenuation ponds for this development can effectively attenuate the post-development run-off (Post-Runoff).

A total design storage volume (including freeboard) of 12 634 m^3 has been provided to cater to the required storage volume of 8 814 m^3. The required storage volume (8 814 m^3) is comparable to JRA's Guideline of a 350 m^3 storage volume per hectare (24.87 ha x 350 m^3/ha = 8 705 m^3). Therefore, the management objective of the stormwater scheme has been met. Hence, the proposed stormwater management strategy can be considered effective and sustainable.

Table 13: Performance of Attenuation Ponds

Description	Return Period (Years)		
	1:5	1:25	1:50
Permanent Pond 1			
Pre-Runoff (Q_{pre}) [m³/s]	0.11	0.18	0.21
Post-Runoff (Q_{post}) [m³/s]	0.30	0.52	0.61
Pond-Discharge (Q_{pond}) [m³/s]	0.10	0.12	0.14
Permanent Pond 2			
Pre-Runoff (Q_{pre}) [m³/s]	0.17	0.29	0.34
Post-Runoff (Q_{post}) [m³/s]	0.48	0.83	0.98
Pond-Discharge (Q_{pond}) [m³/s]	0.13	0.18	0.20
Permanent Pond 3			
Pre-Runoff (Q_{pre}) [m³/s]	0.19	0.32	0.38
Post-Runoff (Q_{post}) [m³/s]	0.53	0.92	1.08
Pond-Discharge (Q_{pond}) [m³/s]	0.13	0.21	0.22
Temporary Pond 1A			
Pre-Runoff (Q_{pre}) [m³/s]	0.16	0.27	0.32
Post-Runoff (Q_{post}) [m³/s]	0.45	0.77	0.91
Pond-Discharge (Q_{pond}) [m³/s]	0.13	0.25	0.17
Temporary Pond 2A			
Pre-Runoff (Q_{pre}) [m³/s]	0.25	0.43	0.51
Post-Runoff (Q_{post}) [m³/s]	0.72	1.24	1.46
Pond- Discharge (Q_{pond}) [m³/s]	0.12	0.23	0.25
Temporary Pond 3A			
Pre-Runoff (Q_{pre}) [m³/s]	0.19	0.32	0.38
Post-Runoff (Q_{post}) [m³/s]	0.53	0.91	1.08
Pond-Discharge (Q_{pond}) [m³/s]	0.10	0.20	0.22
Temporary Pond 1B			
Pre-Runoff (Q_{pre}) [m³/s]	0.16	0.27	0.32
Post-Runoff (Q_{post}) [m³/s]	0.45	0.77	0.91
Pond-Discharge (Q_{pond}) [m³/s]	0.13	0.25	0.17
Temporary Pond 2B			
Pre-Runoff (Q_{pre}) [m³/s]	0.25	0.43	0.51
Post-Runoff (Q_{post}) [m³/s]	0.72	1.24	1.46
Pond-Discharge (Q_{pond}) [m³/s]	0.12	0.23	0.25
Temporary Pond 3B			

Description	Return Period (Years)		
	1:5	1:25	1:50
Pre-Runoff (Q_{pre}) [m³/s]	0.19	0.32	0.38
Post-Runoff (Q_{post}) [m³/s]	0.53	0.91	1.08
Pond-Discharge (Q_{pond}) [m³/s]	0.10	0.20	0.22
Temporary Pond 4(A & B)			
Pre-Runoff (Q_{pre}) [m³/s]	0.22	0.37	0.44
Post-Runoff (Q_{post}) [m³/s]	0.62	1.06	1.25
Pond-Discharge (Q_{pond}) [m³/s]	0.16	0.32	0.36
Temporary Pond 5A			
Pre-Runoff (Q_{pre}) [m³/s]	0.05	0.08	0.10
Post-Runoff (Q_{post}) [m³/s]	0.14	0.24	0.28
Pond-Discharge (Q_{pond}) [m³/s]	0.04	0.08	0.10
Temporary Pond 6A			
Pre-Runoff (Q_{pre}) [m³/s]	0.08	0.14	0.16
Post-Runoff (Q_{post}) [m³/s]	0.23	0.39	0.46
Pond-Discharge (Q_{pond}) [m³/s]	0.05	0.12	0.15
Temporary Pond 7(A&B)			
Pre-Runoff (Q_{pre}) [m³/s]	0.21	0.38	0.56
Post-Runoff (Q_{post}) [m³/s]	0.61	1.12	1.47
Pond-Discharge (Q_{pond}) [m³/s]	0.17	0.35	0.47

8.4 Management scheme

8.4.1 Proposed Stormwater Management Scheme

The development of the new WwTW means the undeveloped land will be transformed into a hardened surface because of roofs, paved parking areas, and roads. This limits the volume of water that can infiltrate the ground, thereby increasing stormwater run-off. High stormwater run-off has negative impacts on both humans and the environment. Hence, the need for an effective stormwater management philosophy.

The proposed stormwater management philosophy for this development entails the collection of run-offs into underground pipes and channels, which discharges into attenuation ponds. The attenuation ponds store and manages the increased flows between pre- and post-development.

The stormwater run-off from impervious surfaces like roads paved (open) areas and roofs drain into stormwater concrete pipes and channels through kerb inlets and catch pits. The pipes and channels convey the run-off into attenuation ponds, where the increased flow is attenuated while silt is deposited. Due to the size of the site, several attenuation ponds have been proposed and are placed at the lower ends of the site, close to the natural streams where they will discharge.

As mentioned earlier, the development will be carried out in three phases, each involving the implementation of a 50 Mℓ/d module treatment facility. Therefore, the stormwater management plan has been developed accordingly for each module.

The attenuation ponds adjacent to the Balancing Tanks (Temporary 1A & 1B), Biological Reactor (Temporary 2A & 2B), and Clarifiers (Temporary 3A & 3B), as well as the three ponds next to the Sludge Drying Beds (Temporary Pond 4(A & B)), Lime Clarifiers (Temporary Pond 5A), Digesters (Temporary Pond 6A) and one pond in the Primary Sedimentation Tanks (Temporary 7 (A&B)), are considered temporary ponds and will be moved (demolished and rebuild) to allow for expansion during the different phases of construction. The ponds located in the North, West, and East of the site are permanent. Refer to **Figure 4** below for the general arrangement of all ponds (combined). The channels and underground pipes feeding into or drawing off temporary ponds will be rerouted under each phase.
.

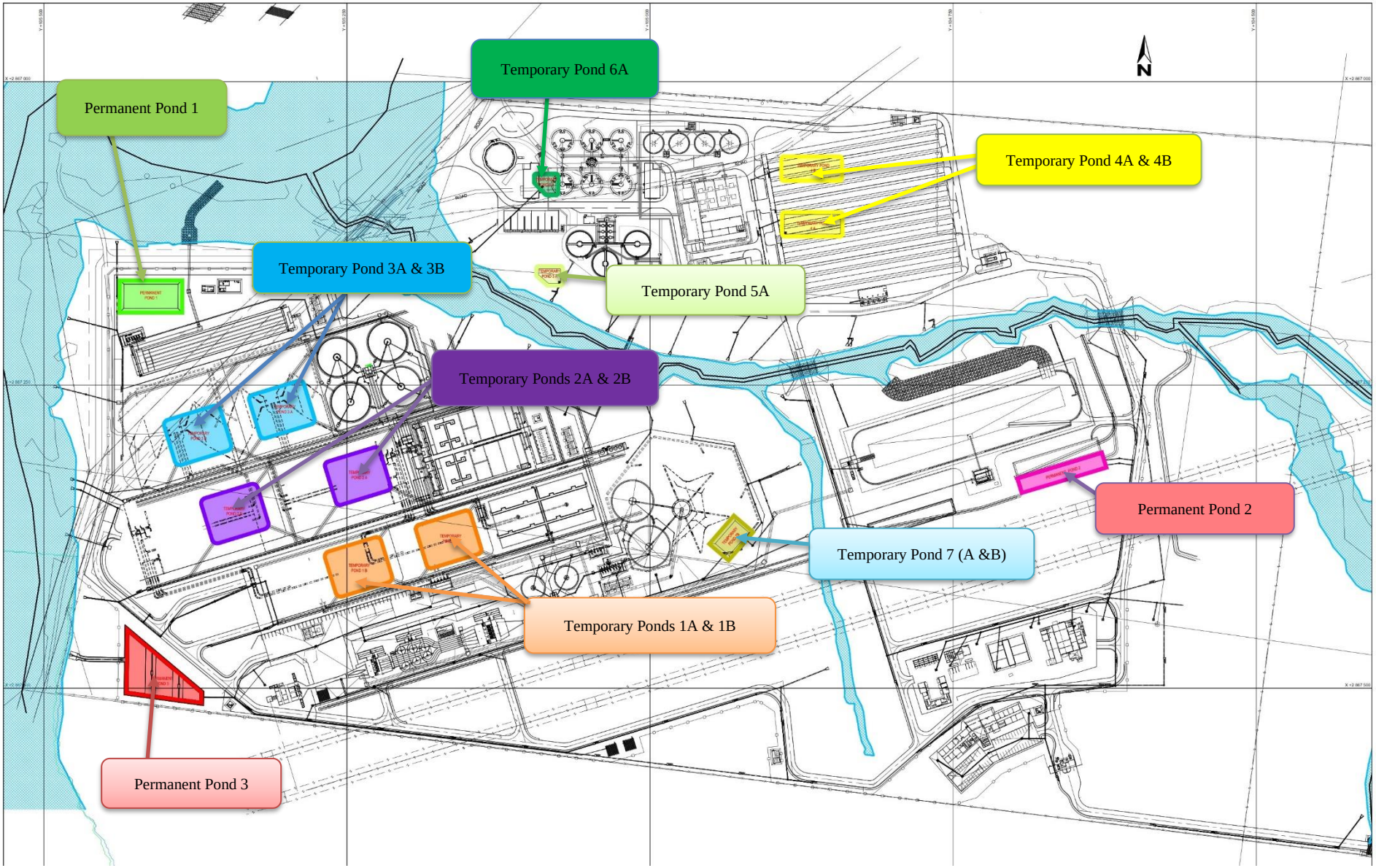

Figure 4: General Arrangement of Ponds

The outlet or discharge from the attenuation ponds, channels, and underground pipes is protected with gabion mattresses and energy dissipaters to release into the Jukskei River or Tributary in a controlled manner.

8.4.2 Effectiveness of the Proposed Scheme

The proposed scheme (attenuation ponds, pipes, and channels) discharges directly into the adjacent Jukskei River and its tributaries. As mentioned earlier, there is no existing stormwater infrastructure; hence the scheme was designed to drain directly into the natural stream. The Jukskei River and its tributaries have enough capacity to handle the inflow run-offs since pre-development run-offs were maintained using attenuation ponds.

The attenuation ponds were designed to handle the excess run-off from -post-development. The outlet structures from the ponds were sized to ensure that outflows from the pond are less or equal to the pre-development flows for 5, 25, and 50-year storm events, as shown in the hydrographs/results above.

The proposed attenuation ponds are vegetated earth dams, which are to operate as green ponds which improve stormwater quality before being discharged into the stream and form part of the natural wetland rehabilitation of the site.

8.4.3 Monitoring during Construction

During construction, the stormwater management system is to be monitored at regular intervals by the Environmental Control Officer (ECO) in terms of the Environmental Management Programme (EMPr) by paying attention to the following aspects:

- Implementation of temporary attenuation measures such as earth berms to retain surface run-off until the attenuation areas are complete and functional.
- Planting vegetation as soon as open areas are complete prevents scouring and soil erosion.

It is important that surface run-off is monitored and controlled, and temporary measures are implemented until the construction is complete and the system can function independently.

8.4.4 Operation and Maintenance

On completion of construction, JW will be responsible for the operations and maintenance of the proposed stormwater management system, including attenuation ponds, stormwater pipes, and channels, to ensure it functions properly. Regular maintenance work restores and maintains the system to its original design. It is a good practice to carry out routine maintenance work on the stormwater system, at least at the beginning of the rainy season, in case serious problems need immediate attention. It should be noted that work of critical nature should be conducted under the supervision of a professional engineer.

The following provides guidelines for the maintenance of the proposed stormwater management system:

- Kerb Inlets and Catch Pits – Need to be inspected and cleared of any build-up of silt, litter, vegetation, and rubble that may block the clear flow of stormwater into the inlet. In addition, it should be inspected for structural damage. These inlets need to be protected by a grid to prevent solid waste from blocking the system.
- Pipes – They need to be checked systematically to ensure they are clear of any obstructions and can flow at their full capacity. Any build-up of silt or other obstructions must be removed by hand or jetting.
- Channels – Need to be cleared of any build-up obstructions and should be inspected for structural damage.

- Attenuation Ponds – Need to be inspected for open cracks, sinkholes, and pipe tunnels on the embankments surrounding the ponds and should be filled with a suitable compacted material. In addition, the ponds need to be cleaned and de-sludged by hand excavation or mechanical means once 50% of the pond capacity is occupied. Where necessary, vegetation on the embankment should be maintained by regular pruning and watering. Blockages at the outlets are to be cleared or repaired.

It is highly recommended that specialist service providers are employed to implement more technical maintenance or repair works, such as replacing pipes or remedial work at the attenuation ponds if required.

8.4.5 Safety and Hazards

To ensure the safety of the proposed management system, the following practices should be adopted:

- Erection of the appropriate signage on-site (at the treatment plant).
- No oil spillages or any contamination is allowed to enter the stormwater system.

In conclusion, JW is constructing a new WwTW in Lanseria, hence the need for a stormwater management plan for this development. Therefore, the proposed stormwater management strategy was designed and modelled to ensure that the -post-development discharge from the site matches the pre-development discharge using attenuation ponds. As seen in this report, the ponds were designed such that the pre-development flows for the 1:5 and 1:25-year storm events are not exceeded while also being capable of handling a 1:50-year storm event. The ponds, underground pipes, and channels ultimately discharge run-off into the Jukskei River and its tributaries. The required storage volume (8 814 m^3) is comparable to the expected storage (24.87 ha x 350 m^3/ha = 8 705 m^3) as per JRA's policy. Therefore, the proposed stormwater management plan can be considered effective and sustainable.

9. Rehabilitation Plan

A wetland ecologist with rehabilitation experience should monitor the construction phase of the project, to assess compliance with the Environmental Management Programme (EMPr) and to also provide guidance for other wetland related matters that arise. Should the construction phase be monitored and guided by a wetland specialist, the expected impacts for the phase of the project will be mitigated and the operational phase concerns pro-actively managed to reduce the overall negative ecological impact of the project.

The operational phase of the project should include monitoring of the water quality of the respective systems on a quarterly basis. Results should be compared with the baseline data set and the Target Water Quality Range (TWQR) for aquatic ecosystems. In addition to this, the rehabilitation measures taken to stabilise the banks of the receiving systems (from discharge) should also be managed and measures taken to maintain these structures, or replace these structures where required. Clearing of alien invasive plants and on-site maintenance of vegetation must be undertaken to promote the growth of indigenous marginal and riparian vegetation.

10. Water Uses applied for:

The application includes the following water uses.

Table 14: Water Uses Applied for

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
Pipe Bridge 6	Construction of pipe bridge to carry a pipeline with side drain outlets.	Construction of a bridge to carry a pipeline across a wetland	Valley Bottom Wetland No.1.	Within the Wetland	Portion 30 of the Farm Rietfontein 532 JQ	25°54'32.34" S 27°57'20.57" E	25°54'33.81" S 27°57'21.05" E	43.83m	4m x 2.5m x 45m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline
Proposed re-alignment of road bridge	Re-alignment of road bridge through valley bottom wetland	Construction of road bridge in road servitude	Valley Bottom Wetland No.1.	Within the Wetland	Portion 28 and 30 of the Farm Rietfontein 532 JQ	25°54'31.34" S 27°56'58.70" E	25°54'29.81" S 27°57'00.56" E	74m	2.3m x 14.11m x 34.89m	Reinforced concrete, and soil backfill
Pipe Bridge 7	Construction of a pipe bridge to carry a pipeline with side drain outlets.	Construction of a bridge to carry a pipeline across a wetland	Valley Bottom Wetland No.1.	Within the Wetland	Portion 31 of the Farm Rietfontein 532 JQ	25°54'46.43" S 27°57'37.0" E	25°54'45.79" S 27°57'38.35" E	31m	4m x 2.5m x 45m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline
Road Bridge 9	Construction of a road bridge with side drain outlets	Construction of a road bridge with drainage outlets across a wetland	Valley Bottom Wetland No.1.	Within the Wetland	Portion 30 of the Farm Rietfontein 532 JQ	25°54'34.61" S 27°57'06.58" E	25°54'33.43" S 27°57'07.21" E	40m	4m x 13.5m x 40m	Reinforced concrete, precast culverts and soil backfill
Pipe Bridge 8	Construction of a pipe Bridge with side drain outlets.	Construction of a Bridge to carry a pipeline across a wetland	Valley Bottom Wetland No.1.	Within the Wetland	Portion 31 of the Farm Rietfontein 532 JQ	25°54'45.29" S 27°57'12.76" E	25°54'44.85" S 27°57'14.68" E	36m	4m x 2.5m x 55m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
Road Bridge 8	Construction of a road bridge with side drain outlets	Construction of a road bridge with a drainage outlet across wetland	Valley Bottom Wetland No.1.	Within the Wetland	Portion 31 of the Farm Rietfontein 532 JQ	25°54'45.51" S 27°57'12.82" E	25°54'45.1" S 27°57'14.74" E	45m	4m x 13.5m x 55m	Reinforced concrete, precast culverts and soil backfill
Pipe Crossing 1	Construction of a pipeline across a wetland	Construction of a pipeline across a wetland	Valley Bottom Wetland No.1.	Within the Wetland	Portion 30 of the Farm Rietfontein 532 JQ	25°54'37.93" S 27°57'12.41" E		1m	4m x 2m x 10m	Concrete pipe and soil backfill
Pipe Crossing 2	Construction of a pipeline across a wetland	Construction of a pipeline across a wetland	Valley Bottom Wetland No.1.	Within the Wetland	Portion 30 of the Farm Rietfontein 532 JQ	25°54'39.33" S 27°57'12.51" E			4m x 2m x 10m	Concrete pipe and soil backfill
Temporary Pond 1A	Construction of a Temporary Pond in the 500m regulated area of a wetland	Construction of a Temporary Pond in the 500m regulated area of a wetland	500m regulated area of wetland (Valley Bottom Wetland) No 1.	Within 500m regulated area of the Valley Bottom wetland 1	Portion 30 of the Farm Rietfontein 532 JQ	25°54'39.22" S 27°57'0.6" E	25°54'38.83" S 27°57'02.29" E	n/a	0.6m x 29m x 59m	Vegetated Earth material, gabions and concrete
Temporary Pond 1B	Construction of a Temporary Pond in the 500m regulated area of a wetland	Construction of a Temporary Pond in the 500m regulated area of a wetland	500m regulated area of wetland (Valley Bottom Wetland) No 1.	Within 500m regulated area of the Valley Bottom wetland 1	Portion 30 of the Farm Rietfontein 532 JQ	25°54'40.08" S 27°56'57.93" S	25°54'39.47" S 27°56'29.61" E	n/a	0.6m x 29m x 59m	Vegetated Earth material, gabions and concrete
Temporary Pond 2A	Construction of a Temporary Pond in a 500m regulated	Construction of a Temporary Pond in a 500m regulated area of a wetland	500m regulated area of Valley bottom wetland 1	Within 500m regulated area of the Valley bottom wetland 1	Portion 30 of the Farm Rietfontein 532 JQ	25°54'37.55" S 27°56'57.95" E	25°54'36.91" S 27°56'59.45" E	n/a	0.8m x 29m x 59m	Vegetated Earth material, gabions and concrete

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
	area of a wetland									
Temporary Pond 2B	Construction of a Temporary Pond in a 500m regulated area of a wetland	Construction of a Temporary Pond in a 500m regulated area of a wetland	500m regulated area of Valley bottom wetland 1	Within 500m regulated area of the Valley bottom wetland 1	Portion 30 of the Farm Rietfontein 532 JQ	25°54'38.56" S 27°56'54.27" E	25°54'38.0" S 27°56'57.95" E	n/a	0.8m x 29m x 59m	Vegetated Earth material, gabions and concrete
Temporary Pond 3B	Construction of a Temporary Pond in a 500m regulated area of a wetland	Construction of a Temporary Pond in a 500m regulated area of a wetland	500m regulated area of Valley bottom wetland 1	Within 500m regulated area of the Valley bottom wetland 1	Portion 30 of the Farm Rietfontein 532 JQ	25°54'36.38" S 27°56'53.23" E	25°54'35.78" S 27°56'54.90" E	n/a	0.6m x 29m x 59m	Vegetated Earth material, gabions and concrete
Temporary Pond 3A	Construction of a Temporary Pond in a 500m regulated area of a wetland	Construction of a Temporary Pond in a 500m regulated area of a wetland	500m regulated area of Valley bottom wetland 1	Within 500m regulated area of the Valley bottom wetland 1	Portion 30 of the Farm Rietfontein 532 JQ	25°54'35.64" S 27°56'55.62" E	25°54'35.39" S 27°56'57.41" E	n/a	0.6m x 29m x 59m	Vegetated Earth material, gabions and concrete
Temporary Pond 4A	Construction of a Temporary Pond in a 500m regulated area of a wetland	Construction of a Temporary Pond in a 500m regulated area of a wetland	500m regulated area of a seep wetland	Within 500m regulated area of the seep wetland	Portion 28 of the Farm Rietfontein 532 JQ	25°54'30.22" S 27°57'11.41" E	25°54'29.96" S 27°57'13.33" E	n/a	1.5m x 19m x 38m	Vegetated Earth material, gabions and concrete

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
Temporary Pond 4B	Construction of a Temporary Pond in a 500m regulated area of a wetland	Construction of a Temporary Pond in a 500m regulated area of a wetland	500m regulated area of a seep wetland	Within 500m regulated area of the seep wetland	Portion 28 of the Farm Rietfontein 532 JQ	25°54'29.12" S 27°57'11.17" E	25°54'28.81" S 27°57'12.99" E	n/a	1.5m x 19m x 38m	Vegetated Earth material, gabions and concrete
Temporary Pond 5A	Construction of a Temporary Pond in a 500m regulated area of a wetland	Construction of a Temporary Pond in a 500m regulated area of a wetland	500m regulated area of Valley bottom wetland 1	Within 500m regulated area of the Valley bottom wetland 1	Portion 30 of the Farm Rietfontein 532 JQ	25°54'31.90" S 27°57'04.08" E	25°54'31.90" S 27°57'04.90" E	n/a	1.4m x 10m x 19m	Vegetated Earth material, gabions and concrete
Temporary Pond 6A	Construction of a Temporary Pond in a 500m regulated area of a wetland	Construction of a Temporary Pond in a 500m regulated area of a wetland	500m regulated area of Valley bottom wetland 1	Within 500m regulated area of the Valley bottom wetland 1	Portion 28 of the Farm Rietfontein 532 JQ	25°54'29.44" S 27°57'04.10" E	25°54'29.48" S 27°57'04.76" E	n/a	2.0m x 10m x 19m	Vegetated Earth material, gabions and concrete
Temporary Pond 7A and 7B	Construction of a Temporary Pond in a 500m regulated area of a wetland	Construction of a Temporary Pond in a 500m regulated area of a wetland	500m regulated area of a seep wetland	Within 500m regulated area of the seep wetland	Portion 30 of the Farm Rietfontein 532 JQ	25°54'39.39" S 27°57'09.47" E	25°54'38.61" S 27°57'10.19" E	n/a	2.0m x 18m x 36m	Vegetated Earth material, gabions and concrete
Storm Water Culvert Crossing 1	Construction of Stormwater culvert within 500m	Construction of Stormwater culvert within 500m regulated	500m seep wetland	Within 500m regulated area of a seep wetland	Portion 29 of the Farm Rietfontein 532 JQ	25°54'38.10" S 27°57'56.38" E	25°54'38.50" S 27°57'56.34" E		2m x 5m x 14m	Reinforced concrete, precast culverts and soil

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
	regulated area of a wetland	area of a wetland								backfill, Steel pipeline
Permanent Attenuation Pond 3	Construction of stormwater attenuation pond 3 within the 100m regulated area of riparian zone of the Jukskei River and 500m regulated area of wetland	Construction of stormwater attenuation pond within the 100m regulated area of riparian zone of the Jukskei River and 500m regulated area of wetland	100m regulated area of riparian zone of the Jukskei River and 500m regulated area of wetland	100m regulated area of riparian zone of the Jukskei River and 500m regulated area of wetland	Portion 31 of the Farm Rietfontein 532 JQ	25°54'42.16" S 27°56'51.78" E	25°54'43.09" S 27°56'54.04" E	n/a	0.5m x 25m x 50m	Vegetated Earth material, gabions and concrete
Permanent Attenuation pond 2A&2B	Construction of stormwater attenuation pond 2A&2B within 500m regulated area of wetland	Construction of stormwater attenuation pond within the 500m regulated area of the seep wetland	500m of seep wetland	Within 500m regulated area of a seep wetland	Portion 30 of the Farm Rietfontein 532 JQ	25°54'37.43" S 27°57'18.34" E	25°54'36.78" S 27°57'20.71" E	n/a	0.5m x 10m x 70m	Vegetated Earth material, gabions and concrete
SW Infrastructure Ponds (SW01)	Construction of SW infrastructure within the 100m regulated area of riparian zone of the Jukskei River and	Construction of SW infrastructure within the 100m regulated area of riparian zone of the Jukskei River and 500m regulated area of wetland	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian	Portion 31 of the Farm Rietfontein 532 JQ	25°54'41.93" S 27°56'50.14" E	25°54'40.72" S 27°56'02.27" E	n/a	450mm diameter	Concrete pipe and soil backfill

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
	500m regulated area of wetland		riparian zone of Jukskei River	zone of Jukskei River						
SW02	Construction of SW infrastructure in 500m regulated area of valley bottom wetland 1	Construction of SW infrastructure in 500m regulated area of valley bottom wetland 1	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	Portion 31 of the Farm Rietfontein 532 JQ	25°54'40.44" S 27°56'50.63" E	25°54'41.78" S 27°56'54.28" E	n/a	450mm, 525mm and 600mm diameter	Concrete pipe and soil backfill
SW03	Construction of SW infrastructure in 500m regulated area of valley bottom wetland 1	Construction of SW infrastructure in 500m regulated area of valley bottom wetland 1	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	Portion 30 of the Farm Rietfontein 532 JQ	25°54'38.75" S 27°56'50.04" E	25°54'39.04" S 27°56'51.24" E	n/a	450mm diameter	Concrete pipe and soil backfill
SW04p	Construction of SW infrastructure in 500m regulated area of valley	Construction of SW infrastructure in 500m regulated area of valley	500m Regulated area of wetland (Valley bottom	500m Regulated area of wetland (Valley bottom wetland 1) –	Portion 30 of the Farm Rietfontein 532 JQ	25°54'42.16" S 27°56'51.78" E	25°54'42.16" S 27°56'51.78" E	n/a	450mm diameter	Concrete pipe and soil backfill

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
	bottom wetland 1	bottom wetland 1	wetland 1) – and 100m regulated area of riparian zone of Jukskei River	and 100m regulated area of riparian zone of Jukskei River						
SW05	Construction of SW infrastructure in 500m regulated area of valley bottom wetland 1	Construction of SW infrastructure in 500m regulated area of valley bottom wetland 1	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	Portion 28 of the Farm Rietfontein 532 JQ	25°54'34.77" S 27°56'49.73" E	25°54'35.27" S 27°56'57.72" E	n/a	450mm diameter	Concrete pipe and soil backfill
SW06	Construction of Stormwater infrastructure in the 100m regulated area of riparian zone and 500m regulated area of Valley Bottom Wetland 1	Construction of Stormwater infrastructure in 100m regulated area of riparian zone of Jukskei River and 500m regulated area of Valley Bottom Wetland 1	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	Portion 30 of the Farm Rietfontein 532 JQ	25°54'30.94" S 27°56'51.68" E	25°54'32.38" S 27°56'51.75" E	n/a	450mm diameter	Concrete pipe and soil backfill
Permanent Attenuation Pond 1	Construction of Stormwater attenuation	Construction of Stormwater attenuation	500m Regulated area of	500m Regulated area of	Portion 28 of the Farm	25°54'32.38" S 27°56'51.75" E	25°54'32.38" S 27°56'53.54" E	n/a	0.6m x 30m x 60m	Vegetated Earth material, gabions and concrete

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
	pond in the 100m regulated area of riparian zone and 500m regulated area of Valley Bottom Wetland 1	pond in 100m regulated area of riparian zone of Jukskei River and 500m regulated area of Valley Bottom Wetland 1	wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	Rietfontein 532 JQ					
SW07	Construction of Stormwater infrastructure in 100m regulated area of riparian Zone and 500m regulated area of Valley Bottom Wetland 1	Construction of Stormwater infrastructure in 100m regulated area of riparian Zone of Jukskei River and 500m regulated area of Valley Bottom Wetland 1	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	Portion 28 of the Farm Rietfontein 532 JQ	25°54'32.28" S 27°56'57.83" E	25°54'31.88" S 27°56'58.46" E	n/a	450mm diameter	Concrete pipe and soil backfill
SW08	Construction of Stormwater infrastructure in 100m regulated area of riparian Zone and 500m regulated area of Valley Bottom Wetland 1	Construction of Stormwater infrastructure in 100m regulated area of riparian Zone of Jukskei River and 500m regulated area of Valley Bottom Wetland 1	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	500m Regulated area of wetland (Valley bottom wetland 1) – and 100m regulated area of riparian zone of Jukskei River	Portion 30 of the Farm Rietfontein 532 JQ	25°54'33.06" S 27°56'58.38" E	25°54'32.32" S 27°56'59.24" E	n/a	450mm diameter	Concrete pipe and soil backfill

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
SW09	Construction of Stormwater infrastructure within 500m regulated area of the Valley Bottom Wetland 1	Construction of Stormwater infrastructure within 500m regulated area of the Valley Bottom Wetland 1	500m regulated area of the Valley Bottom Wetland 1	500m regulated area of the Valley Bottom Wetland 1	Portion 28 of the Farm Rietfontein 532 JQ	25°54'31.14" S 27°57'01.94" E	25°54'30.45" S 27°57'02.97" E	n/a	450mm diameter	Concrete pipe and soil backfill
SW010	Construction of Stormwater infrastructure in the valley bottom wetland 1 and its 500m regulated area	Construction of Stormwater infrastructure in the valley bottom wetland 1 and its 500m regulated area	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Portion 30 of the Farm Rietfontein 532 JQ	25°54'34.08" S 27°57'01.37" E	25°54'33.04" S 27°57'01.92" E	12m	450mm diameter	Concrete pipe and soil backfill
SW011	Construction of Stormwater infrastructure in the valley bottom wetland 1 and its 500m regulated area	Construction of Stormwater infrastructure in the valley bottom wetland 1 and its 500m regulated area	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Portion 30 of the Farm Rietfontein 532 JQ	25°54'35.05" S 27°57'03.29" E	25°54'33.82" S 27°57'03.83" E	21m	450mm diameter	Concrete pipe and soil backfill
SW012	Construction of Stormwater infrastructure in the valley bottom wetland 1 and its 500m regulated area	Construction of Stormwater infrastructure in the valley bottom wetland 1 and its 500m regulated area	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Portion 28 of the Farm Rietfontein 532 JQ	25°54'31.56" S 27°57'05.22" E	25°54'32.65" S 27°57'04.53" E	3m	450mm diameter	Concrete pipe and soil backfill

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
SW013	Construction of Stormwater infrastructure in the valley bottom wetland 1 and its 500m regulated area	Construction of Stormwater infrastructure in the valley bottom wetland 1 and its 500m regulated area	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Portion 30 of the Farm Rietfontein 532 JQ	25°54'35.71" S 27°57'04.93" E	25°54'34.15" S 27°57'05.66" E	24.88m	450mm diameter	Concrete pipe and soil backfill
SW014	Construction of Stormwater infrastructure in the valley bottom wetland 1 and its 500m regulated area	Construction of Stormwater infrastructure in the valley bottom wetland 1 and its 500m regulated area	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Portion 28 of the Farm Rietfontein 532 JQ	25°54'32.26" S 27°57'06.58" E	25°54'33.45" S 27°57'06.20" E	17m	450mm diameter	Concrete pipe and soil backfill
SW015	Construction of Stormwater infrastructure in 500m regulated area of Valley bottom wetland 1	Construction of Stormwater infrastructure in 500m regulated area of Valley bottom wetland 1	500m regulated area of Valley bottom wetland 1	500m regulated area of Valley bottom wetland 1	Portion 30 of the Farm Rietfontein 532 JQ	25°54'36.98" S 27°57'06.75" E	25°54'35.25" S 27°57'07.31" E	n/a	450mm diameter	Concrete pipe and soil backfill
SW016	Construction of Stormwater infrastructure in 500m regulated area of Valley bottom wetland 1	Construction of Stormwater infrastructure in 500m regulated area of Valley bottom wetland 1	500m regulated area of Valley bottom wetland 1	500m regulated area of Valley bottom wetland 1	Portion 30 of the Farm Rietfontein 532 JQ	25°54'35.29" S 27°57'08.39" E	25°54'37.6" S 27°57'10.35" E	n/a	450mm diameter	Concrete pipe and soil backfill
SW025	Construction of Stormwater	Construction of Stormwater	500m regulated	500m regulated area	Portion 30 of the Farm	25°54'32.6" S 27°57'10.35" E	25°54'39.34" S 27°57'12.07" E	n/a	450mm diameter	Concrete pipe and soil backfill

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
	infrastructure in 500m regulated area of Valley bottom wetland 1	infrastructure in 500m regulated area of Valley bottom wetland 1	area of Valley bottom wetland 1	of Valley bottom wetland 1	Rietfontein 532 JQ					
SW017	Construction of Stormwater infrastructure in the Valley bottom wetland 1 and within the 500m regulated area	Construction of Stormwater infrastructure in the Valley bottom wetland 1 and within the 500m regulated area	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Portion 30 of the Farm Rietfontein 532 JQ	25°54'32.72" S 27°57'08.68" E	25°54'34.07" S 27°57'08.01" E	20m	450mm diameter	Concrete pipe and soil backfill
SW018	Construction of Stormwater infrastructure in the Valley bottom wetland 1 and within the 500m regulated area	Construction of Stormwater infrastructure in the Valley bottom wetland 1 and within the 500m regulated area	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Portion 28 of the Farm Rietfontein 532 JQ	25°54'33.20" S 27°57'11.51" E	25°54'34.23" S 27°57'10.44" E	17m	450mm diameter	Concrete pipe and soil backfill
SW019	Construction of Stormwater infrastructure in the Valley bottom wetland 1 and within the 500m regulated area	Construction of Stormwater infrastructure in the Valley bottom wetland 1 and within the 500m regulated area	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Valley Bottom Wetland 1 and the 500m regulated area of the wetland	Portion 30 of the Farm Rietfontein 532 JQ	25°54'35.15" S 27°57'11.37" E	25°54'40.85" S 27°57'19.66" E	127m	450mm diameter	Concrete pipe and soil backfill

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
SW020	Construction of Stormwater infrastructure in Valley Bottom Wetland 1	Construction of Stormwater infrastructure in Valley Bottom Wetland 1	Valley Bottom Wetland 1	Valley Bottom Wetland 1	Portion 29 of the Farm Rietfontein 532 JQ	25°54'34.93" S 27°57'12.83" E	25°54'36.04" S 27°57'13.31" E	40m	450mm diameter	Concrete pipe and soil backfill
SW021	Construction of Stormwater infrastructure in 500m regulated area of valley bottom wetland 1	Construction of Stormwater infrastructure in 500m regulated area of valley bottom wetland 1	500m Regulated area of Valley Bottom Wetland 1	500m Regulated area of Valley Bottom Wetland 1	Portion 28 of the Farm Rietfontein 532 JQ	25°54'33.09" S 27°57'13.51" E	25°54'35.89" S 27°57'13.30" E		450mm diameter	Concrete pipe and soil backfill
SW022	Construction of Stormwater infrastructure in 500m regulated area of valley bottom wetland 1	Construction of Stormwater infrastructure in 500m regulated area of valley bottom wetland 1	500m Regulated area of Valley Bottom Wetland 1	500m Regulated area of Valley Bottom Wetland 1	Portion 28 of the Farm Rietfontein 532 JQ	25°54'32.79" S 27°57'15.53" E	25°54'33.44" S 27°57'15.61" E	n/a	450mm diameter	Concrete pipe and soil backfill
SW023	Construction of Stormwater infrastructure in valley bottom wetland 1	Construction of Stormwater infrastructure in valley bottom wetland 1	Valley Bottom Wetland 1	Valley Bottom Wetland 1	Portion 30 of the Farm Rietfontein 532 JQ	25°54'33.36" S 27°57'19.34" E	25°54'34.34" S 27°57'19.67" E	34m	450mm diameter	Concrete pipe and soil backfill
SW024	Construction of Stormwater infrastructure in 500m regulated area of valley bottom wetland 1 and	Construction in valley bottom wetland and in the 500m regulated area of the wetland and valley	500m Regulated area of Valley Bottom Wetland 1 and Valley Bottom Wetland 1	500m Regulated area of Valley Bottom Wetland 1 and Valley Bottom Wetland 1	Portion 30 of the Farm Rietfontein 532 JQ	25°54'36.56" S 27°57'21.85" E	25°54'33.85" S 27°57'20.41" E	78m	450mm diameter	Concrete pipe and soil backfill

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
	valley bottom wetland 1	bottom wetland 1								
Stormwater pipeline	Construction of stormwater pipeline in the Valley bottom wetland 1 and in the 500m in the regulated area of the seep wetland.	Construction of stormwater pipeline in the Valley bottom wetland and in the 500m in the regulated area of the seep wetland.	500m regulated of the steep wetland and in the valley bottom wetland 1	500m regulated of the steep wetland and in the valley bottom wetland 1	Portion 30 and 31 of the Farm Rietfontein 532 JQ	25°54'33.65" S 27°57'20.24" E	25°54'45.57" S 27°57'19.45" E	43m	450mm diameter	Concrete pipe and soil backfill
SW026	Construction of Stormwater infrastructure within the 500m regulated area of the valley bottom wetland 1 and in the valley bottom wetland 1	Construction of Stormwater infrastructure within the 500m regulated area of the valley bottom wetland 1 and in the valley bottom wetland 1	500m Regulated area of Valley Bottom Wetland 1 and in the valley bottom wetland 1	500m Regulated area of Valley Bottom Wetland 1 and in the valley bottom wetland 1	Portion 31 of the Farm Rietfontein 532 JQ	25°54'43.19" S 27°56'58.12" E	25°54'39" S 27°57'12.08" E	6m	450mm diameter	Concrete pipe and soil backfill
SW027	Construction of Stormwater infrastructure in 500m regulated area of area valley bottom wetland 1	500m Regulated of area of valley bottom wetland 1	500m Regulated of area of valley bottom wetland 1	Wetland	Portion 31 of the Farm Rietfontein 532 JQ	25°54'43.70" S 27°56'55.48" E	25°54'45.45" S 27°57'12.03" E	n/a	450mm diameter	Concrete pipe and soil backfill
SW Culvert Crossing 1	Construction of SW Culvert along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'38.51" S 27°57'56.34" E	25°54'38.10" S; 27°57'56.39" E	15m	2m x 5m x 14m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
SW Culvert Crossing 2	Construction of SW Culvert along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'32.30" S 27°58'11.37" E	25°54'31.71" S 27°58'11.47" E	15m	2m x 5m x 14m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline
SW Culvert Crossing 3	Construction of SW Culvert along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'18.09" S 27°58'43.73" E	25°54'17.69" S 27°58'43.80" E	15m	2m x 5m x 14m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline
SW side drain outlet (150)	Construction of SW drain outlet along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'17.85" S 27°58'44.31" E	25°54'17.85" S 27°58'44.31" E	1m	450mm diameter	Concrete pipe and soil backfill
SW side drain outlet (151)	Construction of SW drain outlet along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'12.09" S 27°58'55.82" E	25°54'12.09" S 27°58'55.82" E	1m	450mm diameter	Concrete pipe and soil backfill
SW Culvert Crossing 4	Construction of SW Culvert along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'10.92" S 27°59'01.97" E	25°54'10.81" S 27°59023.44" E	14m	2m x 5m x 14m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline
SW Culvert Crossing 5	Construction of SW Culvert along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'20.16" S 27°59'03.11" E	25°54'19.94" S 27°59'03.67" E	15m	2m x 5m x 14m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline
SW Culvert Crossing 6	Construction of SW Culvert along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'21.66" S 27°59'03.35" E	25°54'21.39" S 27°59'03.72" E	15m	2m x 5m x 14m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
SW Culvert Crossing 7	Construction of SW Culvert along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'30.80" S 27°59'04.50" E	25°54'30.76" S 27°59'04.85" E	12m	2m x 5m x 14m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline
SW Culvert Crossing 8	Construction of SW Culvert along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'49.19" S 27°59'06.22" E	25°54'49.19" S 27°59'06.93" E	21m	2m x 5m x 14m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline
SW side drain outlet (152)	Construction of SW drain outlet along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'55.67" S 27°59'07.54" E	25°54'55.67" S 27°59'07.54" E	1m	450mm diameter	Concrete pipe and soil backfill
SW side drain outlet (153)	Construction of SW drain outlet along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°54'49.19" S 27°59'08.32" E	25°54'49.19" S 27°59'08.32" E	1m	450mm diameter	Concrete pipe and soil backfill
SW Culvert crossing 9	Construction of SW Culvert along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°55'00.80" S 27°59'08.09" E	25°55'00.76" S 27°59'08.51" E	10m	2m x 5m x 14m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline
SW Culvert crossing 10	Construction of SW Culvert along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°55'06.94" S 27°59'08.81" E	25°55'06.92" S 27°59'09.22" E	13m	2m x 5m x 14m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline
SW Culvert crossing 11	Construction of SW Culvert along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°55'15.80" S 27°59'09.88" E	25°55'15.84" S 27°59'10.33" E	11.54m	2m x 5m x 14m	Reinforced concrete, precast culverts and soil backfill, Steel pipeline

Ref	Activity	Purpose of Activity	Name of Water Course	Type of Water Source	Property	Co-ordinates Start	End	Length of watercourse affected	Height, width, length of impeding structure	Impeding structure materials
SW side drain outlet (154)	Construction of SW drain outlet along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°55'19.49" S 27°59'10.97" E	25°55'19.49" S 27°59'10.97" E	1m	450mm diameter	Concrete pipe and soil backfill
SW side drain outlet (155)	Construction of SW drain outlet along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°55'31.83" S 27°59'12.53" E	25°55'31.83" S 27°59'12.53" E	1m	450mm diameter	Concrete pipe and soil backfill
SW side drain outlet (156)	Construction of SW drain outlet along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°55'35.67" S; 27°59'12.46" E	25°55'35.67" S 27°59'12.46" E	1m	450mm diameter	Concrete pipe and soil backfill
SW side drain outlet (157)	Construction of SW drain outlet along access road to WwTW	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Within the riparian zone of Jukskei river	Remainder of the Farm Rietfontein 532 JQ	25°55'36.36" S 27°59'13.04" E	25°55'36.36" S 27°59'13.04" E	1m	450mm diameter	Concrete pipe and soil backfill

11. Impacts and mitigation measures

The potential impacts and mitigation measures that are expected from the proposed activities are presented in Table 15.

Table 15: Summary of impacts and mitigation measures

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
Section 21 (c) and 21 (i)	<u>Construction Phase:</u> The proposed clearing and preparation of footprint area for construction activities for the construction of the bridge and the additional stormwater infrastructure may impact on the loss or degradation of wetlands.	Loss or degradation of wetland vegetation	The following mitigation measures must be implemented to minimise the loss or degradation of wetland vegetation during construction of the proposed bridge and additional stormwater infrastructure: • Use the wetland shapefiles to clearly demarcate (on the ground) the edge of the buffer and wetlands. Regard these as strict no-go areas, unless authorised. • All activities (including driving and equipment storage) must remain outside of the wetlands identified on site that will be conserved. • The footprint area of the construction should be kept a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas. • While clearing keep a nursery of plant sods (priorities wetland

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
			plants such as sedges, rushes and grasses in an on-site nursery for use in wetland restoration efforts. • Use existing access roads wherever possible.
Section 21 (c) and 21 (i)	Construction Phase: The proposed clearing and preparation of footprint area for construction activities for the construction of the bridge and the additional stormwater infrastructure may impact on the loss or degradation of wetlands. Vegetation clearance as a result of construction activities will expose the site to bare surfaces, thereby increasing the surface area and velocity of stormwater runoff entering into the wetlands and watercourses. This may expose the wetlands and watercourses to erosion.	Increased bare surfaces, flood peaks and potential for erosion	The following mitigation measures must be implemented to minimise the potential for erosion during construction of the proposed bridge and additional stormwater infrastructure: • Hold off on the clearing of vegetation as long as possible, ensuring that all environmental and water use authorisations are in place. • Take every measure to ensure that the bulk of the site clearing and earth moving activities take place in winter when rainfall is lowest (and the grass sward is thinnest) to minimize environmental damage, erosion, sedimentation and contamination. • Ensure soil stockpiles and concrete /

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
			building sand are sufficiently safeguarded against rain wash. • Scrape the area where mixing and storage of sand and concrete occurred to clean and regrass once finished. • Revegetate all denuded areas beyond the buildings as soon as possible. • The following mitigation measures must be implemented to minimise the potential for erosion during construction of the proposed bridge: • It is critical to spread flows across the system (within existing drainage channels), avoiding incisions in the landscape caused by concentrated flows. • The structures required for the bridge should avoid inundation (damming) of upstream areas by facilitating streamflow and catering properly for both low flows and high flows. • Temporary stormwater channels should be filled with aggregate and/or logs

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
			(branches included) to dissipate flows. • Abutments must be constructed on the bedrock and not within the channel bed, nor within the preferential flow path of the systems to avoid obstructing flows (where possible).
Section 21 (c) and 21 (i)	<u>Construction Phase:</u> During construction, there will be excavation for the installation of the proposed additional stormwater infrastructure. This may lead to the alteration of the hydrological regime and decreased flow inputs to the water resource.	Decreased flow inputs to the water resource	The following mitigation measures must be implemented to minimise the impacts on decreased flow inputs to the wetlands and watercourses during construction of the proposed additional stormwater infrastructure: • Aim to maximise infiltration of rainwater and maintain diffuse subsurface for non-developed areas. • Develop a sound stormwater management plan that is engineered to promote rainfall infiltration, maintain diffuse subsurface flows on slopes, minimise the development of preferential flow paths. • All low points, flow paths or clean water

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
			drains should be engineered to minimize erosion through the installation of small drop downs and flow attenuation structures especially out outlets into the wetland system. • Stormwater leaving the site should not be concentrated in a single exit drain but spread across multiple drains around the site each fitted with energy dissipaters (e.g. slabs of concrete with rocks cemented in). • Minimise the extent of concreted / paved / gravel areas. • Avoid excessively compacting the ground not to be developed. • Introduce coarse, preferably washed, gravel in areas amongst infrastructure where vegetation is required to be cleared.
Section 21 (c) and 21 (i)	<u>Construction Phase:</u> During construction, there will be excavation for the installation of the proposed bridge (Option C). This may lead to the alteration of the	Concentrated flow inputs to the water resource	The following mitigation measures must be implemented to minimise the impacts on concentrated flow inputs to the wetlands and

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
	hydrological regime and concentrated flow inputs to the water resource.		watercourses during construction of the proposed bridge: • Abutments must be constructed on the bedrock and not within the channel bed, nor within the preferential flow path of the systems to avoid obstructing flows (where possible). • Alignment of the structure must be perpendicular to the channel and flows. • Monitor and maintain the structure, keeping clear structure clear of blockages and debris. • Avoid excessively compacting the ground proximal to the structure.
Section 21 (c) and 21 (i)	<u>Construction Phase:</u> During construction, there will be excavation for the installation of the proposed bridge (Option 4) and the additional stormwater infrastructure (Option C). This may lead to soil disturbance and increased sediment loads to downstream reaches of the receiving water resources.	Increased sediment loads to the downstream reaches	The following mitigation measures must be implemented to minimise the impacts on increased sediment loads to downstream reaches during construction of the proposed bridge and additional stormwater infrastructure: • See mitigation for increased bare surfaces, runoff and potential for erosion.

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
			• Ensure monitoring and maintenance of structures and address any erosion sources or weak points that contribute to sedimentation of the system. • Introduce coarse, preferably washed, gravel in infrastructure areas cleared of vegetation.
Section 21 (c) and 21 (i)	<u>Construction Phase:</u> During the construction phase of the proposed bridge and additional stormwater infrastructure, there may be an increase in the spread of alien invasive plant species which may decrease the flow of water in the wetlands and watercourses. Wetland habitats may be impacted due to this occurrence.	Increase in spread of alien invasive plant species	The following mitigation measures must be implemented to minimise the spread of alien invasive plant species during construction phase of the proposed additional stormwater infrastructure and bridge: • Promptly remove all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs). • Appropriately stockpile topsoil cleared from the site. • Minimize unnecessary clearing of vegetation beyond the infrastructure footprints. • Lightly till any disturbed soil around

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
			the development to avoid compaction.
Section 21 (c) and 21 (i)	Operational Phase There will be routine maintenance of the bridge (Option 4). This may disrupt faunal movement across the watercourse.	Disruption to faunal movement across the watercourse	The following mitigation measures must be implemented to minimise the impacts to disruption to faunal movement across the watercourse during operational phase of the proposed bridge: • Keep areas beneath the structure clear of debris. Culverts/piers must be inspected after high rainfall events. • Minimise the physical disturbance to the watercourse.
Section 21 (c) and 21 (i)	Operational Phase There will be routine maintenance for the additional stormwater infrastructure (Option C) and the bridge (Option 4) and this may lead to increased sedimentation from cleared and landscaped areas.	Increased sedimentation from cleared and landscaped areas	The following mitigation measures must be implemented to minimise the impacts of increased sedimentation from cleared and landscaped areas during operational phase of the proposed additional stormwater infrastructure: • Develop a sound stormwater management plan that is engineered to promote rainfall infiltration, maintain diffuse subsurface flows on slopes, minimise the

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
			development of preferential flow paths. • Consider the use of a coarse heavy metal-free gravel around infrastructure in cleared areas to promote infiltration and minimize surface runoff and erosion during high rainfall events. The following mitigation measures must be implemented to minimise the impacts of increased sedimentation from cleared and landscaped areas during operational phase of the proposed bridge: • Ensure monitoring and maintenance of structures and address any erosion sources or weak points that contribute to sedimentation of the system.
Section 21 (c) and 21 (i)	<u>Operational Phase</u> There will be routine maintenance for the proposed bridge (Option 4) and this may lead to changes in the flow regime.	Changes to the flow regime	The following mitigation measures must be implemented to minimise the impacts of change of flow regime during operational phase of the proposed bridge:

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
			• Discharge volumes to best replicate 'natural' flow regimes as much is feasible. The hydrology study to advise in this regard.
Section 21 (c) and 21 (i)	Operational Phase There will be routine maintenance for the proposed additional stormwater infrastructure (Option C) and this may lead to increased contamination of the watercourses in the event that there are accidental spillages and leaks of hydrocarbons.	Increased contamination (spills and leaks)	The following mitigation measures must be implemented to minimise the impacts of contamination of watercourses during operational phase of the proposed additional stormwater infrastructure: • Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility. • Do not store any construction materials or equipment within any of the identified wetlands or their buffers. • Landscape and rehabilitate project area. • Mixing of concrete must under no circumstances take place within any wetland.

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
			• Release only clean water into the environment.
Section 21 (c) and 21 (i)	Operational Phase There will be routine maintenance for the proposed additional stormwater infrastructure (Option C) and this may lead to increased bare surfaces, floodpeaks and potential for erosion of wetlands and watercourses. Wetland habitats may be impacted due to this occurrence.	Disturbance of wetland habitat	The following mitigation measures must be implemented to minimise the impacts of increased erosion of watercourses during operational phase of the proposed additional stormwater infrastructure: • Discharge volumes to best replicate 'natural' flow regimes as much is feasible. The hydrology study to advise in this regard.
Section 21 (c) and 21 (i)	Operational Phase During the operational phase of the proposed bridge and additional stormwater infrastructure i.e. during route maintenance, there may be an increase in the spread of alien invasive plant species which may decrease the flow of water in the wetlands and watercourses. Wetland habitats may be impacted due to this occurrence.	Increase in spread of alien invasive plant species	The following mitigation measures must be implemented to minimise the impacts of increased spread of alien invasive plant species during operational phase of the proposed bridge and additional stormwater infrastructure: • Continue to remove all alien and invasive plant species as they arise (i.e. weedy annuals and other alien forbs). • Attempt to plant only locally indigenous plant species within the gardens.

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
Section 21 (c) and 21 (i)	<u>Operational Phase</u> The introduction of sewage reticulation and WwTW services will promote residential and commercial development, which would translate into job creation and economic growth. The construction of additional stormwater infrastructure and the bridge will ensure that the proposed WwTW is fully functional with due consideration for management of stormwater runoff to delay stormwater runoff entering into the watercourses, ensure minimal erosion, sedimentation and pollution of the wetlands and watercourses. The proposed construction of the bridge will minimise road kills of fauna.	Access to a fully functional WwTW at Lanseria	The following mitigation measures must be implemented to enhance the positive impact: • Monitor and maintain the structure, keeping clear structure clear of blockages and debris. • Ensure monitoring and maintenance of structures and address any erosion sources or weak points that contribute to sedimentation of the system. • Continue to remove all alien and invasive plant species as they arise (i.e. weedy annuals and other alien forbs). • Attempt to plant only locally indigenous plant species within the gardens. • Culverts/piers to be inspected after high rainfall events. • Minimise the physical disturbance to the watercourse. • The rehabilitation measures taken to stabilise the banks of the receiving systems (from discharge) should also be managed and measures taken to maintain these

Water Use activity	Possible causes of the impacts of the activities Impacts to the water resources	Possible Impacts to the water resource and other water users	Mitigation Measures
			structures, or replace these structures where required.

12. Water demand and water supply

(a) Water demand

Potable water to the works will be fed from an existing pipeline that supplies municipal treated water to Northern Farm. This pipeline originates at the Northern WwTW potable water reservoir, a portion of which will need to be upgraded. JW propose to re-route the existing 80mm pipe at Northern Farm around the border of the property and replace the 100mm steel pipe from the reservoir with a 110mm HDPE or uPVC pipe. A new section of pipeline approximately 6km long will be installed from Northern Farm, along the new Main Access Road to the Lanseria Works.

(b) Water supply

In addition, two new boreholes are proposed to be installed as a backup facility on the site. There is an existing WUL that has been issued for the two new boreholes.

13. Public participation

Notification of the Public Participation Process (PPP) for the WULA for the proposed additional infrastructure associated with the proposed Lanseria WwTW was made to potential Interested and Affected Parties (I&APs). The following WULA documentation was available at the online links for review by the potential I&APs from 13 March 2025 to 19 May 2025 (*Potential I&APs were requested to register as I&APs*):

1) Scoping and EIA Process:
   a) Final Environmental Impact Report (FEIR)
   b) Appendix 3 – Maps
   c) Appendix 4 – Photographs of the development site
   d) Appendix 5 – Layout Plans & Drawings
   e) Appendix 6 – Specialist Studies
   f) Appendix 9 – EMPr
   g) Appendix 10 – Technical Studies

2) WULA Process:
   a) Integrated Water and Waste Management Plan
   b) Appendix B – Master Plan
   c) Appendix C – Preliminary Design Report
   d) Appendix D – Specialist Studies
   e) Appendix F – Stormwater Management Plan

The PPP for the WULA process was announced as follows:

- English advertisements were placed in “The Citizen” and in the “Cosmo City Chronicle” on Thursday, 13 March 2025 (refer to the proof of newspaper placement in Appendix 2).

- A Background Information Document (BID) was emailed to I&APs on 13 March 2025 (refer to the BID in Appendix 2).

The WULA documents for public review were available at the following online links:

- Zitholele Consulting website www.zitholele.co.za/environmental, under the heading "Lanseria WWTW Additional Infrastructure WULA"
- Online Information Portal 1 (Dropbox): https://tinyurl.com/LansWULA1
- Online Information Portal 2 (OneDrive): https://tinyurl.com/LansWULA2

No comments and registrations were received during the PPP for the WULA for the additional infrastructure.

Table 16: Outcome of the public participation

Person who commented	Comments (support or object)	Reasons for objection	Applicant's response to the objection
No comments and registrations were received during the PPP for the WULA for the additional infrastructure.			

14. Other authorisations applicable to the activity

As indicated in Section 1, the Final Motivation Report (including Impact Assessment) for a Part 2: Amendment of Environmental Authorisation (EA) was submitted to the GDARD for the amendment of the EA (dated 17 November 2017) that was obtained in terms of Reference No: GAUT:002/16-17/E0235 for the construction of the proposed Lanseria WwTW. The amendment of the EA is awaited. Refer to the original EA in Appendix 3. These amendments specifically deal with the changes to the Site Layout Plan that was approved in the EA. The amendment of the EA process will be undertaken in terms the EIA Regulations of 2014 (as amended) of the National Environmental Management Act (107 of 1998) (NEMA). The amendments of the EA will also assess the impacts of the proposed additional stormwater infrastructure as mentioned herein.

15. Section 27 (1)

The requirements contained in Section 27(1) of the National Water Act, 1998 (Act 36 of 1998) have been considered and are discussed further below.

a) Existing lawful water uses

No existing lawful water uses are associated with the development site. However, a Water Use Licence (WUL), Licence No.: 07/A21C/ACFGI/9705, was issued by the Department of Human Settlements, Water and Sanitation (DHSWS) on 22 July 2020 for the construction and operation of the new Wastewater Treatment Works (WwTW). This WUL authorised the following water uses associated with the approved Lanseria WwTW development:

- 21 (a): taking water from a water resource;
- 21 (c): impeding or diverting the flow of water in a watercourse;
- 21 (i): altering the bed, banks, course or characteristics of a watercourse;
- 21 (f): discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit; and
- 21 (g): disposing of waste in a manner which may detrimentally impact a water resource.

This new WULA has been launched to authorise additional stormwater management infrastructure that has become necessary to make the WwTW operable.

b) Need to redress the results of past racial and gender discrimination

One objective of the NWA is to address past racial and gender discrimination and to alleviate poverty in South Africa. Therefore, it is of utmost importance to support and stimulate economic development to realise the upliftment of previously disadvantaged groups and/or individuals. The proposed project will support the already approved WwTW development, which will facilitate increased capacity for sanitation management within Gauteng. This will directly improve or strengthen basic living conditions for communities linked to this sewage system through existing and new reticulation. The key areas that will be affected by the new WwTW and associated services will include areas within the greater Lanseria area, Dieplsoot that currently do not have sanitation services, as well as parts of the Mogale Local Municipality.

JW, through the Social and Ethics Committee of the Board, has adopted Corporate Social Responsibility (CSR) to ensure that the organisation consistently operates in a manner that minimises detrimental impacts to society and the environment.

JW reported in their 2021/22 Mid-year Report the following:

- A total of 2 125 households have been provided with access to basic water against a target of 3 325 while no households were provided with access to basic sanitation against the annual target of 5 720.
- In mitigating the performance of the basic sanitation project, the procurement process was expedited and finalised and the work is planned to commence in February 2022 following public participation.
- The response time to water bursts restored within 48 hours of notification was 76.09% against a target of 92%, and the corresponding sewer blockages cleared within 24 hours of notification was 94. 76% against a target of 95%. A close attention is paid on the response times to ensure an improvement.
- The Entity managed to reduce the water consumption to 263.49 l/c/d against a target of 263.49 l/c/d.
- On the pipe replacement programme, JW have replaced a total of 31.4 km and 17.2 km of water and sewer pipes against the annual targets of 26 km and 15.7 km, respectively. Targets for the financial year have already been exceeded in this area. Whilst we would have preferred to replace more of the water and sewer pipes, the financial resources are very limited. Ideally, the Entity's backlog assessment indicates that we need to annually renew our infrastructure at a rate of 2%. Currently, we were only able to budget for a renewal rate of 0.81%.
- JW managed to spend 29% (R331.859 million) of its allocated capital budget against a target of 35%. In expending this capital budget, the Entity supported 71 SMMEs against a target of 30 for the mid-year. These SMMEs were mainly from the respective communities where projects were being implemented, and preference was given to those that were compliant with the Broad-Based Black Economic Empowerment (B-BBEE) programme. This culminated in the achievement of·B-BBEE recognition level of 131% on SMMEs against a target of 125%. The national benchmark is 75%.
- Johannesburg Water ensured that all its labour-intensive programmes provided job opportunities to support the national Expanded Public Works Programme (EPWP). Through this programme, 783 job opportunities were created against a target of 694. Whilst we have strived to achieve a number of targets during this difficult time, our health and safety protocols were not compromised, and this was evident in the achievement of the Disabling Injury Frequency Rate of 0.46 against a target of 1.
- As at the end of June 2021, JW supplied 1.6 billion litres per day of potable water, procured from Rand Water, through a water distribution network of 12 364 km, 128 reservoirs and water towers, and 37 water pump stations. Wastewater is collected and reticulated through 11 816 km of wastewater networks and 38 sewer pump stations. Johannesburg Water treats 979 Ml/day of sewage at its six Wastewater Treatment Works (WwTW), which includes one of its pilot biogas-to-energy plants where methane gas is converted to energy.

JW awarded the following contracts/tenders to black designated groups in terms of its empowerment initiatives for the quarter:

- Youth owned: RO million (2020/21: R2.6 million) (Enterprises that are more than 50% owned by black youth)
- Women owned: R35.5 million (2020/21: R12.7 million) (Enterprises that are more than 30% owned by black women)
- SMMEs: R28.8 million (2020/21: R86.8 million) (Exempted micro & small enterprises that have a turnover up to R50 million) Black owned: R386.2 million (2020/21: R99.8 million) (Enterprises that are more than 50% owned by black people)

c) Efficient and beneficial use of water in the public interest

The establishment of a new Lanseria WwTW on a greenfields site is an opportunity to develop a facility that reflects the JW strategy with respect to:

- Leadership in the municipal wastewater treatment sector in South Africa with respect to the best wastewater treatment technology, operating and maintenance practices;
- Sustainability of wastewater treatment with respect to efficient water and electrical power utilisation, beneficial use of the waste sludge, limited carbon footprint and resource recovery; and
- Cost-effective and efficient wastewater treatment and associated sludge stabilisation and use.

The construction of three 50Mℓ/d modules (total capacity of 150 Mℓ/d) of an activated sludge WwTW will expand the CoJ's capacity to provide wastewater services to the Lanseria, Diepsloot and Northern suburb areas, amongst other areas, that currently do not have access to this service.

d) Socio-economic impact –

i) Of water use or uses if authorised:

Development of the proposed project will create job opportunities to the local residents, mainly during construction phase. The proposed development will improve basic living conditions and access to services to areas that previously were without sanitation services. The introduction of sewage reticulation and WwTW services will promote residential and commercial development, which would translate into job creation and economic growth.

ii) Of the failure to authorise water use or uses:

Failure to approve this water use authorisation will result in the constrained operation of the existing WwTWs in the Johannesburg City area. Therefore, there will be not available wastewater treatment capacity to facilitate growth in Lanseria, Diepsloot and Northern suburb areas. Without the relevant Water Use License, JW may not be able to meet its intention to expand on its provision of adequate sanitation services in South Africa.

e) Any catchment management strategy applicable to the relevant water resource

Chapter 2 of the NWA addresses the development of strategies to facilitate the management of water resources. "Part 2 requires every catchment management agency to progressively develop a Catchment Management Strategy (CMS) for the water resources within its water management area". A CMS is the framework for water resource management in a WMA and provides a coherent approach (and intent) for managing water resources in the WMA (DWA, 2014).

The proposed project falls within the recently promulgated Limpopo WMA within the A21C Jukskei catchment. As such, a CMS has not yet been developed. In the interim, until CMAs are fully operational, and the Department's Regional Offices are able to hand over the water resource management functions to them, the Department has developed Internal Strategic Perspectives for each of the 9 WMAs to serve as the frameworks for the management of water resources in each WMA.

f) Likely effect of the water use to be authorized on the water resource and on other water users

An EIA was undertaken to identify the impacts that are likely to occur as a result of the proposed development. Specialist studies were undertaken to support the EIA application and included, amongst other, a wetland impact assessment undertaken by a wetland specialist team from The Biodiversity Company.

Two wetland types were identified and delineated within the project area, these are valley bottom and hillslope seepage systems. A riparian zone associated with the Jukskei River was also identified and delineated for the project. The status of the wetlands was determined to be moderately modified, with the modifications largely associated with the local land uses and development of the catchment area.

The proposed WwTW footprint areas encroached within the delineated wetland (and buffer) areas in selected areas (only) resulting in some loss of wetland area. The significance of the remaining aspects (impacts sources) was determined to be minor without mitigation, with the significance being reduced to negligible for the majority of the aspects.

When three alternative layout designs and bridge designs were considered and compared with one another and the original layout submitted with the EIA, the overall footprint of the development will be larger due to the proposed changes when compared to the original designs. However, the proposed amendments (Option C Site Layout Plan) have achieved further avoidance of the delineated wetland and buffer areas when compared with the original layout, namely Option A. This with regards to the mitigation hierarchy, the proposed options have achieved further avoidance, albeit not completely avoiding the wetlands.

Overall, Layout Design Option C is the preferred option based on most of the wetland areas being avoided. For the bridge development the high-level bridge (Design 4) is the preferred option as the overall disturbance will be lower. It is of utmost importance that the mitigations be strictly adhered to in order to limit the extent of the impact. Overall, no fatal flaws were identified for the planned amendment and additional infrastructure.

g) Class and the resource quality objectives of the water resource

The project falls within MRU 22 Crocodile 1 resource unit, under the Jukskei SQR and within quaternary catchment A21C. The reach spans 18.7 km of the Jukskei River. A large degree of riparian and wetland zone modification is present in the catchment. The PES for the Jukskei SQR (A21C-1167) is categorised as an E-class rating due to urbanisation, industrialisation, return flows (increased flows) and poor water quality (The Biodiversity Company, 2015a).

No Water Resource Quality Objectives (WRQO) could be sourced for the Crocodile River (West) catchment. However, a brief overview of the Crocodile River catchment as well as its water quality is given below.

The upper portion of the catchment, south east of Hartbeespoort Dam, is located in the Gauteng Province. The north and north-east corners lie in the Limpopo Province, whereas the central or western sections fall within the North-West Province. The total area of the Crocodile River Catchment is 29 400 km2. There are nine major storage dams in the catchment with very limited scope for additional dams. Large quantities of water are transferred into the Crocodile River (West) Catchment to augment the local water resources, constituting close to 46% of the total water use in the catchment. The most significant transfers of water, are the supply of potable water via the Rand Water bulk distribution system from the Upper Vaal WMA to northern Johannesburg, Tshwane, Rustenburg and surrounds. A quantity of almost 520 million m3 of water was transferred during the year 2000 (DWA, 2014).

h) Investments already made and to be made by the water user in respect of the water use in question

The following investments have been made and are to be made by JW for the proposed project:

- Site selection and pre-feasibility study – ±R1.48m (Excl. VAT);
- EIA processes including specialist studies – ± R1.32m (Excl. VAT);
- WUL application including specialist studies – ± R580 000 (Excl. VAT);
- Engineering process to date – ±R13.05m (Excl. VAT); and
- Engineering process to be made – ±R848.67m (Excl. VAT).

i) Strategic importance of the water use to be authorised

The importance of the proposed construction of three 50 Mℓ /d modules (total capacity of 150 Mℓ/d) of an activated sludge WwTW will expand the CoJ's capacity to provide wastewater services to residential areas that currently do not have access to this service. The scale of wastewater treatment service provided in the City of Johannesburg will be expanded to service areas including Lanseria, Diepsloot and Northern suburbs.

j) The quality of water in the water resource which may be required for the Reserve and for meeting international obligations

A Hydrological Assessment of the Jukskei River Catchment (A21C) was undertaken during the EIA process.

DWS is mandated to undertake a Reserve determination in support of each licence application. A preliminary reserve determination and ecological categorisation were undertaken for surface water resources in the Crocodile (West) Catchment as part of the Crocodile West and Mario Intermediate Reserve Determination Study conducted in 2014 by the DWS (DWA, 2014). The A21C quaternary catchment is delineated from the origin of the Jukskei River to just downstream of the discharge of Johannesburg Northern Works (The Biodiversity Company, 2015a).

A summary of Eco Classification and Preliminary Reserve for each for the A21C catchment is as follows (DWA, 2014):

Table 18: Preliminary Reserve based on Present day flows (DWA, 2014)

Water Resource	EWR Site	Catchment	PES	EIS	REC	PD MAR (Mm^3/a)	EWR (%PDMAR)	BHNR Requirement (% PDMAR)	Reserve Requirement (% PDMAR)
Jukskei	2	A21C	E	Moderate	D	139.90	24.87	4.90	29.77

The study found that there was no potential to improve the PES in the Ecological Water Requirements (EWR) due to the continuous discharges from WwTWs in the catchment, irrigation, that impact on the water quality and quantity as well as the water transfers that further increases the flow (DWA, 2014). Therefore, the Recommended Ecological Category (REC) for most of the sites remained the same (DWA, 2014).

k) Probable duration of any undertaking for which a water use is to be authorised

A Water Use License is required for the construction and operation of the proposed Lanseria WwTW for a permanent period. Therefore, it is recommended that the water use be authorised for a maximum period as required and mentioned above; and be subjected to a review every 5 years.

16. Declaration by the applicant with signature confirming that the information submitted is correct

I, Ms. Joyce Ngobele, hereby declare that all the above information is correct and accurate. I hereby declare that all the information contained in this document is in accordance with facts or truths to my knowledge.

Signed: 

Date: 08/11/2023

[END OF WATER USE LICENCE APPLICATION SUMMARY]