

20 September 2018

Chief Engineer: Water Services Planning

City of Ekurhuleni

P O Box 215

BOKSBURG

1460

Attention: Mr. Mthokozisi Mlotshwa

Dear Sir,

PROPOSED NEW MIXED LAND USE DEVELOPMENT ON PTN 63 OF THE FARM WITFONTEIN 15-IR (BIRCHLEIGH NORTH X4 REV1) – KEMPTON PARK: ASSESSMENT OF IMPACT ON SEWER SYSTEM AND REQUIRED WORKS

As requested by Lebash Architects (Pty) Ltd on behalf of their client, we have investigated the capacity of the sewer system to drain the proposed development located on the abovementioned property and comment as follows:

1. EXTENT OF DEVELOPMENT

The proposed development layout is as per the attached drawing “Birchleigh North X4 layout” received from the detail design consultants. As indicated in the information provided to us, the proposed development will comprise of the following land use distribution:

LAND USE	BLOCK NO	NO OF UNITS	TOTAL SITE AREA (ha)	DENSITY (Units/ha)
Residential (Free standing)	32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 79, 80, 82, 83, 88, 89, 90, 91, 92, 93, 94	762	15.24 (16.7%)	50
Government subsidised housing	18, 19, 78	361	6.02 (6.6%)	60
Residential (Walk-ups)	8, 10, 11, 12, 20, 23, 24, 27, 31, 42, 44, 49, 51, 60, 63, 74	4318	22.56 (24.7%)	110
GAP Housing	5, 13, 15, 46, 47, 48	1754	9.23 (10.1%)	190
Business/Commercial	4, 9, 54, 55, 57, 61	-	8.26 (9.0%)	-
Institutional	6, 22, 50, 52, 59, 77, 81, 85	-	5.9 (6.5%)	-
Educational	14, 17, 29, 86, 87	-	14.14 (15.5%)	-
Park	1, 84	-	9.95 (10.9%)	-
TOTAL	-	7195	91.3 (100.0%)	-

The location and layout of existing sewer services in the vicinity of the site are indicated in Figure A. The current sewer drainage areas of the area under discussion are indicated in Figure B. We confirm that the site is located within the urban development boundary, as defined in the 2010/2011 Metropolitan Spatial Development Framework (MSDF).

We confirm that provision was made for the proposed development in the Olifantsfontein sewer master plan. The proposed development's water demand and resulting sewage flow as calculated below is significantly higher than anticipated in the master plan. Therefore the master plan will be updated accordingly.

2. SEWER SYSTEM

2.1 Sewage flow:

The water demand and resulting sewage flow for the proposed development is estimated as follows:

LAND USE	UNIT	QTY	UNIT DEMAND (kl/day)	TOTAL (kl/day)
Residential (Free standing)	No.	762	0.60	453.4
Government subsidised housing	No.	361	0.51	184.1
Residential (Walk-ups)	No.	4318	0.51	2202.2
GAP Housing	No.	1754	0.51	894.5
Business/Commercial	ha	8.26	21.25	175.5
Institutional	ha	5.9	12.75	75.2
Educational	ha	14.14	12.75	180.3
Park	ha	6.4675	12.75	82.5
SUB-TOTAL				4247.7 kl/d
PLUS UAW (15% OF TOTAL AADD)				749.6 kl/d
TOTAL AVERAGE DEMAND (AADD)				4997.3 kl/d
AVERAGE DAILY DRY WEATHER FLOW (ADDWF)				3540.2 l/s
PEAK DAILY DRY WEATHER SEWAGE FLOW				82.0 l/s

The unit water demand for each unit of development was combined with a unique sewer unit hydrograph for the specific land use (derived over history for the flow pattern of similar types of development) and yielded a peak dry weather sewage flow of approximately 82.0 l/s for the development.

2.2 Existing Sewer Services, Proposed Connection Points and Proposed Upgrading

Drainage areas (See Figure B)

The development site falls within the area currently draining directly under gravity to the Olifantsfontein WWTP.

Certain changes in sewer drainage area boundaries are recommended between the current- and ultimate future drainage scenarios in the master plan. None of these changes, however, will have a direct implication on the proposed development.

Sewage pump station capacities

No existing municipal sewer pump stations are affected by the proposed development.

Please note that the master plan proposes that the Esselen Park X2 pump station be phased out in the near future (MP Item: PS_Esselen). This will entail the construction of approximately 540m of 160Ø sewer pipes, as indicated on Figure A.

Main outfall sewers

Existing main outfall sewers:

According to our hydraulic analysis, the highlighted sections of sewer pipes in Figure C are experiencing capacity problems in the interim and ultimate scenario. We however have limited certainty with regards to the integrity of these sections and therefore recommend the following surveying to be conducted in the near future. Upon receiving the surveying results of the proposed surveys, we will re-investigate our hydraulic analysis to determine the necessity of upgrading these sections.

The existence, layout, connectivity, diameter and slope of the following MP Projects need to be verified for the development to proceed (refer to Figure C):

- MP Project - Oli_11
- MP Project - Oli_12
- MP Project - Oli_13.

The following MP Projects need to be upgraded for the development to proceed (refer to Figure C):

- MP Project - Oli_8
- MP Project - Oli_13.

Please note the requirement to survey and upgrade the abovementioned sewer is already an existing priority and was not caused solely by the increase in sewage flow from the proposed development. We can however confirm that several consultants have been appointed for the abovementioned surveying and upgrades.

Future planned main outfall sewers:

The following main outfall sewer pipes need to be implemented for the development to proceed (refer to Figure A):

- Construct the following sections of sewer pipes to make a connection at point F:
 - Approximately 1520 m of new 200Ø sewer pipes from point A to point B, point G to point H, as well as point I to point E
 - Approximately 190 m of new 225Ø sewer pipe from point B to point C and from point H to point C
 - Approximately 200 m of new 315Ø sewer pipe from point C to point D
 - Approximately 230 m of new 450Ø sewer pipe from point D to point E
 - Approximately 50 m of new 500Ø sewer pipe from point E to point F.

- Construct the following sections of sewer pipes to make a connection at point L (refer to Figure A):
 - Approximately 80 m of new 200Ø sewer pipe from point M to point K
 - Approximately 330 m of new 250Ø sewer pipe from point J to point K; or
Approximately 210 m of new 250Ø sewer pipe from point J to point N
 - Approximately 190 m of new 280Ø sewer pipe from point K to point L.

Network sewer pipes and connections to existing system

Required works and recommended connection points:

The following network sewer pipes need to be surveyed for the implementation of a connection at point N or point L (refer to Figure C):

- The sewer section from point N to point L needs to be surveyed for a connection at point N, as indicated on Figure A
- The sewer section downstream of point L needs to be surveyed as part of Master Plan Projects: MPi - Oli_33 and MPi - Oli_17 for a connection at point N or point L
- These projects entail the surveying of the Esselen Park X1 gravity sewers to determine the diameter and slopes of this section of pipes.

The development can proceed by making a connection at point F, point L and point N (refer to Figure A). As an alternative to draining the flow from point J to point K, it is also an option to drain from point J to point N.

- Connect to the existing 300Ø sewer pipe in Pongola River Drive at point F
- Connect to the existing 150Ø sewer pipe on the corner of Nineteenth Street and Eighteenth Street at point L
- A connection can also be made to the existing 150Ø sewer pipe at point N
- The development is responsible for a design sewer flow of 30 l/s at connection point L and 52 l/s at connection point F.

With the above connections in place we confirm that none of the affected network sewers downstream of the development will experience a decrease in spare capacity to below the minimum requirement of 30% spare capacity.

Future provisions:

Due to the cadastral layout and natural topography of the area, no provision has to be made for any further future development to drain through the development site.

Wastewater treatment plants

Olifantsfontein WWTP:

The Olifantsfontein WWTP currently has a treatment capacity of approximately 105 Ml/d. The current measured dry weather inflow to the plant is approximately 86 Ml/d. This results in a spare capacity of approximately 18%. The difference between the measured wet- and dry weather inflow at the plant results in a calculated infiltration of 15%. Therefore the current 18% spare capacity of the plant is sufficient to accommodate the additional sewage flow from the proposed development.

3. DEVELOPER CONTRIBUTIONS TO UPGRADING OF INFRASTRUCTURE

GLS hereby confirms that any contributions of the developer to the required construction of infrastructure and/or the upgrading of the existing infrastructure, whether it be in the form of a cash contribution, or in the form of constructing sections of new infrastructure, is a matter to be discussed and agreed upon between the developer and the City of Ekurhuleni (CoE) and ERWAT.

4. SUMMARY RECOMMENDATIONS

In summary we comment as follows:

- The development falls within the area currently draining under gravity directly to the Olifantsfontein WWTP
- No sewage pump stations are affected. Please note however that it is proposed for the Esselen Park X2 pump station to be phased out in the near future. The abandoning of this PS will entail the construction of approximately 540m of 160Ø sewer pipes, as indicated on Figure A
- To make a connection at point D, it is recommend that Master Plan Project Oli_11, should be surveyed (refer to Figure C)
- To make a connection at point H, it is recommended that the highlighted sections of Master Plan Project Oli_13 should be surveyed and upgraded (refer to Figure C)
- The network sewer pipes indicated as part of Master Plan Project Oli_18 should be surveyed to make a connection at point D (refer to Figure C)
- Please note that the requirement to survey and construct the abovementioned sewer is already an existing priority and was not caused solely by the increase in sewage flow from the proposed development
- We can confirm that several consultants have been appointed for the abovementioned surveying and upgrades
- The following main outfall sewer pipes need to be implemented for the development to proceed (refer to Figure A):
 - Construct the following sections of gravity pipes to make a connection at point F (refer to Figure A):
 - Approximately 1520 m of new 200Ø sewer pipes from point A to point B, point G to point H, as well as point I to point E
 - Approximately 190 m of new 225Ø sewer pipe from point B to point C and from point H to point C
 - Approximately 200 m of new 315Ø sewer pipe from point C to point D
 - Approximately 230 m of new 450Ø sewer pipe from point D to point E
 - Approximately 50 m of new 500Ø sewer pipe from point E to point F
 - Construct the following sections of gravity pipes to make a connection at point L (refer to Figure A):
 - Approximately 80 m of new 200Ø sewer pipe from point M to point K
 - Approximately 330 m of new 250Ø sewer pipe from point J to point K; or Approximately 210 m of new 250Ø sewer pipe from point J to point N
 - Approximately 190 m of new 280Ø sewer pipe from point K to point L

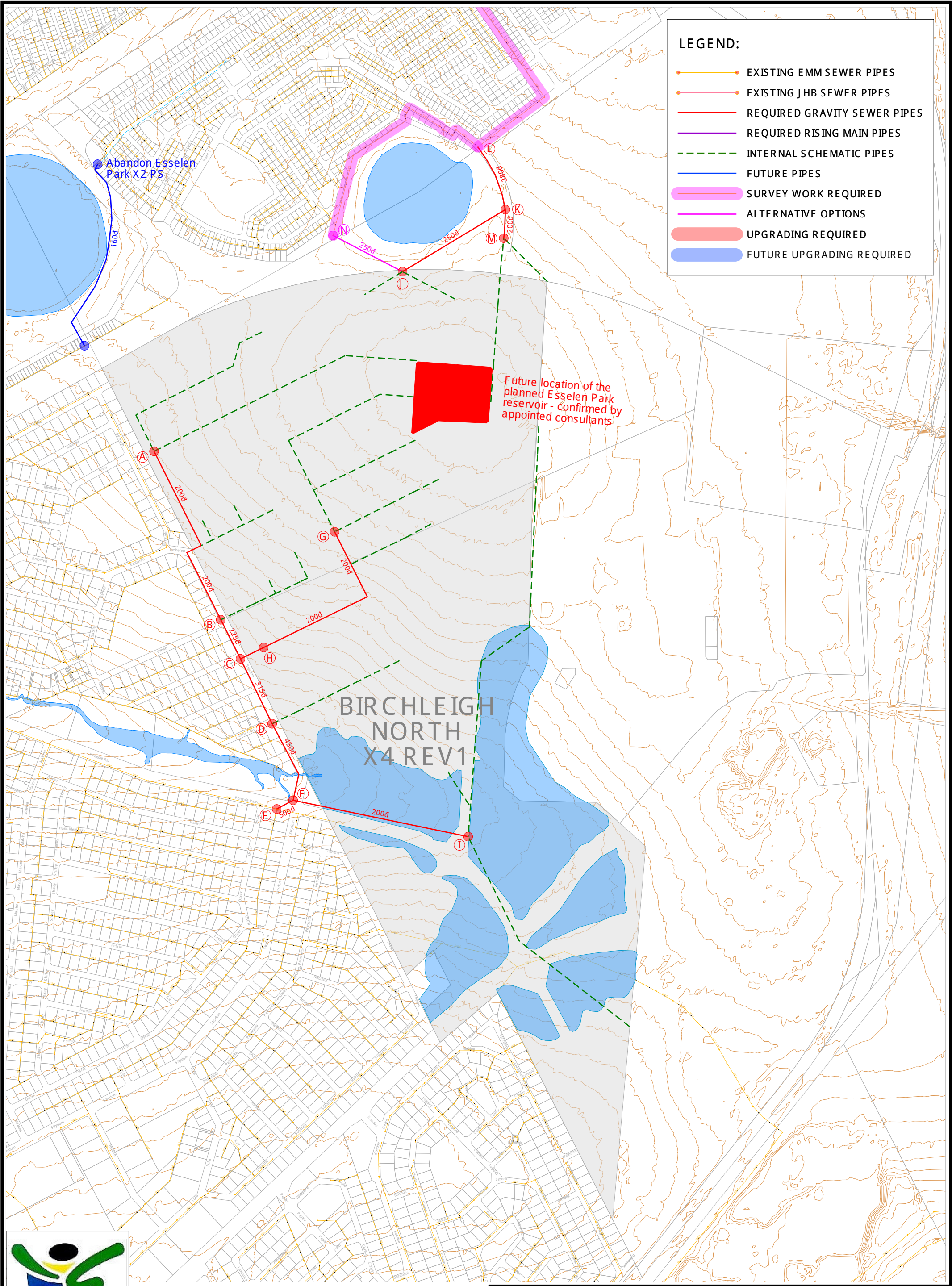
- The following network sewer pipes need to be surveyed for the implementation of a connection at point N or point L (refer to Figure C):
 - The sewer section from point N to point L needs to be surveyed for a connection at point N, as indicated on Figure A
 - The sewer section downstream of point L needs to be surveyed as part of Master Plan Projects: MPi - Oli_33 and MPi - Oli_17 for a connection at point N or point L
 - This project entails the surveying of the Esselen Park X1 gravity sewers to determine the diameter and slopes of this section of pipes
- The development can proceed by making a connection to point F, point L and point N, as indicated on Figure A. As an alternative to draining the flow from point J to point K, it is also an option to drain from point J to point N
- Due to the cadastral layout and natural topography of the area, no provision has to be made for any further future development to drain through the development site.

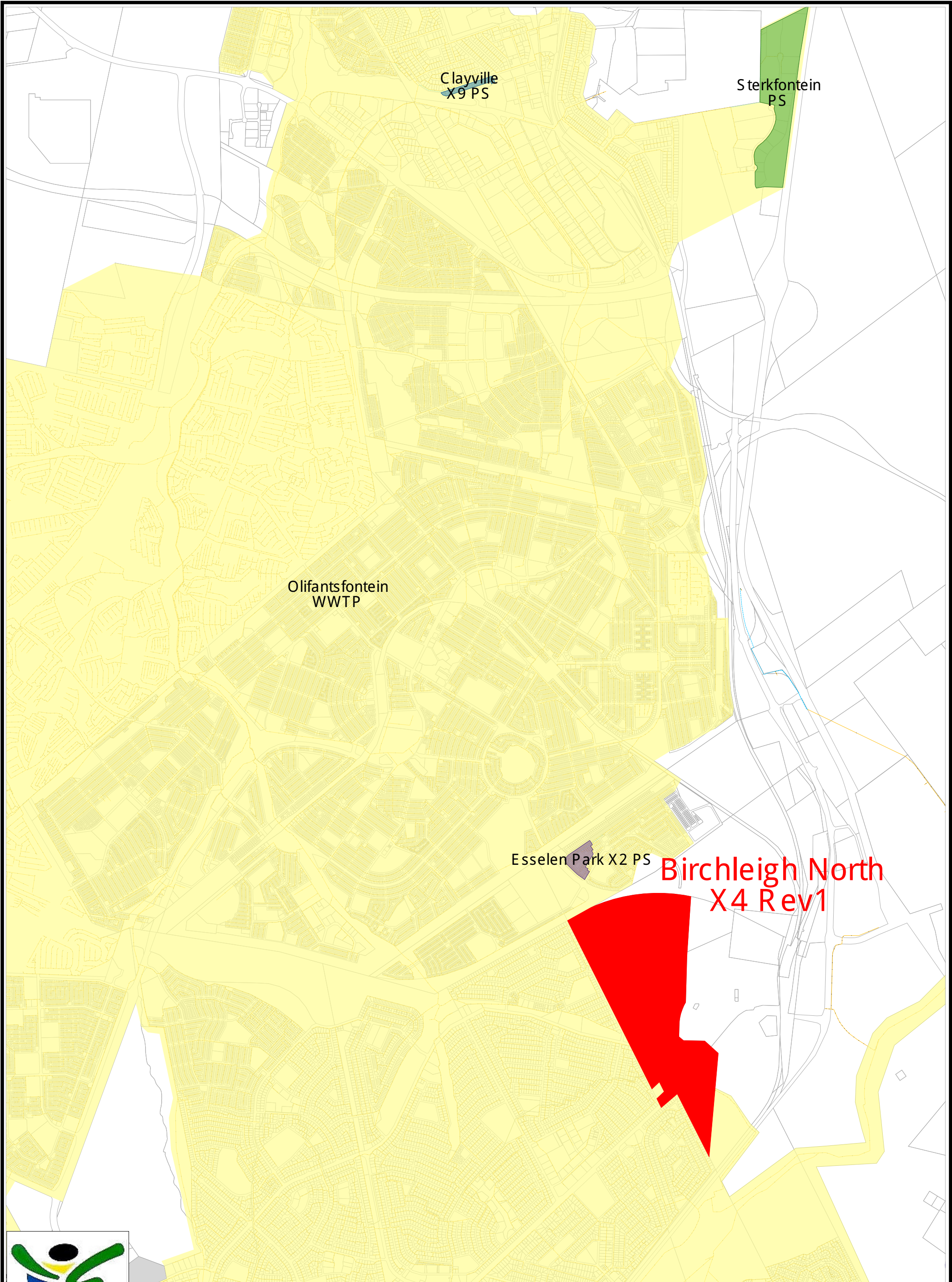
We trust you will find the above sufficient in terms of your request. Should you have any further queries, please do not hesitate to contact us. The contact person regarding the above is Dian Pretorius.

Yours sincerely,
GLS CONSULTING



Per: JL (LOUIS) STRIJDOM





September 2018

Ad Hoc Sewer Capacity Investigation
Birchleigh North X4 Rev1 - Kempton Park

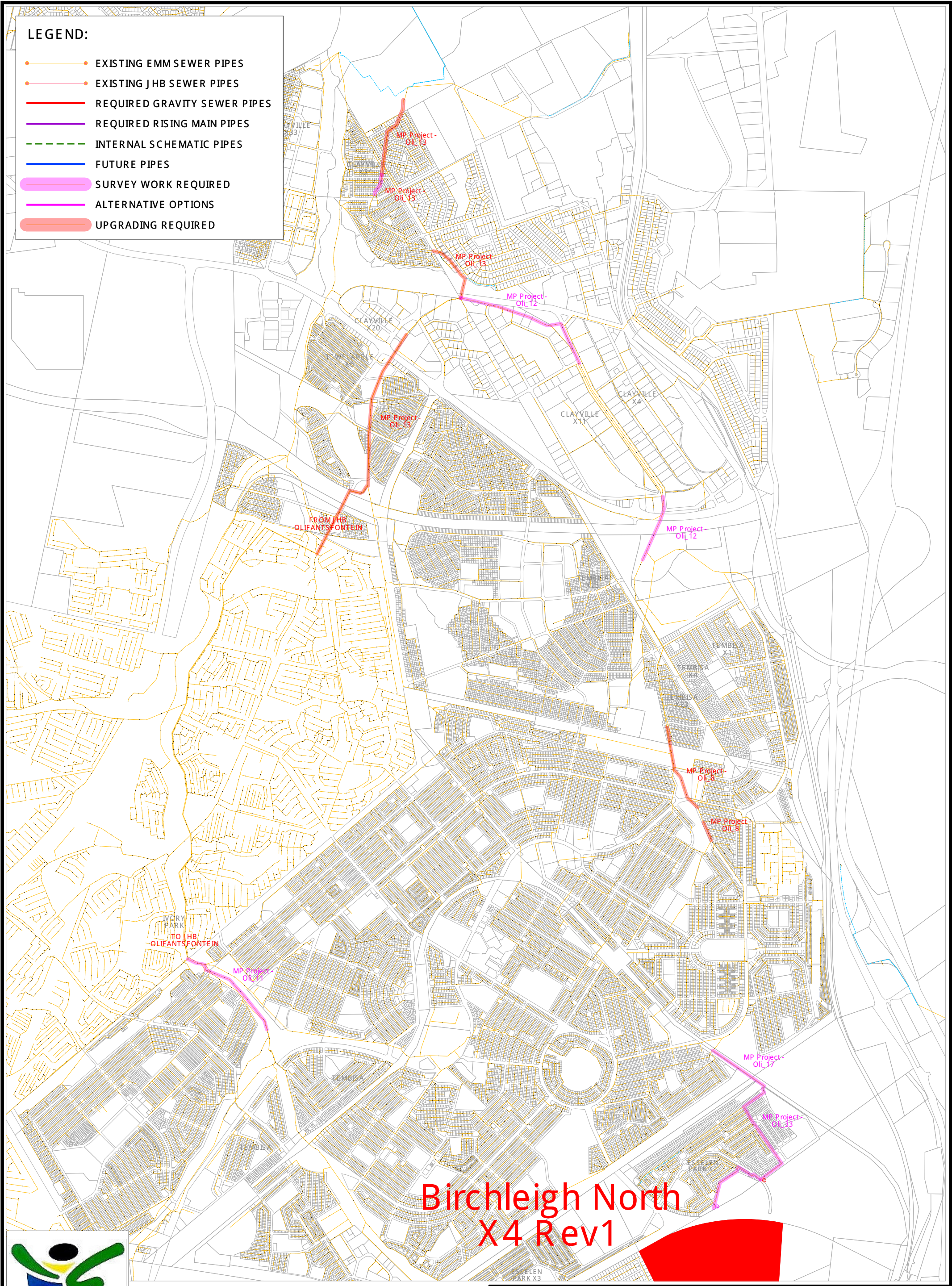


Figure B

Layout and location of existing
sewer drainage areas

LEGEND:

- EXISTING EMM SEWER PIPES
- EXISTING JHB SEWER PIPES
- REQUIRED GRAVITY SEWER PIPES
- REQUIRED RISING MAIN PIPES
- - - INTERNAL SCHEMATIC PIPES
- FUTURE PIPES
- SURVEY WORK REQUIRED
- ALTERNATIVE OPTIONS
- UPGRADING REQUIRED



Birchleigh North X4 Rev1



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Figure C
Upgrading requirements to
Tembisa outfall sewers

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Dear Sir,

PROPOSED NEW MIXED LAND USE DEVELOPMENT ON PTN 63 OF THE FARM WITFONTEIN 15-IR (BIRCHLEIGH NORTH X4 REV1) – KEMPTON PARK: ASSESSMENT OF IMPACT ON WATER SUPPLY SYSTEM AND REQUIRED WORKS

As requested by Lebash Architects (Pty) Ltd on behalf of their client, we have investigated the capacity of the water supply system to supply the proposed development located on the abovementioned property and comment as follows:

1. EXTENT OF DEVELOPMENT

The proposed development layout is as per the attached drawing “Birchleigh North X4 layout” received from the detail design consultants. We would hereby like to point out that the position of the future planned Esselen Park reservoir interferes with the proposed development’s layout, as confirmed by the consultants appointed for the design and construction supervision of the Esselen Park reservoir. As indicated in the information provided to us, the proposed development will comprise of the following land use distribution:

LAND USE	BLOCK NO	NO OF UNITS	TOTAL SITE AREA (ha)	DENSITY (Units/ha)
Residential (Free standing)	32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 79, 80, 82, 83, 88, 89, 90, 91, 92, 93, 94	762	15.24 (16.7%)	50
Government subsidised housing	18, 19, 78	361	6.02 (6.6%)	60
Residential (Walk-ups)	8, 10, 11, 12, 20, 23, 24, 27, 31, 42, 44, 49, 51, 60, 63, 74	4318	22.56 (24.7%)	110
GAP Housing	5, 13, 15, 46, 47, 48	1754	9.23 (10.1%)	190
Business/Commercial	4, 9, 54, 55, 57, 61	-	8.26 (9.0%)	-
Institutional	6, 22, 50, 52, 59, 77, 81, 85	-	5.9 (6.5%)	-
Educational	14, 17, 29, 86, 87	-	14.14 (15.5%)	-
Park	1, 84	-	9.95 (10.9%)	-
TOTAL	-	7195	91.3 (100.0%)	-

This study was based on a minimum required residual pressure of 24 m from the municipal system. Please note that, should any part of the proposed development ultimately have more than two storeys, private boosting to the higher storeys might be required if excess pressure is not available from the municipal system.

The location and layout of existing water supply services in the vicinity of the site are indicated on Figure A1 and Figure A2 included herewith. The future water distribution zones of the area under discussion are indicated on Figure B. We confirm that the site is located within the urban development boundary, as defined in the 2010/2011 Metropolitan Spatial Development Framework (MSDF).

We furthermore confirm that provision was not made for the proposed development in the Kempton Park water master plan. Therefore, the master plan will be updated accordingly.

2. WATER SYSTEM

2.1 Water demand:

The total water demand for the proposed development is estimated as follows:

LAND USE	UNIT	QTY	UNIT DEMAND (kl/day)	TOTAL (kl/day)
Residential (Free standing)	No.	762	0.60	453.4
Government subsidised housing	No.	361	0.51	184.1
Residential (Walk-ups)	No.	4318	0.51	2202.2
GAP Housing	No.	1754	0.51	894.5
Business/Commercial	ha	8.26	21.25	175.5
Institutional	ha	5.9	12.75	75.2
Educational	ha	14.14	12.75	180.3
Park	ha	6.4675	12.75	82.5
SUB-TOTAL				4247.7 kl/d
PLUS UAW (15% OF TOTAL AADD)				749.6 kl/d
TOTAL AVERAGE DEMAND (AADD)				4997.3 kl/d
PEAK DEMAND (excl. fire flow)				231.4 l/s
FIRE FLOW PER HYDRANT (x4) - (Moderate risk 1)				25 l/s

2.2 Existing Water Services, Proposed Connection Points and Proposed Upgrading

Water distribution zone (See Figure B)

The proposed development was divided into four discrete pressure zones that can be incorporated into the existing/future water distribution zones as follows (see Figure A1, Figure A2 and Figure B):

Pressure Zone 1 falls within the Birchleigh PRV1 zone - a proposed sub-zone of the area currently being supplied from the Kempton West reservoirs. The Birchleigh PRV1 is located on the existing 200Ø pipe parallel to the M43, as indicated on Figure A1 and Figure A2. For the implementation of Birchleigh PRV1 zone, master plan item MP – KW_2.9 needs to be implemented. This entails the construction of a new PRV on the existing 225Ø pipe at the corner of Strydom and Theuns Street, limiting the downstream pressure to 60m. Pressure Zones 3 and 4 also fall within the area currently being supplied from the Kempton West reservoirs zone.

Pressure Zone 2 can be supplied from two different water distribution zones as follows:

- For Option 1, Pressure Zone 2 can be supplied from the Kempton West reservoirs zone, as indicated on Figure A1
- For Option 2, Pressure Zone 2 can be supplied directly from Rand Water through RW Connection RW1744, as indicated on Figure A2.

Certain changes in the water distribution zone boundaries are proposed between the current and the future water supply scenarios. These changes will have a direct implication on Pressure Zone 2 – Option 2. For Option 2, Pressure Zone 2 will be supplied from the Tembisa and Esselen Park Tower Zone in the ultimate scenario.

Reservoir Capacities

GLS received instruction from CoE, Department of Water and Sanitation, dated 20 July 2018 to amend the Modelling Design Standards January 2017 (Section 4.5.1) to define the minimum reservoir storage capacity as 36 h x AADD when the reservoir is supplied by Rand Water through gravity or 36 h x AADD when supplied through a pumped system. The calculations for the minimum required reservoir storage capacity below take cognizance of the aforementioned amendment.

Kempton West reservoirs:

The total AADD of the area currently being served from the Kempton West reservoirs was calculated from the latest Rand Water meter readings in conjunction with the latest Ekurhuleni treasury data to be approximately 29 236 kℓ/d.

Assuming the supply rate of the reservoirs is controlled at 1.5 x AADD, the following applies to the current demand scenario:

$$\begin{aligned}\text{Supply rate:} &= 1.5 \times \text{AADD} \\ &= 1.5 \times 29\,236 / 86.4 \\ &= 508 \text{ ℓ/s}\end{aligned}$$

$$\begin{aligned}\text{Total volume required} &= 36 \text{ h} \times \text{AADD} \\ &= 36 \times 29\,236 / 24 \\ &= 43\,854 \text{ kℓ}\end{aligned}$$

With the inclusion of the additional demand from the proposed development the current AADD increases to 34 233 kℓ/d. This results in a total required reservoir volume of 51 350 kℓ. The 50Mℓ combined reservoir storage volume currently available therefore has a slight deficiency in storage capacity.

Water tower capacities

No existing municipal water towers are directly affected by the proposed development.

Pump Station Capacities

No existing municipal pump stations are directly affected by the proposed development.

Bulk pipe capacities

Existing affected bulk pipes:

The following existing bulk pipe needs to be upgraded for Pressure Zone 2 - Option 1:

- The short section of existing 300Ø supply pipe needs to be upgraded to a 450Ø pipe, as indicated on Figure A1.

The following existing bulk pipe needs to be upgraded for Pressure Zone 2 - Option 2:

- The existing 225Ø supply pipe needs to be upgraded to a 450Ø pipe from the bulk meter connection up to the connection of Pressure Zone 2 to the existing system, as indicated on Figure A2.

With the implementation of the abovementioned upgrades, none of the affected main feeder lines will have an increase in flow velocity to above 2.0 m/s - the maximum allowable flow velocity according to the City of Ekurhuleni's (CoEs) modeling guidelines. We can therefore confirm that no upgrading to any existing affected bulk pipes will be required for the development to proceed.

Future planned bulk pipes:

The following future planned bulk pipes are required for Pressure Zone 2:

Option 1:

The following future planned bulk pipes are required for the development to proceed (refer to Figure A1):

- Approximately 2 340m of 450Ø water pipe
- Approximately 290m of 355Ø water pipe
- Approximately 160m of 280Ø water pipe
- Approximately 670m of 250Ø water pipe
- Approximately 90m of 225Ø water pipe
- Approximately 170m of 200Ø water pipe
- Approximately 800m of 160Ø water pipe.

Option 2:

The following future planned bulk pipes are required for the development to proceed (refer to Figure A2):

- Approximately 130m of 450Ø water pipe
- Approximately 400m of 315Ø water pipe
- Approximately 140m of 250Ø water pipe
- Approximately 110m of 225Ø water pipe
- Approximately 530m of 200Ø water pipe
- Approximately 780m of 180Ø water pipe
- Approximately 2 280m of 160Ø water pipe.

Connection to the existing system, residual network pressures and required works

The development can proceed by making connections to the existing system as per the options provided on Figure A1 or Figure A2.

With the above connections in place, the inclusion of the additional demand from the proposed development will not result in any of the affected main feeder pipes or network pipes experiencing an increase in flow velocity beyond the maximum flow velocity of 2.0 m/s nor will it result in other more critical sections of the water supply network experiencing decreases in residual pressures below the minimum of 24 m head.

The static and residual pressures (at ground level) that can be expected within the vicinity of the proposed development are as follows:

SCENARIO	PRESSURE (m)	CRITERIA
Peak flow	Zone 1: 25 Zone 2 – Option 1: 25 Zone 2 – Option 2: 24 Zone 3: 53 Zone 4: 44	24 m minimum
Fire flow	15*	15 m minimum
Static	Zone 1: 71 Zone 2 – Option 1: 77 Zone 2 – Option 2: 51 Zone 3: 80 Zone 4: 77	90 m maximum

*Note: * Fire flow can only be supplied to Pressure Zone 3 of the proposed development. On site storage for fire flow conditions is therefore recommended.*

3. DEVELOPER CONTRIBUTIONS TO CONSTRUCTION / UPGRADING OF INFRASTRUCTURE

GLS hereby confirms that any contributions of the developer to the required construction of infrastructure and/or the upgrading of the existing infrastructure, whether it be in the form of a cash contribution, or in the form of constructing sections of new infrastructure, is a matter to be discussed and agreed upon between the developer and the City of Ekurhuleni (CoE).

4. SUMMARY RECOMMENDATIONS

In summary we comment as follows:

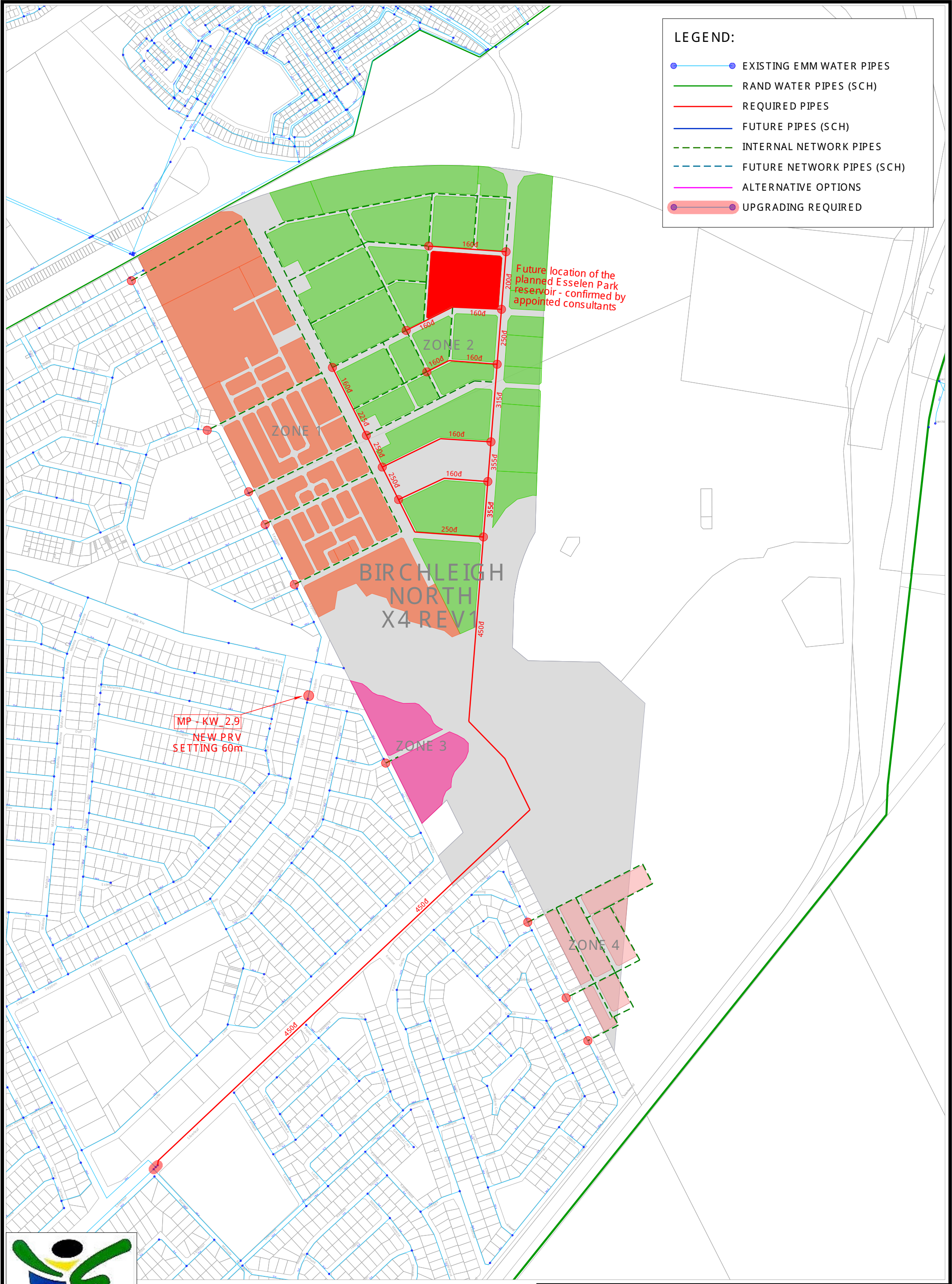
- The development was divided into four different pressure zones:
 - Pressure Zone 1 falls within the Birchleigh PRV1 zone - a proposed sub-zone of the area currently being supplied from the Kempton West reservoirs
 - Pressure Zones 3 and 4 also fall within the area currently being supplied from the Kempton West reservoirs zone
 - Pressure Zone 2 can be supplied from two different water distribution zones as follows:
 - For Option 1, Pressure Zone 2 can be supplied from the Kempton West reservoirs zone
 - For Option 2, Pressure Zone 2 can be supplied directly from Rand Water through RW Connection RW1744
- The 50Mℓ combined reservoir storage volume currently available has a slight deficiency in storage capacity
- No water towers or pump stations are affected for the interim scenario
- The required future planned bulk pipes are summarized under the Future planned bulk pipes section above
- The development can proceed by making connections to the existing system as per the options provided on Figure A1 or Figure A2.

We trust you will find the above sufficient in terms of your request. Should you have any further queries, please do not hesitate to contact us. The contact person regarding the above is Dian Pretorius.

Yours sincerely,
GLS CONSULTING



Per: JL (LOUIS) STRIJDOM



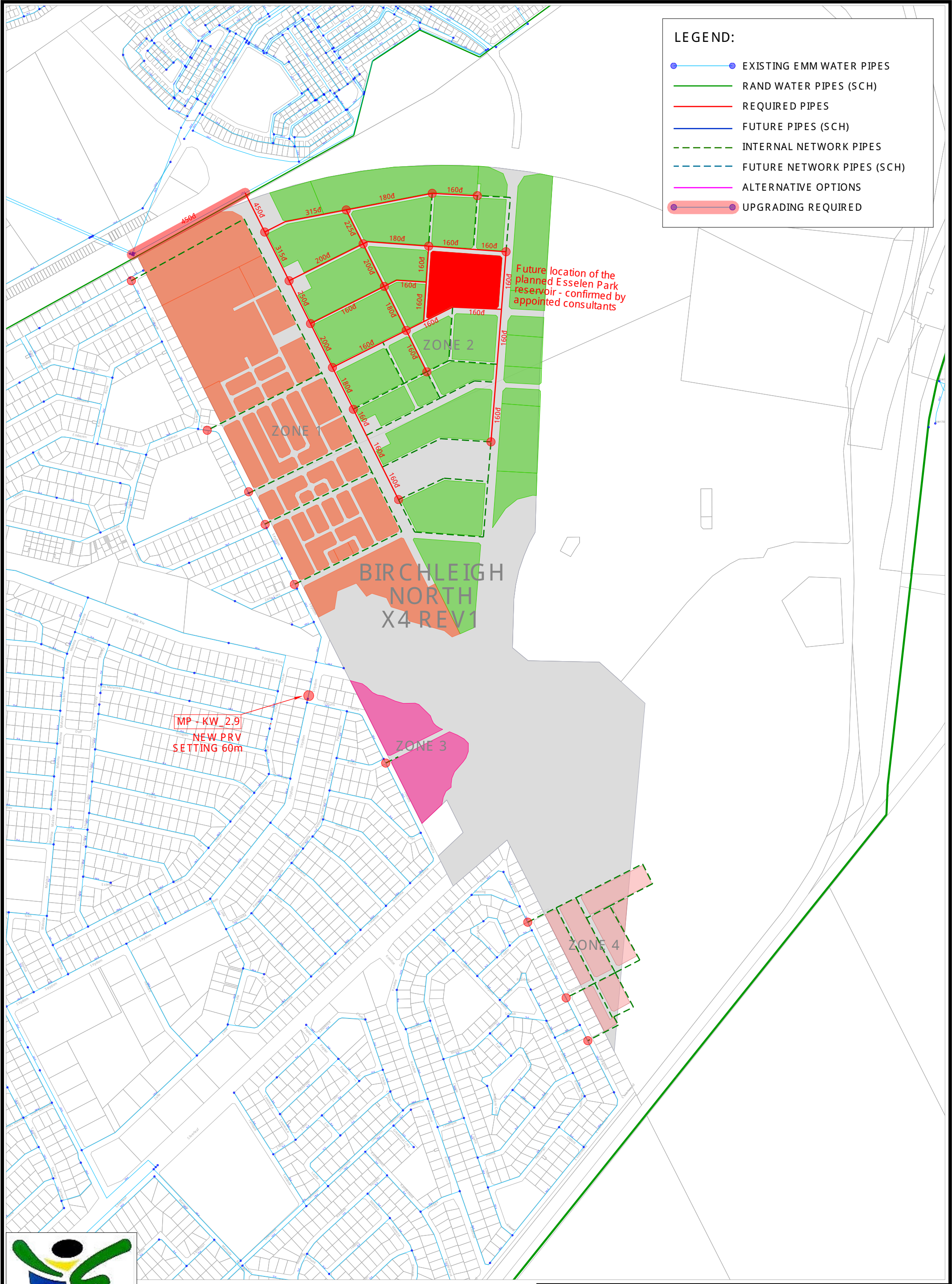
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Figure A1

Location and layout of existing water supply services & proposed connection points



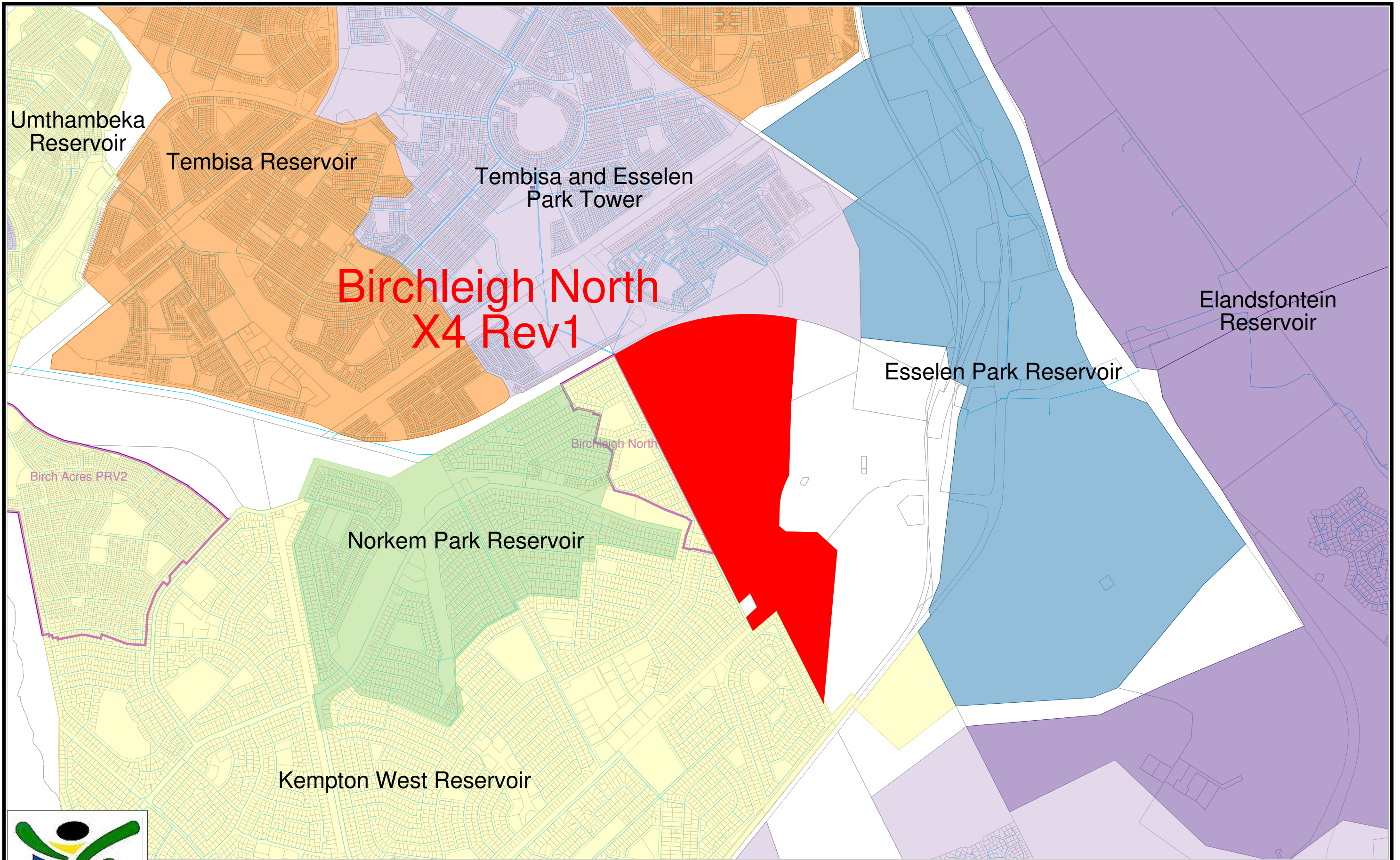
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Figure A2

Location and layout of existing water supply services & proposed connection points



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Figure B
 Layout and location of future
 water distribution zones