DEVELOPMENT OF CLAYVILLE EXTENSION 50
DRAFT ENGINEERING BULK SERVICES
OUTLINE SCHEME REPORT
MAY 2015

Issued by:
Valumax Midrand (Pty) Ltd
Ballywoods Office Park
Ground Floor, Ironwood House
33 Ballyclare Drive, Bryanston, 2146
PO Box 78772, Sandton, 2146

Tel: 011 463 8882
Fax: 011 463 8838

Attention: Mr Rocco De Kock

Compiled by:

Allan Cormack Street, The Innovation Hub, Persequor, Pretoria
PO Box 29, The Innovation Hub, Pretoria, 0087
Tel: +27 (0)12 843 9082
Fax: +27 (0)12 843 9000/1
E-mail: jason.webster@bigenafrica.com
www.bigenafrica.com

BIGEN AFRICA
INFRASTRUCTURE DEVELOPMENT COMPANY

Enquiries: Mr Philip Reyneke / Mr Jason Webster

CLAYVILLE EXTENSION 50 DEVELOPMENT

PRELIMINARY BULK SERVICES REPORT

TABLE OF CONTENTS

ANNEXURES

CLAYVILLE EXTENSION 50 DEVELOPMENT

OUTLINE SCHEME REPORT

1. INTRODUCTION

1.1. Purpose of this report

Bigen Africa Services (Pty) Ltd was appointed by Valumax Midrand (Pty) Ltd to do the investigation on the existing and required external engineering services for the proposed Clayville Extension 50 integrated housing development.

The purpose of this report is the following:

- To stipulate the design norms and standards on which the estimation of the capital costs of the Engineering Services are based on;
- To establish the status of the existing infrastructure available to the development; and
- To determine the upgrading and new infrastructure needed for the development.

In addition to the above, the estimated cost of the external services is reported on. This will allow the Developer and the Local Authority to assess the impact and plan for the provision of external services to the proposed developments.

The Engineering Services addressed in this report are:

- Water Supply;
- Sanitation;
- Roads Infrastructure;
- Stormwater; and
- Electricity Supply

1.2. Project Brief

The Clayville Extension 50 integrated housing project is a large scale mixed income, mixed typology and mixed tenure housing development, in accordance with the Breaking New Ground Policy of national government.

The development is assumed to consist of approximately 4 110 units situated on the

northern Portion 183 of the farm Olifantsfontein 410-JR. directly north-west of the Clayville Extension 45 development. See **Annexure A** for a key / locality plan of the area. Approximately 4 110 units are to be made available as single residential GAP/FLISP, multi-storey RDP and multi-storey Social/Rental units. The development will also make provision for community and business stands.

2. SITE DESCRIPTION

2.1. Locality

The Site of approximately 146.39 hectares is located directly north-west of Clayville Extension 45, north of Kaalfontein Extension 22 and north of the proposed Clayville Extension 71 and south of the PWV 5. The proposed development site borders the City of Johannesburg Metropolitan Municipality to the south and is located within the Ekurhuleni Metropolitan area of jurisdiction.

Clayville Ext 50 will be developed on Portion 207 (A Portion of Portion 183) of the farm Olifantsfontein 410 JR. and Clayville Ext 71 on the Remainder of Portion 183 of the farm Olifantsfontein 410-JR.

A locality plan is attached to this report as **Annexure A**.

2.2. Flood Lines

Two flood plains initiate on the site, one at the southern border and one at the center of the development, as indicated on Drawing No 2374.00.ZA.04.A001, included as **Annexure B**. The flood areas have relatively shallow embankments and will be accommodated into the layout plan as open space and stormwater runoff.

3. WATER SUPPLY

3.1 Authority and Service provider

The Ekurhuleni Metropolitan Municipality is the Water Service Authority for the Clayville development in terms of the Water Services Act (Act No. 108 of 1997).

3.2 Regional Supply

The project area is sited within the EMM jurisdiction area. However, the existing bulk water infrastructure close to the development is located within the Johannesburg Metropolitan Municipality. Johannesburg's water entity, Johannesburg Water (Pty) Ltd, implements the stipulations of the Water Master plan for the Midrand MLC as compiled in 2000. This plan reflects the division of the Midrand supply area into 18 distribution zones, each served by either ground reservoirs or water towers. The project area falls within the PPT (President Park Tower) supply zone.

In addition to the above existing Johannesburg Water infrastructure, a 915mm diameter Rand Water Bulk RW3508 supply line is located within Allan Road to the west of the development. A 600ND connection from this Rand Water line exists to Clayville Extensions 71 and 50 and runs along the southern boundary of Clayville Extension 71. This bulk connection is to also supply water to Clayville Extensions 71 and 50 via two zones within Extensions 71 and 50; a direct feed zone and a reservoir and tower zone.

A GLS report was commissioned in 2009 which outlines the details of the water demand and zones. The locality of the abovementioned infrastructure is indicated on Drawings No. 2374.00.ZA.05.A001, attached as **Annexure C.**

3.3 Water Demands

The design of the bulk, link and internal reticulation required for the development will accommodate the ultimate demands anticipated. The proposed demands followed the identical approval process as that of the norms and standards. The total average annual daily demand (AADD) of the Clayville Ext 50 development project amounts to 4.3 Mℓ/day. The peak hour demand totals 203 ℓ/s.

The design demands used for this development is mostly derived from the guidelines proposed in *Table 4.1 Reference A* and are summarised below in table 3.1.

TABLE 3.1: Water Design Demands

ZONING	UNIT DEMAND	UNITS OR ERVEN	AADD (kℓ/d)	Flow (ℓ/s)	DESIGN PEAK FLOW (ℓ/s)
GAP/FLISP	800 ℓ/unit/day	2 055 units	1 644	19.02	76.11
3-4 Storey RDP Units	600 ℓ/unit/day	1 644 units	986	11.42	45.67
3-4 Storey Social Rental Units	600 ℓ/unit/day	411 units	247	2.85	11.42
Creche	2 000 ℓ/day/erf		1 500	17.36	69.44
Religious	2 000 ℓ/day/erf				
Schools	15 000 ℓ/day/erf)				
Business (Office, shops etc.)	20 000 ℓ/day/erf				
Industrial	20 000 ℓ/day/erf				
Community facilities	2 000 ℓ/day/erf				
Cultural Village	2 000 ℓ/day/erf				
		Total	**4 377**	**51**	**203**

3.4 Design Norms and Standards

The design criteria for the development of the site are based on the standards of Ekurhuleni Metropolitan Municipality: “Developer’s Guidelines to Installing Water and Sewer Services” which adopted the standards of the Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development, summarized below in Table 3.2.

The design norms and standards are currently in draft format, but are being finalized by CES (Community Engineering Services).

Table 3.2: Standards and Specifications for Water supply:

PARAMETER	DETAIL	SPECIFICATION
Peak Factor	Entire Development	4
Placement of service	Distribution Network Supply to erven	High side of the street Street front of erven 1m to 1.5m from boundaries
Flow velocity	Residential areas ø⩽150mm ø≥200mm	1,0 m/s – 3.5m/s 1.5m/s – 2.5m/s
Pressure	Static pressure Dynamic pressure	*Max* - 90m *Min* - 25m residential 35m business / industrial
Losses	Secondary	10%
Fire flow: Central Business area and cluster housing	Hydrant spacing Flow at hydrant Total flow Minimum pressure: At node Rest of system	*Max* - 120m from furthest erf 25 ℓ/s 50 ℓ/s 15 m 10 m
Fire flow: Single residential erven	Hydrant Flow at hydrant Total flow Minimum pressure: At node Rest of system	*Max – 120 m for furthest erf* 15 ℓ/s 15 ℓ/s 8 m 8 m
Pipe-cover	Sidewalks Road-crossing Tarred Roads Across erven Other services present	*Min* - 1m *Min* - 1m Min – 1m *Max* -1m *Min* - 0,75m *Max* -1,5m *Min* - 0,8m
Piping	Sizes Material	*Min* – 75mm dia uPVC class 12 spigot and socket
	Adjacent house connections	1 stand: 25mm minimum 2 stands: 32mm minimum
	House connections across street	1 stand: 25mm minimum 2 stands: 32mm minimum
Valves	Type	RSV – class 16 to SANS664, cap top, non-rising spindle and anti-clockwise closing.

3.5 Required upgrade

As indicated in Paragraph 3.2, Johannesburg Water and Rand Water bulk water infrastructure exist in close proximity to the development. The utilization of both entities' infrastructure was considered for the provision of water, but the only viable option is the supply from the Rand Water infrastructure.

3.6 Rand Water Infrastructure

A 915mm diameter Klipfontein – Pretoria Rand Water Line RW3508 is situated within the road reserve of Allan Road to the West of the development. Supply to on-site infrastructure was considered by connecting to the abovementioned Rand Water pipeline. Rand Water requires that on-site storage facilities be provided if the peak flow rate exceeds 30% of the average annual daily demand flow rate.

As a result a 20Ml ground reservoir, a 2Ml Water tower and pump station which will supply the high and low pressure zone areas need to be constructed. A 700mm diameter supply line will be required between the Rand Water line and the new ground reservoir on site, as well as a new 400mm diameter steel connection line to the township. Refer to drawings 2374.00.ZA.05.A001, attached as **Annexure C**.

4 SEWERAGE

4.1 Authority and Service Provider

The Ekurhuleni Metropolitan Municipality is the Water Service Authority for the Clayville Extension 71 development in terms of the Water Services Act (Act No. 108 of 1997).

4.2 Design Norms and Standards

The design criteria for the development of the site have been based on the standards of Ekurhuleni Metropolitan Municipality: "Developer's Guidelines to Installing Water and Sewer Services" which adopted the Guidelines for the provision of engineering services and amenities in residential township development, summarised in Table 4.1.

Sewerage designs will be in line with the Sewer Master Plan of the area. The entire development will be in accordance with conventional level 3 – a metered pressure water connection with water-borne sanitation for each property.

Table 4.1: Standards and Specifications for Sewage Infrastructure:

PARAMETER	DETAIL	SPECIFICATION
Peak Factor	Entire Development	2.5
Minimum Flow Velocity	Residential areas	0.7 m/s
Minimum dept to invert	Mid blocks Road reserve Other areas	1m 1m 800mm
Manhole spacing	Network sewers	110m
Minimum Gradients	150mm diameter (fewer than 24 dwellings) 150mm diameter 200mm diameter 225mm diameter 250mm diameter 300mm diameter	 1/80 1/100 1/200 1/220 1/240 1/300
Pipe Material	110mm to 315mm diameter ≥ 355mm diameter	Solid wall uPVC class 400 to SANS 1601 Solid wall uPVC class 34 to SANS 791
Design Capacity	All Pipes	67% at design flow
Minimum Pipe diameter	Gravity sewers	150 mm

	Connections	100 mm
Stormwater Infiltration		15% of design flow
Hydraulic Calculations	Manning Equation	n = 0,012
Location of Sewers	All Areas	Sewers 2.5m from road reserve boundaries, unless otherwise indicated. 1m from the erf boundary for midblocks
Connections	For Stands	110 mm uPVC with slip on couplings

4.3 Connection to existing Bulk Services

The Kempton Park Water Master Plan categorizes the project area within the "Eastern Area" served by the 750mm diameter ERWAT Regional Outfall Sewer, draining the entire area and connecting to the Olifantsfontein Waste Water Treatment Works (WWTW) located to the North West of Clayville (refer to Drawing No. 2374.00.ZA.06.A001).

4.4 Required upgrade

The natural topography of the site divides it into three drainage areas as indicated on Drawing No. 2374.00.ZA.06.A001 attached as **Annexure D**.

Drainage Area One

Drainage area one (±52.5 ha) drains to the south where it will connect into a bulk sewer located in the vicinity of the Kaalspruit floodline in Kaalfontein. A 160mm diameter link sewer (Pipe 1 on drawing No. 2374.00.ZA.06.A001) of 1 100 m in length needs to be constructed and 475m of 250mm diameter need to be upgraded to a 315mm diameter pipeline. The sewer drains into the ERWAT Regional Outfall Sewer which drains into the Olifantsfontein WWTW.

Drainage Area Two and Three

Drainage area two (± 300 ha) slopes towards the east where a 450mm diameter communal link sewer (Pipe 2 on drawing No. 2374.00.ZA.06.A001) needs to be constructed which will drain both the Clayville Development and a future Ekurhuleni Housing Development (± 4 000 stands) located to the east. This pipe follows the Kaalspruit flood line at a minimum slope.

Drainage area three drains Extension 50 and (± 50 ha) drains toward the north where a new 250mm diameter link (Pipe 3 on drawing No. 2374.00.ZA.06.A001) needs to connect area three with the link of area two. A small pump station may be required to transfer the run-off from this area over the watershed into Drainage Area 2.

Pipe 2 and Pipe 3 will connect into the proposed 500mm outfall sewer (Pipe A on drawing No. 2374.00.ZA.06.A001) and a 500mm sewer bridge crossing need to be constructed upstream of the connection into the ERWAT sewer east of the Kaalspruit. The total length of the outfall sewer is approximately 1.5km and the sewer bridge crossing is approximately 80 m in length. The alignment of the outfall sewer and locality of future developments, which will connect to the collective sewer, are indicated on drawing No. 2374.00.ZA.06.A001.

The sewerage will be treated at the Olifantsfontein WWTW which has a total capacity of 105 Mℓ/day. Previously Ekurhuleni Metro Municipality indicated that the treatment works are currently operating at 65 Mℓ/day. ERWAT still needs to confirm that the works has sufficient capacity to accommodate sewer flows generated by the proposed development of 9.2 Mℓ/day.

5 ROADS

5.1 Design Norms and Standard

The design guidelines of Ekurhuleni Metropolitan Municipality, supplemented by the Guidelines for Human Settlement Planning and Design (Red Book) were used to establish the criteria given in table 5.1. The criteria are given for various road classes on relevant road reserve widths. This design will be finalized after the township is approved, inputs from a Traffic Engineer in the form of a Traffic Impact Assessment are provided, and before construction drawings are submitted for approval.

A structural design period of 20 years will be adopted.

TABLE 5.1: ROAD DESIGN GUIDELINES

	ROAD CATEGORY				
	Local Distributor Class 4	**Access Collector Class 4**	**Access Collector Class5a**	**Access Loop Class 5b**	**Access Loop / Cul-de-Sac Class 5c**
Road Reserve Width (m)	30	25	25 / 20	16/13	10
Carriage Way Width (m)	14	14	7,4 / 8	6 / 5,5	5
Minimum Centre Line Radii for Angles of deflection > 60 Deg (m)	90	90	90/50	50/30	12,5
Minimum Centre Line Radii for Angles of deflection <= 60 Deg	500	500	130	110/60	30
Roadway Shoulders (m)	2,0	2,0	2,0	2,0	N/A
Desired Maximum Speed (km/h)	60	60	50	40	20
Minimum Stopping Distances (m)	85	85	65	65	20

Minimum Gradient	1:150	1:150	1:150	1:150	1:150
Maximum Gradient	1:10	1:10	1:10	1:8	1:5
Minimum K-Value	10	10	10	6	1
Minimum Vertical Curve (m)	40	40	40	30	20
Cross Fall / Camber	2% for Road Gradient <6% 3% for Road Gradient >6%				2,5%
Super Elevation	4%	4%	4%	None	None

5.2 Access

The N1 and R21 National Routes are in close proximity of the project area, as indicated on the locality Drawing No.2374.00.ZA.01.A001. The proposed development can either be accessed from the east via Thabana Ntlentana Drive which connects to K111 or from the south via Dale Road.

5.3 External Roads

Road servitudes in the vicinity of the development include the future PWV5 (East West direction) located to the North, the planned K109 (North South direction) to the west and the existing K111 (North South direction) to the East (Refer to Drawing No. 2374.00.ZA.03.A001, attached as **Annexure E**).

5.4 Required upgrade

It is envisaged that the majority of traffic will be generated from the Midrand City Centre. As a result access from the North and South East will to be achieved by extending Dale Road on the Southern border of the development and constructing the K109 link between Dale Road and Olifantsfontein Road with intersections. The cost of these extensions is summarized in paragraph 8.1.3.

Access from the North and South East will to be achieved by extending Dale Road on the Southern border of the development to Ruwenzori Road in the east and constructing the K109 link between Dale Road and Olifantsfontein Road as an initial phase. Stormwater Retention Dams need to be constructed at positions indicated on 2374.00.ZA.03.A001, attached as **Annexure E**.

6 STORMWATER

6.1 Design Norms and Standards

Permissible stormwater flow on roadways within the development will be based on guidelines included in the "The Red Book".

All streets in the township will be bitumen surfaced and will be designed to act as stormwater collectors and conveyors. The streets will be placed below natural ground level so that stormwater from adjacent erven can drain onto the streets. The layout and vertical alignment of the streets will be designed so that stormwater can be conveyed to the natural drainage channel that traverses the site.

An underground stormwater drainage system will be supplied to handle the minor floods (1:2 year) so that the traffic is not disrupted by the minor floods. Major floods that cannot be accommodated in the minor stormwater drainage system will be conveyed on the road surface and will not overspill into adjacent erven.

Table 6.1: Design Criteria and Standards

PARAMETER	SPECIFICATION
Recurrence Interval	No kerb overtopping 1:5 years
Maximum flow velocity on road edge	3 m/s
Kerb inlet position	At kerb overtopping, and road intersection
Kerb inlet size	1,5 m minimum 10,0 m maximum
Pipe Size	450 dia minimum
Rational model	C Value = 0,8 MAP = 740 mm Summer rainfall region

6.2 Natural River System and Flood Lines

A water course originates within the site towards the east of the site which will facilitate stormwater drainage.

The naturally occurring flood lines affecting the project site has been designated a wetland and will be retained for drainage, detention and ecological purposes.

6.3 Stormwater Attenuation

It is a requirement of EMM that provision is made for stormwater attenuation to reduce the increased stormwater run-off resulting from the development to pre-development volumes through the incorporation of stormwater attenuation ponds in the stormwater system.

Provision will be made for attenuation for the rate of run-off within the development area. The floods will be attenuated in proposed attenuation dams on site. Attenuation will be calculated to ensure that outflows do not exceed the undeveloped calculated floods.

7 ESTIMATED CONSTRUCTION COST

The costs of the services' infrastructure were estimated using typical current rates and is summarised below. The services' estimates include P's and G's and contingencies, but exclude VAT. Professional fees, disbursements and site supervision costs are shown separately. Escalation for civil related costs has been included at a rate of 6% per annum with the implementation periods assumed as one year up to the commencement of the first bulk infrastructure element and with completion of the bulks within three years from commencement of it. MIG applications will be submitted for all bulk and link services.

7.1 Bulk Services

7.1.1 Water Supply

The bulk water services will be constructed as part of Extension 71.

7.1.2 Sewerage

The bulk sewer services will be constructed as part of Extension 71.

7.1.3 Bus Routes and Stormwater Drainage

The major bus routes will be constructed using funding from the MIG programme, while internal minor roads will be built with funding from the subsidy allocation.

The cost estimates and funding requirements for the bus routes and stormwater is provided below.

Description	Estimated Costs	
	Excluding VAT	Including VAT
Bulk SW & Attenuation	R 14 273 800.00	R 16 272 132.00
Bus Routes (Class 4, 7,5m Roads)	R 39 368 000.00	R 44 879 520.00
Sub-total Roads & SW	**R 53 641 800.00**	**R 61 151 652.00**

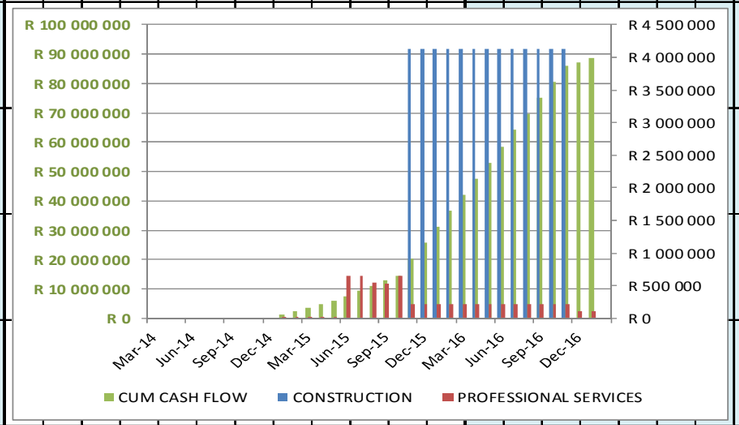
7.1.4 Total Cost Estimate Summary And Cash Flow

The table below summarises the total bulk/link costs as indicated:

ITEM	DESCRIPTION	AMOUNT Excluding VAT	AMOUNT Including VAT
1	Bulk Water	R 0.00	R 0.00
2	Bulk Sewer	R 0.00	R 0.00
3	Roads & Stormwater	R 53 641 800.00	R 61 151 652.00
4	***Sub-Total Bulk Services***	***R 53 641 800.00***	***R 61 151 652.00***
5	Estimated Full Engineering ECSA Fees	R 4 291 344.00	R 4 892 132.16
6	Provisional Sum For: OHS, EIA, WULA	R 250 000.00	R 285 000.00
7	Construction Monitoring	R 1 500 000.00	R 1 710 000.00
8	***Sub-Total Engineering Costs***	***R 6 041 344.00***	***R 6 887 132.16***
9	**Sub-Total Bulk Costs**	**R 59 683 144.00**	**R 68 038 784.16**
10	8% Escalation for 3 years	R 15 500 428.69	R 17 670 488.71
11	**Sub-Total Bulk Costs**	**R 75 183 572.69**	**R 85 709 272.87**
12	10% Contingency	R 7 518 357.27	R 8 570 927.29
13	**Sub-Total Bulk Costs**	**R 82 701 929.96**	**R 94 280 200.16**
14	Project Management Fee 7%	R 5 789 135.10	R 6 599 614.01
15	**Grand Total Bulk Costs**	**R 88 491 065.06**	**R 100 879 814.17**

CLAYVILLE EXT 50 BULK SERVICES ESTIMATED CASH FLOW - 20 MAY 2015

ITEM	DESCRIPTION	ESTIMATED VALUE	EXPENDITURE PERIOD FROM	EXPENDITURE PERIOD TO	2014 Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	2015 Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	2016 Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	TOTALS
1.0	***CONSTRUCTION (with CPA & Contingency)***																																							***TOTALS***
1.1	WATER MAINS		15-Nov-15	10-Dec-16																																				
1.2	SEWER OUTFALL		15-Nov-15	10-Dec-16																																				
1.3	ROADS AND STORMWATER	R 53 641 800	15-Nov-15	10-Dec-16																					R 4 126 292	R 4 126 292	R 4 126 292	R 4 126 292	R 4 126 292	R 4 126 292	R 4 126 292	R 4 126 292	R 4 126 292	R 4 126 292	R 4 126 292	R 4 126 292	R 4 126 292				***R 53 641 800***
1.5	***MONTHLY CONSTRUCTION CASH FLOW***	***R 53 641 800***																							***R 4 126 292***	***R 4 126 292***	***R 4 126 292***	***R 4 126 292***	***R 4 126 292***	***R 4 126 292***	***R 4 126 292***	***R 4 126 292***	***R 4 126 292***	***R 4 126 292***	***R 4 126 292***	***R 4 126 292***	***R 4 126 292***				***R 53 641 800***
2.0	***PROFESSIONAL SERVICES***																																							
2.1	*SPECIALIST STUDIES**	*R 125 000*	15-Jan-15	16-Sep-15											R 15 625	R 15 625	R 15 625	R 15 625	R 15 625	R 15 625	R 15 625	R 15 625																			***R 125 000***
2.2	PRELIMINARY DESIGN	R 1 287 403	02-Jun-15	15-Aug-15																R 643 702	R 643 702																			***R 1 287 403***
2.3	DETAIL DESIGN	R 1 072 836	16-Aug-15	16-Oct-15																		R 536 418	R 536 418																	***R 1 072 836***
2.4	DOCUMENTATION & PROCUREMENT	R 643 702	29-Oct-15	30-Nov-15																				R 643 702																***R 643 702***
2.5	CONTRACT ADMINISTRATION AND CONSTRUCTION MONITORING* (R60k/M)	R 2 572 836	15-Nov-15	10-Dec-16																					R 197 910	R 197 910	R 197 910	R 197 910	R 197 910	R 197 910	R 197 910	R 197 910	R 197 910	R 197 910	R 197 910	R 197 910	R 197 910				***R 2 572 836***
2.6	*ECO AND OHS DUTIES**	*R 125 000*	15-Nov-15	10-Dec-16																					R 9 615	R 9 615	R 9 615	R 9 615	R 9 615	R 9 615	R 9 615	R 9 615	R 9 615	R 9 615	R 9 615	R 9 615	R 9 615				***R 125 000***
2.7	CLOSE OUT	R 214 567	11-Dec-16	09-Feb-17																																			R 107 284	R 107 284		***R 214 567***
2.8	***MONTHLY PROF. SERVICES CASH FLOW***	***R 6 041 344***													***R 15 625***	***R 15 625***	***R 15 625***	***R 15 625***	***R 15 625***	***R 15 625***	***R 659 327***	***R 659 327***	***R 552 043***	***R 536 418***	***R 643 702***	***R 207 526***	***R 207 526***	***R 207 526***	***R 207 526***	***R 207 526***	***R 207 526***	***R 207 526***	***R 207 526***	***R 207 526***	***R 207 526***	***R 207 526***	***R 207 526***	***R 107 284***	***R 107 284***		***R 6 041 344***
2.9	***PROJECT MANAGEMENT, ESCALATION AND CONTINGENCY***	***R 28 807 921***	***15-Jan-15***	***09-Feb-17***											***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***	***R1 152 317***		***R 28 807 921***
3.0	**CUMULATIVE TOTAL CASH FLOW**	**R 59 683 144**													**R1 167 942**	**R2 335 884**	**R3 503 826**	**R4 671 767**	**R5 839 709**	**R7 651 353**	**R9 462 996**	**R11 167 354**	**R12 856 09**	**R14 652 10**	**R20 138 24**	**R25 624 37**	**R31 110 51**	**R36 596 64**	**R42 082 78**	**R47 568 91**	**R53 055 05**	**R58 541 18**	**R64 027 32**	**R69 513 45**	**R74 999 59**	**R80 485 72**	**R85 971 86**	**R87 231 46**	**R88 491 06**		**R 88 491 065**

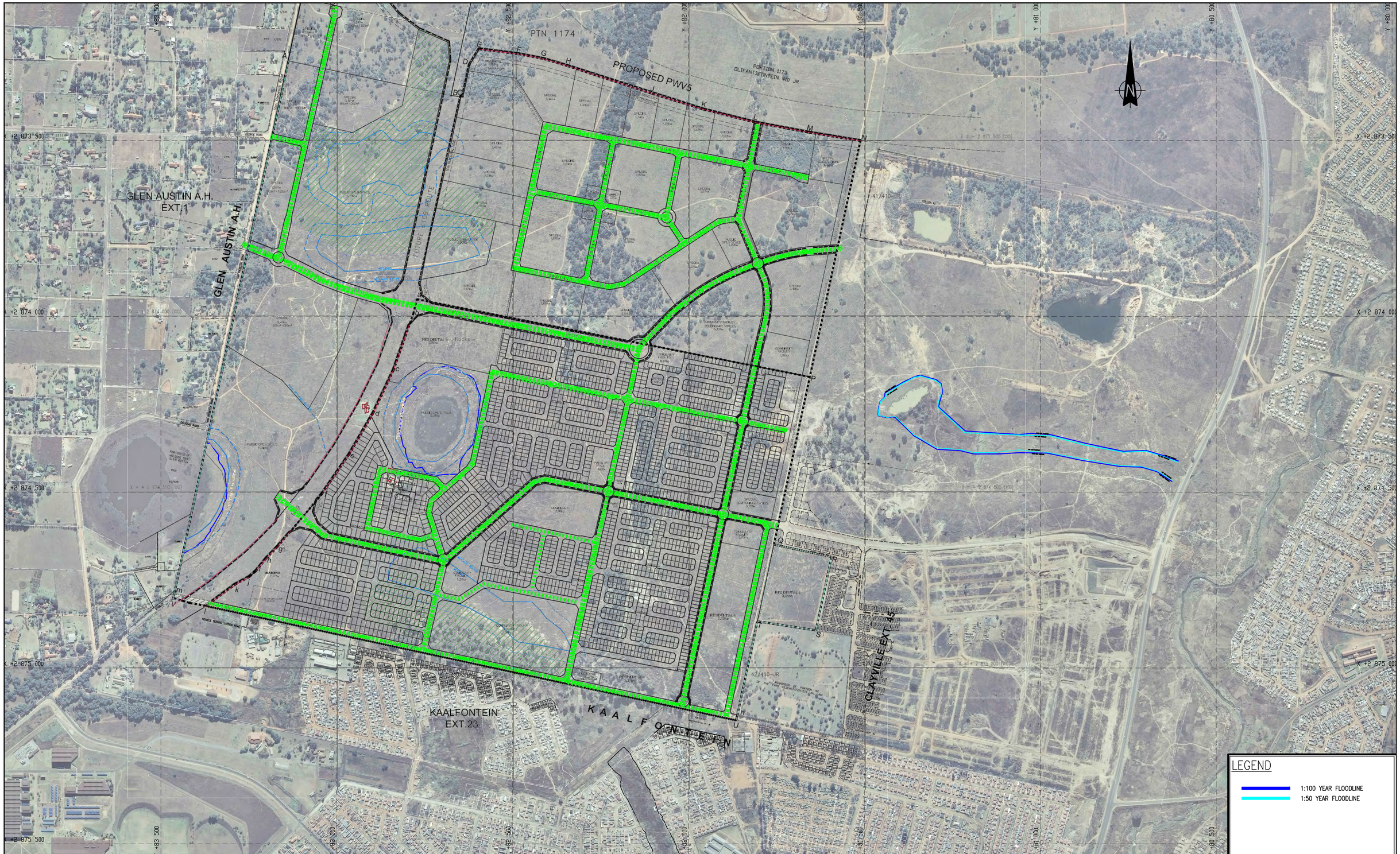


Annexure A

Locality Plan

Annexure B

Flood Lines



BIGEN AFRICA Services (PTY) LTD
Allan Cormack Street
The Innovation Hub Persequor Pretoria
PO Box 29 The Innovation Hub Pretoria 0087
Tel:+ 27 (0) 12 842 8700
Fax:+ 27 (0) 12 843 9000/9001
E-mail: pretoria@bigenafrica.com
www.bigenafrica.com
Engineering Services | Management Consultancy Services | Project Finance Services | Urban/Rural Development Services
Engineering solutions

SURVEYED	–
DESIGNED	P J Koelewyn
DRAWN	M Steenberg
CHECKED	P J Koelewyn
SERVICES CHECKED	WG 29
GEOTECHNICAL INVESTIGATION	
CO-ORD SYSTEM	–
APPROVED	P Reyneke

APPROVED ON BEHALF OF BIGEN AFRICA:
NAME: HV Strauss
SIGNATURE: .....
DATE: .....

AMENDMENTS	APPROVED	DATE

Ekurhuleni METROPOLITAN MUNICIPALITY

CLAYVILLE EXT. 50 & 71 HOUSING PROJECT

1:50 & 1:100 YEAR FLOODLINES

valumax Create more value

EKURHULENI METROPOLITAN MUNICIPALITY

SCALE: AS SHOWN ON ORIGINAL – DRAWING

AS-BUILT RECORD

CONTRACT No.	CONTRACT DESCRIPTION	CERTIFIED	DATE

CERTIFIED AS-BUILT FOR CONTRACT :
ENGINEER DATE

DRAWING No.

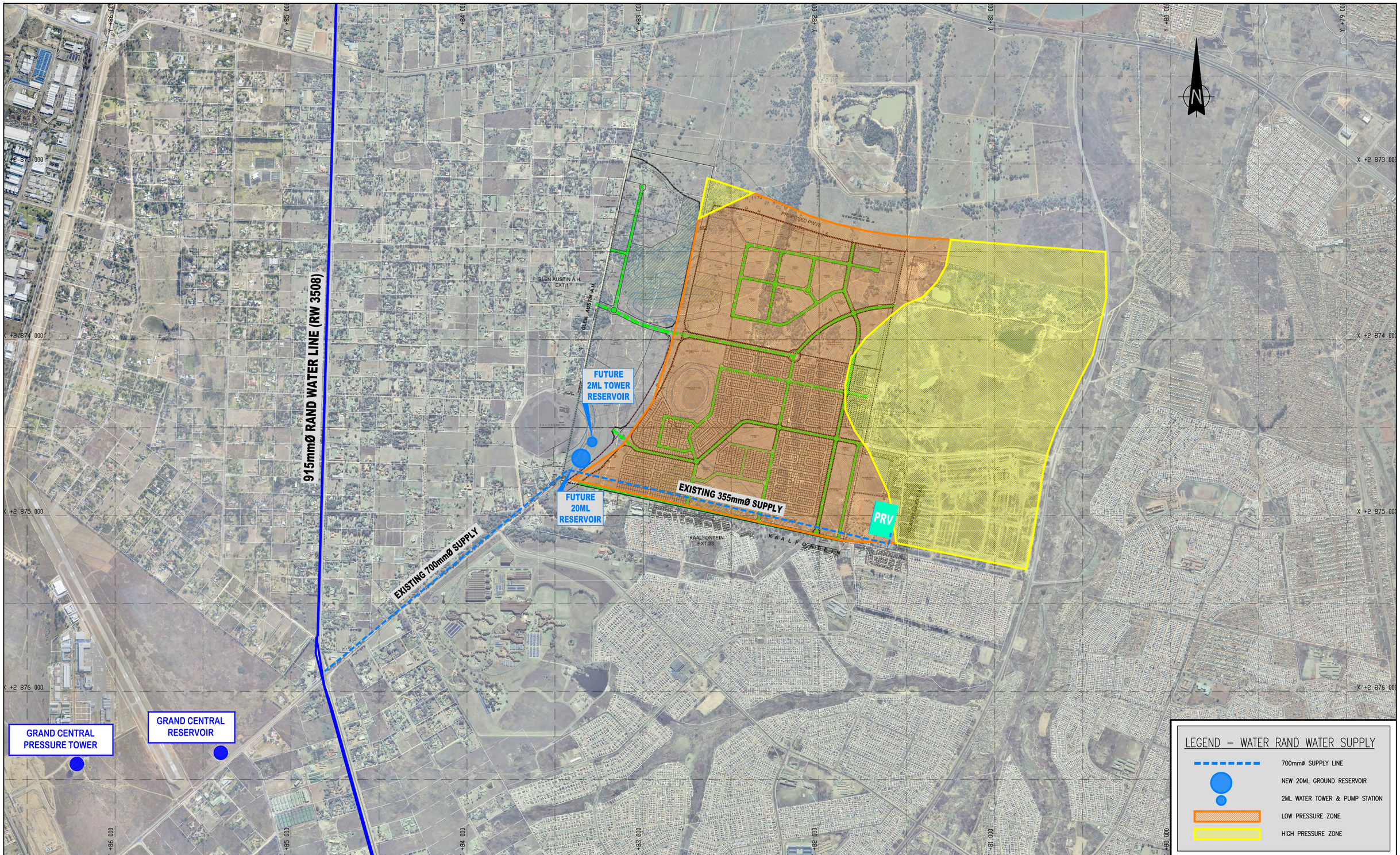
FILE No.

PRIVATE DRAWING No.	REVISION	APPROVED: HV Strauss
2374.00.ZA.05.A001	1.0	Pr. Eng. No.: 850093 DATE: MAY 2009

F:\Drawings\2374\00\04\dgn\ZA04A001.dwg 25/05/2015 16:08:42

Annexure C

Bulk Water



BIGEN AFRICA Services (PTY) LTD
Allan Cormack Street
The Innovation Hub Persequor Pretoria
PO Box 29 The Innovation Hub Pretoria 0087
Tel:+ 27 (0) 12 842 8700
Fax:+ 27 (0) 12 843 9000/9001
E-mail: pretoria@bigenafrica.com
www.bigenafrica.com

SURVEYED	–
DESIGNED	P J Koelewyn
DRAWN	M Steenberg
CHECKED	P J Koelewyn
SERVICES CHECKED	WG 29
GEOTECHNICAL INVESTIGATION	
CO-ORD SYSTEM	–
APPROVED	P Reyneke

APPROVED ON BEHALF OF BIGEN AFRICA:
NAME: HV Strauss
SIGNATURE:
DATE:

AMENDMENTS	APPROVED	DATE

PRIVATE DRAWING No.: 2374.00.ZA.05.A001
REVISION: 1.0
APPROVED: HV Strauss
Pr. Eng. No.: 850093
DATE: MAY 2009

Ekurhuleni METROPOLITAN MUNICIPALITY

CLAYVILLE EXT. 50 & 71 HOUSING PROJECT

PROPOSED BULK WATER INFRASTRUCTURE RAND WATER SUPPLY ZONES

valumax

EKURHULENI METROPOLITAN MUNICIPALITY

SCALE: AS SHOWN ON ORIGINAL – DRAWING

AS-BUILT RECORD

CONTRACT No.	CONTRACT DESCRIPTION	CERTIFIED	DATE

CERTIFIED AS-BUILT FOR CONTRACT :
ENGINEER DATE

DRAWING No.

FILE No.

F:\Drawings\2374\00\05\dwf\ZA05A001.dwg, 31/05/2015 07:34:51

GLS Consulting (Pty) Ltd
Reg. No. 2007/003039/07
11 Electron Street
Techno Park
P.O. Box 814
Stellenbosch 7599, ZA
Tel: +27 21 880 0388
Fax: +27 21 880 0389
Web: www.gls.co.za
E-mail: consulting@gls.co.za

25 August 2009

The Regional Director: Water Services
Ekurhuleni Metropolitan Municipality
P O Box 215
BOKSBURG
1460

Attention: Mr. Danie van der Merwe

Dear Sir

PROPOSED NEW RESIDENTIAL DEVELOPMENT ON PORTION 179 & 183 OF THE FARM OLIFANTSFONTEIN 410 JR (CLAYVILLE X50) – GREATER KEMPTON PARK: ASSESSMENT OF IMPACT ON WATER SUPPLY SYSTEM AND REQUIRED WORKS

As requested by VIP Consulting Engineers, we have investigated the capacity of the water supply system to serve the proposed development located on the above mentioned properties. Please note that this report is to be read in conjunction with a similar report produced for the Clayville X45 development. The upgrading requirements as indicated in the Clayville X45 report is outdated and needs to be replaced by the findings of this report.

1. EXTENT OF DEVELOPMENT

As indicated in the information provided to us the proposed development would comprise of the following land use distribution:

LAND USE	NUMBER OF UNITS	TOTAL STAND AREA (ha)
RESIDENTIAL 3	13 000	± 359
TOTAL	13 000	± 359

This study was based on a maximum development height of two storeys and a corresponding minimum required residual pressure of 24m from the municipal system. Please note that should any part of the 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 A included herewith. The future water supply zones of the area under discussion are indicated on Figure B. The required works are indicated on figure C.

We confirm that the site is located within the urban development boundary as defined in the Spatial Development Framework (2005/2006).

We confirm that provision was made for the proposed development in the Kempton Park Water Master Plan. The proposed development density and resulting water demand (as calculated below), however, is significantly higher than the anticipated future water demand allowed for in the original Master Plan. We have also anticipated that the further future developments within the specific future water distribution zone will be of similar density (higher than what was originally allowed for in the Master Plan). Therefore the Master Plan was updated accordingly to allow for these higher density developments.

2. WATER SYSTEM

2.1 Water demand

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

Land use	Unit	Qty	Unit demand	Total (kl/day)
RESIDENTIAL 3	No	13 000	0.6	7 800
PLUS UAW (15% OF TOTAL AADD)				1 376
TOTAL AVERAGE DEMAND (AADD)				9 176 kl/d
PEAK DEMAND (excl. fire flow)				371 l/s
FIRE FLOW PER HYDRANT - ONE HYDRANT OPEN (Low risk)				15 l/s

2.2 Existing Water Services, Proposed Connection Point and Proposed Upgrading

Water distribution zones (see figure B)

The proposed development does not currently fall within any of the existing Ekurhuleni water distribution zones. According to the updated Master Plan, the development is to be incorporated partly into the future Olifantsfontein Reservoir distribution zone and partly into the future Clayville Direct Zone. The Olifantsfontein Reservoir (yet to be constructed) will receive water from the Rand Water system via Rand Water's meter number RW 3508 situated near the intersection of Dale- and Allan/Modderfontein Road in Johannesburg. The Clayville Direct Zone will be served directly from the Rand Water system via meter number RW 3508.

This constitutes a change in the Master Plan as the Clayville Direct Zone was to be supplied via a new water tower (Olifantsfontein Tower) as per the original Master Plan. The proposed tower zone, however, is now replaced by the Clayville Direct Zone.

Reservoir capacities (Olifantsfontein Reservoir)

As mentioned above, a section of the development will ultimately fall within the Olifantsfontein Reservoir's distribution zone. The total future anticipated AADD of the Olifantsfontein Reservoir zone including the tower zone was previously estimated to be approximately 10 000 kl/day. According to the new denser anticipated developments, the estimated ultimate future AADD of the Olifantsfontein Reservoir's supply area is calculated to be approximately 11 780 kl/d and the AADD of the Clayville Direct Zone is estimated to be approximately 5 530 kl/d. This equates to a total ultimate future AADD of 17 310 kl/d.

As both supply zones will be acquiring water from the same metering point (RW 3508) the supply from RW 3508 will have to be limited to 1.5 x (AADD of Reservoir zone + AADD of Direct zone) according to Rand Water's supply conditions. This equates to an allowable supply rate from the Rand Water system of 1.5 x 17 310 = 300 l/s. Taking this supply rate as well as the peak demands from the Direct zone into account, a reservoir (irrespective of size) cannot be sustainably implemented. Therefore an increased supply rate of 340 l/s (1.7 x AADD) from the Rand Water system will be required. This, however, must be discussed and agreed upon between the Ekurhuleni Metropolitan Municipality and Rand Water. Should Rand Water not allow the increased

supply from their system, it will become necessary to discard the Clayville Direct zone and revert back to the planned tower zone as per the original Master Plan.

Under the presumption that Rand Water will allow the increased supply rate of 1.7 x AADD (340 l/s), the required new reservoir volume to effectively accommodate the peaks of both zones is calculated to be 6 185 kl. This equates to approximately 12.6h x $AADD_{(reservoir)}$. According to the Ekurhuleni Metropolitan Municipality's modelling guidelines, a further 18h x $AADD_{(reservoir)}$ is required as emergency storage. The total required reservoir volume is therefore calculated to be 30.6h x $AADD_{(reservoir)}$ = 15 Ml.

If the increased supply rate is not allowed by Rand Water the required reservoir volume will be 22 Ml.

We hereby recommend that planning for construction of the new reservoir be commenced as soon as possible.

The proposed development will be amongst the first developments within the Olifantsfontein Reservoir zone and will presumably occur over a prolonged timeframe (possibly also in more than one phase). Therefore the total reservoir volume as calculated above will not immediately be required. As a temporary measure, while the planning/construction process of the reservoir is under way, the spare capacity in the Rand Water system should be sufficient to accommodate the peaks from the first phases of the proposed development. The construction of the supply pipe from RW 3508 up to the reservoir site and the critical main feeder pipes from the reservoir site up to the proposed development (see figure C), however, will have to be implemented for this temporary solution.

Water tower capacities

No existing- or future municipal water towers will be directly affected by the proposed development if Rand Water agrees to the increased supply rate as mentioned earlier. If the increased supply rate is not allowed a new 1 000 kl water tower with a minimum top water level of 1623 m.a.s.l. will be required.

Pump Station capacities

No existing- or future municipal pump stations will be affected by the proposed development if Rand Water agrees to the increased supply rate as mentioned earlier. If the increased supply rate is not allowed a new 250 l/s pump station will be required to fill the water tower.

Required works, connection to the existing system and residual network pressures

It is our recommendation that the Ekurhuleni Metropolitan Municipality discuss and agree upon an increased supply rate from the Rand Water system and that Master Plan Item MP – O_2.1 (Construction of a new 15 Ml reservoir at the location indicated on figure C) be implemented as soon as possible. Under the presumption that the development will take place over a prolonged period of time and possibly also in more than one phase, the spare capacity in the Rand Water system should be sufficient to accommodate the peaks from the first phases of the proposed development. Therefore, while the planning of the reservoir is under way the development can proceed by implementing the following critical Master Plan items:

- FM – O_2.1: Construct a 600Ø supply pipe from RW 3508 up to the proposed reservoir site. Note that this pipe size has changed from the original Master Plan pipe size of 400Ø
- FMV – O_1.2: Fit the above pipe with a flow control valve to allow a maximum flow of 340 l/s. Note that this flow restriction has changed from the original Master Plan flow restriction of 173 l/s.
- FMV – O1.2A: Fit the above pipe with a pressure reducing valve to limit the downstream pressure to a maximum of 35m.
- Construct future main pipes with diameters and alignments as shown on figure A with provision for all future connections.
- Construct future PRV's at the positions indicated on figure C.

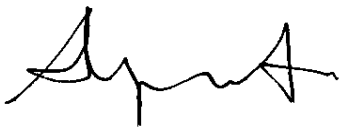
With the above Master Plan items in place, the development can proceed temporarily without the reservoir and the spare capacity in the Rand Water system should be sufficient to balance the peaks from the proposed development.

3. DEVELOPER CONTRIBUTIONS TO CONSTRUCTION / UPGRADING OF INFRASTRUTURE

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 Ekurhuleni Metropolitan Municipality.

We trust you 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 Louis Strijdom.

Yours sincerely
GLS CONSULTING
REG. NO.: 96/13328/07



_____

Per: LC (LEON) GEUSTYN
DIRECTOR

JOHANNESBURG WATER PIPES
EKURHULENI WATER PIPES
RAND WATER PIPES

FUTURE DEVELOPMENT

CLAYVILLE X50

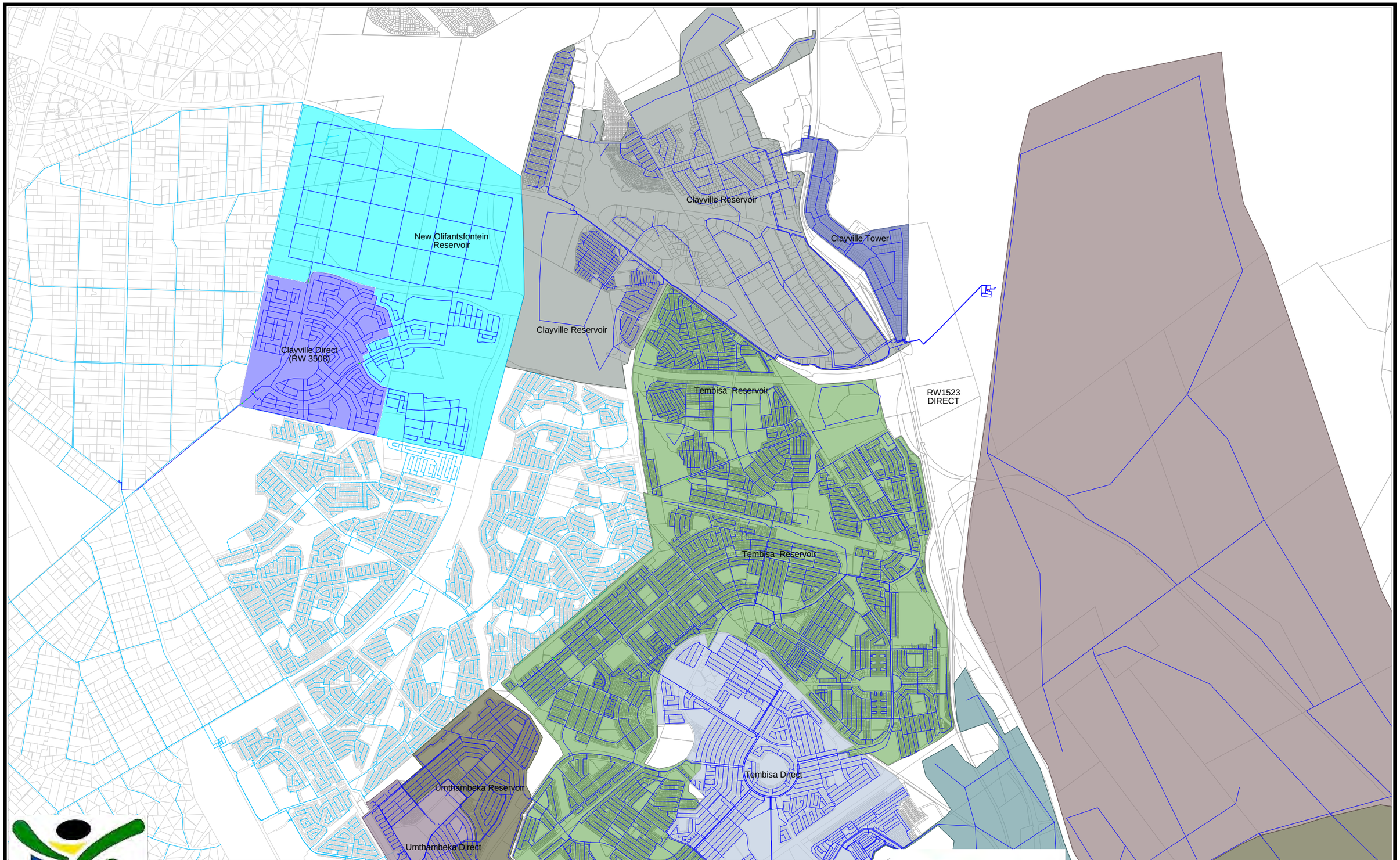
CLAYVILLE X45

August 2009

Ad Hoc Water Supply Capacity Investigation
Clayville X50 - Kempton Park

Figure A

Location and layout of existing water supply services and proposed developments



August 2009

Ad Hoc Water Supply Capacity Investigation
Clayville X50 - Kempton Park

Figure B

Layout of future water distribution zones

PRV (30m)

CLAYVILLE
X50

MP - O_2.1
15 ML RESERVOIR
TWL = 1605

FMV - O_1.2B
PSV (30m)

FMV - O_1.2
FCV (340 l/s)

FMV - O_1.2A
PRV (35m)

FM - O_1.2
600Ï

RW 3508

CLAYVILLE
X45

MAIN PIPES ON RESERVOIR ZONE

NETWORK PIPES ON RESERVOIR ZONE

MAIN PIPES ON DIRECT ZONE

NETWORK PIPES ON DIRECT ZONE

FUTURE MAIN PIPES ON RESERVOIR ZONE

FUTURE NETWORK PIPES ON RESERVOIR ZONE

August 2009

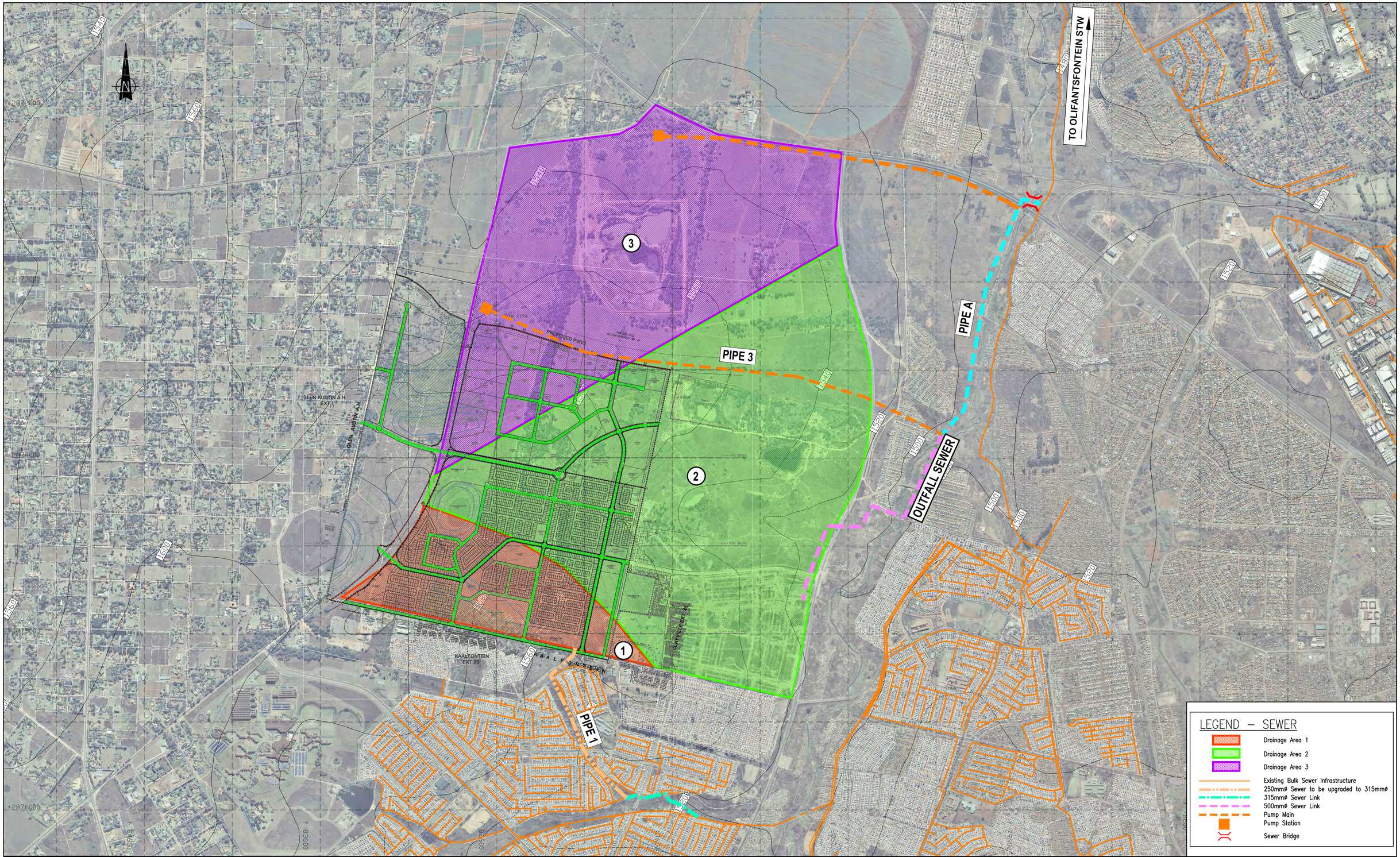
Ad Hoc Water Supply Capacity Investigation
Clayville X50 - Kempton Park

Figure C

Required works

Annexure D

Bulk Sewer



BIGEN AFRICA Services (PTY) LTD
Allan Cormack Street
The Innovation Hub Persequor Pretoria
PO Box 29 The Innovation Hub Pretoria 0087
Tel:+ 27 (0) 12 842 8700
Fax:+ 27 (0) 12 843 9000/9001
E-mail: pretoria@bigenafrica.com
www.bigenafrica.com
Engineering Services | Management Consulting Services | Project Finance Services | Infrastructure Development Services
BIGEN AFRICA Engineering solutions

SURVEYED	–
DESIGNED	P J Koelewyn
DRAWN	M Steenberg
CHECKED	P J Koelewyn
SERVICES CHECKED	WG 29
GEOTECHNICAL INVESTIGATION	
CO-ORD SYSTEM	–
APPROVED	P Reyneke

APPROVED ON BEHALF OF BIGEN AFRICA:
NAME: HV Strauss
SIGNATURE: .....
DATE: .....

AMENDMENTS	APPROVED	DATE

Ekurhuleni METROPOLITAN MUNICIPALITY

CLAYVILLE EXT. 50 & 71 HOUSING PROJECT

PROPOSED BULK SEWER INFRASTRUCTURE

valumax Create more value

EKURHULENI METROPOLITAN MUNICIPALITY

SCALE: AS SHOWN ON ORIGINAL – DRAWING

AS–BUILT RECORD

CONTRACT No.	CONTRACT DESCRIPTION	CERTIFIED	DATE

CERTIFIED AS–BUILT FOR CONTRACT :
ENGINEER DATE

DRAWING No.

FILE No.

PRIVATE DRAWING No.	REVISION	APPROVED: HV Strauss
2374.00.ZA.06.A001	1.0	Pr. Eng. No.: 850093
		DATE: MAY 2009

F:\Drawings\2374\00\06\a2\A06A001.dwg, 25/05/2015 15:56:11

GLS Consulting (Pty) Ltd
Reg. No. 2007/003039/07
11 Electron Street
Techno Park
P.O. Box 814
Stellenbosch 7599, ZA
Tel: +27 21 880 0388
Fax: +27 21 880 0389
Web: www.gls.co.za
E-mail: consulting@gls.co.za

31 August 2009

The Regional Director: Water Services
Ekurhuleni Metropolitan Municipality
P O Box 215
BOKSBURG
1460

Attention: Mr. Danie van der Merwe

Dear Sir

PROPOSED NEW RESIDENTIAL DEVELOPMENT ON PORTION 179 & 183 OF THE FARM OLIFANTSFONTEIN 410 JR (CLAYVILLE X50) – GREATER KEMPTON PARK: ASSESSMENT OF IMPACT ON SEWER SYSTEM AND REQUIRED WORKS

As requested by VIP Consulting Engineers, we have investigated the capacity of the sewer system to serve the proposed development located on the above mentioned properties. Please note that this report is to be read in conjunction with similar reports produced for the Clayville X45- and Olifantsfontein ptn 52 developments. The upgrading requirements as indicated in the Clayville X45 and Olifantsfontein ptn 52 reports are outdated and need to be replaced by the findings of this report.

1. EXTENT OF DEVELOPMENT

As indicated in the information provided to us the proposed development would comprise of the following land use distribution:

LAND USE	NUMBER OF UNITS	TOTAL STAND AREA (ha)
RESIDENTIAL 3	13 000	± 359
TOTAL	13 000	± 359

The location and layout of existing sewer services in the vicinity of the site as well as the upgrading requirements are indicated on Figure A included herewith. The current sewer drainage areas 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 Spatial Development Framework (2005/2006).

We confirm that provision was made for the proposed development in the Kempton Park Sewer Master Plan. The proposed development density, corresponding water demand and resulting sewage flow (as calculated below), however, is significantly higher than the anticipated future sewage flow allowed for in the original Master Plan. We have also anticipated that the further future developments within the specific future sewer drainage area will be of similar density (higher than what was originally allowed for in the Master Plan). Therefore the Master Plan was updated accordingly to allow for these higher density developments.

2. SEWER SYSTEM

2.1 Sewage Flow:

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

Land use	Unit	Qty	Unit demand	Total (kl/day)
RESIDENTIAL 3	No	13 000	0.6	7 800
PLUS UAW (15% OF TOTAL AADD)				1 376
TOTAL AVERAGE DEMAND (AADD)				9 176 kl/d
PEAK DRY WEATHER SEWAGE FLOW				135 l/s

The unit water demand for each residential unit was combined with a unique sewer unit hydrograph for the specific land use (derived over history for the flow pattern of similar types of developments) and yielded a modelled peak dry weather sewage flow of approximately 135 l/s.

2.2 Existing Sewer Services, Proposed Connection Point and Proposed Upgrading

Drainage area

The proposed development does not fall within any of the current Ekurhuleni sewer drainage areas. In the future drainage scenario, however, provision has been made to incorporate the development's sewage flow into the area currently draining directly under gravity to the Olifantsfontein WWTW.

The majority of the development's sewage flow is to drain via new outfall sewers, while the eastern portions can drain via an existing Ekurhuleni outfall sewer. Small portions of the southern part of the development are to drain towards the Olifantsfontein WWTW via the existing Johannesburg sewer system.

Pump station capacities

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

Main outfall sewers

According to the updated Master Plan, the development is to drain directly under gravity towards the Olifantsfontein WWTW via the existing- and new outfall sewers indicated on figure A. Please note that the pipe sizes indicated on figure A have been updated due to the higher anticipated density of the proposed development and further future developments within the drainage area. Therefore the pipe sizes are larger than originally indicated in the reports produced for the Clayville X45 and Olifantsfontein ptn 52 developments.

Please also note that the pipe sizes mentioned above were designed to accommodate all the anticipated future developments upstream thereof – none of which have developed yet. Therefore, if the EMM will allow it, the construction of the 675Ø and 750Ø can be postponed in the interim scenario and replaced by smaller diameter pipes (to be replaced later by the Master Plan pipes when the progress of the further future anticipated developments requires the construction thereof).

Network sewer pipes and connection to existing system

As the development will drain directly into main outfall sewers (new or existing), no existing downstream Ekurhuleni network sewer pipes will be affected by the development.

We confirm that the affected network sewer pipes in the Johannesburg sewer system have sufficient capacity to accommodate the additional sewage flow.

Wastewater Treatment Works

The Olifantsfontein WWTW currently has a treating capacity of approximately 108 Ml/day. The current measured dry weather inflow into the works is approximately 85 Ml/day. This results in a spare capacity of approximately 21%. The difference between the measured wet- and the dry weather inflow at the works results in a calculated infiltration of 15%. Therefore the current 21% spare capacity of the works is sufficient to accommodate the additional sewage flow.

3. DEVELOPER CONTRIBUTIONS TO UPGRADING OF INFRASTRUTURE

GLS Consulting hereby confirms that any contributions of the developer to the required 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 Ekurhuleni Metropolitan Municipality or between the developer and ERWAT.

4. SUMMARY RECOMMENDATIONS

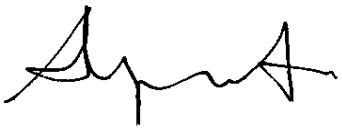
In summary, the requirements for the development to proceed are as follows:

- Construct the new outfall sewers according to the updated Master Plan as per figure A or;
- Construct the new outfall sewer pipes as per figure A but replace the planned 675Ø and 750Ø sewer pipes by temporary smaller diameter pipes that can be replaced when the need arises
- No pump stations are affected by the development

- No upgrading to any reticulation network sewer pipes is required.

We trust you 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 Louis Strijdom.

Yours sincerely
GLS CONSULTING
REG. NO.: 96/13328/07



_____
Per: LC (LEON) GEUSTYN
DIRECTOR

EXISTING EKURHULENI SEWER PIPES
EXISTING JOHANNESBURG SEWER PIPES
REQUIRED WORKS

OLIFANTSFONTEIN WWTW

OLIFANTS FONTEIN PTN 52

FUTURE DEVELOPMENT

CLAYVILLE X50

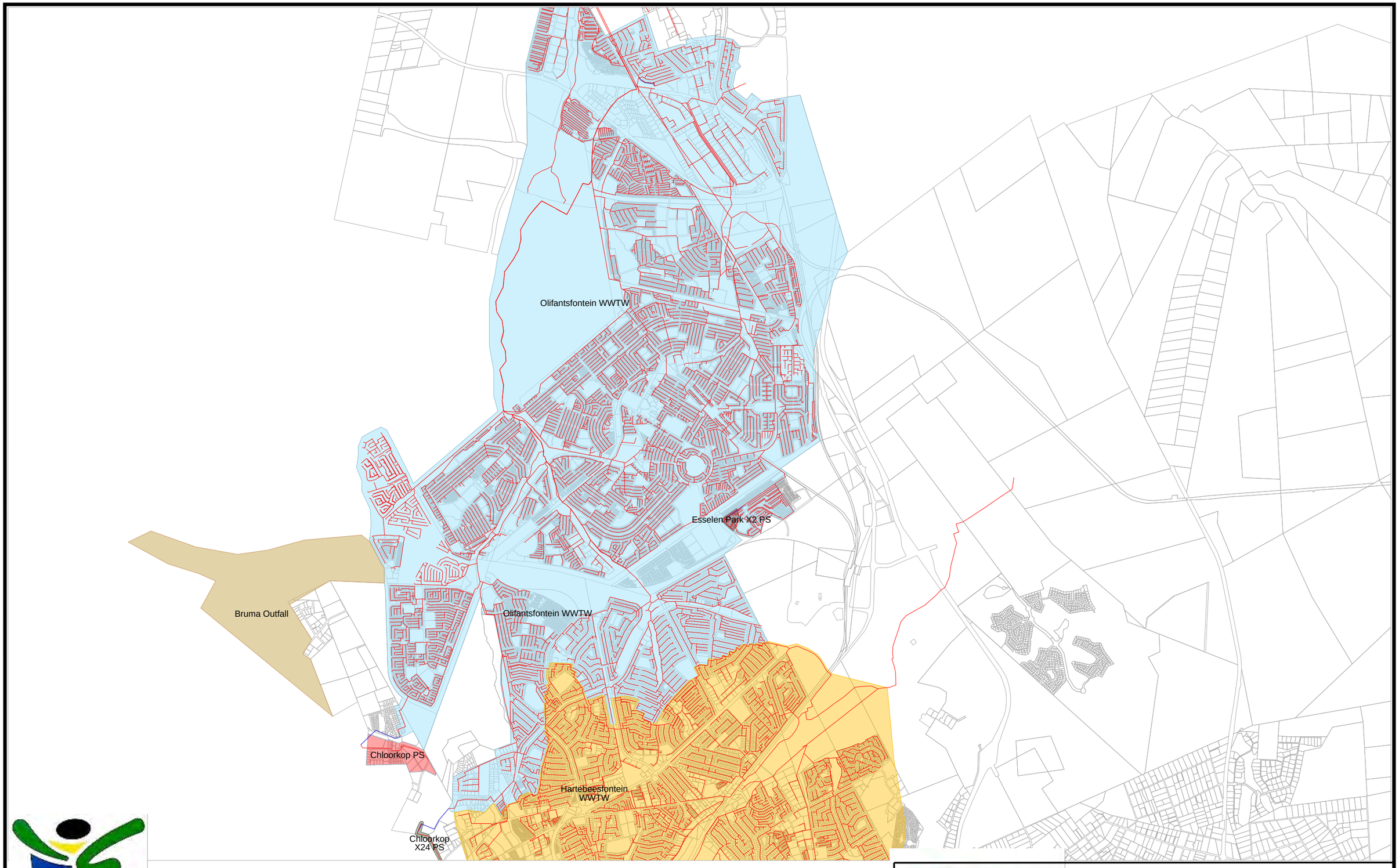
CLAYVILLE X45

August 2009

Ad Hoc Sewer Capacity Investigation
Clayville X50 - Kempton Park

Figure A

Location and layout of existing sewer services, proposed connection points and required upgrading



August 2009

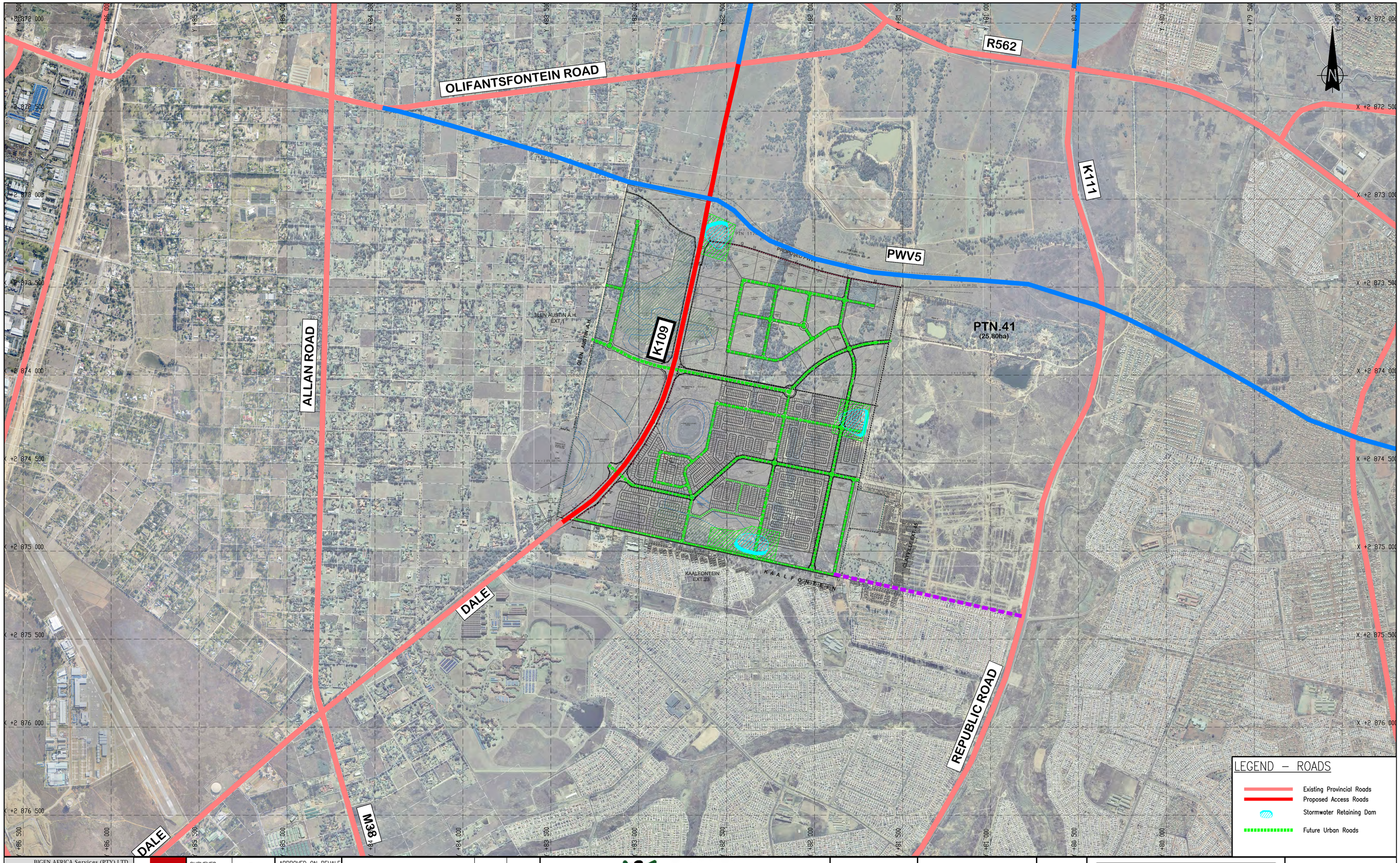
Ad Hoc Sewer Capacity Investigation
Clayville X50 - Kempton Park

Figure B

Layout of current sewer drainage areas

Annexure E

Bulk Roads



LEGEND – ROADS

- Existing Provincial Roads
- Proposed Access Roads
- Stormwater Retaining Dam
- Future Urban Roads

BIGEN AFRICA Services (PTY) LTD
Allan Cormack Street
The Innovation Hub Persequor Pretoria
PO Box 29 The Innovation Hub Pretoria 0087
Tel:+ 27 (0) 12 842 8700
Fax:+ 27 (0) 12 843 9000/9001
E-mail: pretoria@bigenafrica.com
www.bigenafrica.com

Engineering Services | Management Services | Project Finance Services | Organisation Development Services

Engineering solutions

SURVEYED	–
DESIGNED	P J Koelewyn
DRAWN	M Steenberg
CHECKED	P J Koelewyn
SERVICES CHECKED	WC 29
GEOTECHNICAL INVESTIGATION	
CO-ORD SYSTEM	–
APPROVED	P Reyneke

APPROVED ON BEHALF OF BIGEN AFRICA:
NAME: HV Strauss
SIGNATURE: .....
DATE: .....

AMENDMENTS	APPROVED	DATE

Ekurhuleni METROPOLITAN MUNICIPALITY

CLAYVILLE EXT. 50 & 71 HOUSING PROJECT

PROPOSED BULK ROADS & STORMWATER INFRASTRUCTURE

valumax Create more value

EKURHULENI METROPOLITAN MUNICIPALITY

SCALE: AS SHOWN ON ORIGINAL – DRAWING

AS-BUILT RECORD

CONTRACT No.	CONTRACT DESCRIPTION	CERTIFIED	DATE

CERTIFIED AS-BUILT FOR CONTRACT :
ENGINEER DATE

DRAWING No.

FILE No.

PRIVATE DRAWING No.	REVISION	APPROVED: HV Strauss
2374.00.ZA.03.A001	1.0	Pr. Eng. No.: 850093 DATE: MAY 2009

F:\Drawings\2374\00\ZA\03\A001.dwg, 25/05/2015 16:12:14