Appendix D5 – ENGINEERING RPORT

BIGEN AFRICA

CALGRO M3
HOLDINGS

JABULANI HOSTELS and CBD

Construction of Engineering Services

OUTLINE SCHEME REPORT

April 2011

Prepared for:

Calgro M3 Holdings
Private Bag X33
GRAIGHALL
2025
Tel: (011) 300 7500
Fax: (086) 1444 477
Attention: Mr Charles Le Roux

Compiled by:

BIGEN AFRICA Services (Pty) Ltd
Allan Cormack Street, The Innovation Hub, Pretoria
PO Box 29, Innovation Hub, 0087
Tel: +27(0)12 842 8700
Fax: +27(0)12 843 9000/9001
e-mail: pretoria@bigenafrica.com
Enquiries: Mr H de V Strauss PrEng. PMP/
Mr T. Mukwena

Report No. 1479/00/00/IR01 W&S

Engineering solutions

CALGRO M3 HOLDINGS

JABULANI CBD AND HOSTELS

OUTLINE SCHEME REPORT

Table of Contents

1 DEVELOPMENT INFROMATION 1
1.1 Developer 1
1.2 Development Information and Proposed Zoning 1
2 SITE DESCRIPTION 2
2.1 Locality 2
2.2 Climate 2
3 ROAD INFRASTRUCTURE AND SERVICES 2
3.1 Access points and external road upgrades 2
3.2 Standards and Specifications 3
4 STORMWATER MANAGEMENT PLAN 3
4.1 Summary of Stormwater Management Plan 3
4.2 Stormwater Catchment Areas 5
4.3 Standards and Specifications 6
5 WATER INFRASTRUCTURE AND SERVICES 6
5.1 Available Information 6
5.2 Bulk Services and Supply Capacity 7
5.3 Proposed Design Standards 8
5.4 Water Demand 9
6 SEWER INFRASTRUCTURE AND SERVICES 10
6.1 Available Information 10
6.2 Bulk Services and Supply Capacity 10
6.3 Proposed Design Standards 12
6.4 Sewer Flows 12
7 Summary of Bulk Services Requirements 13

APPENDICES

Appendix A	Locality Plan
Appendix B	Cadastral Layout Plan
Appendix C	Roads Layout Plan
	Traffic Impact Assessment
Appendix D	Bulk Stormwater Layout Plan
Appendix E	Bulk Water Layout Plan
Appendix F	Bulk Sewer layout Plan

CALGRO M3 HOLDINGS

JABULANI CBD AND HOSTELS

OUTLINE SCHEME REPORT

1 DEVELOPMENT INFROMATION

1.1 Developer

The developer of the portions of property that make up Jabulani CBD and Hostels is CALGRO M3 HOLDINGS and Inkanyeli Projects (Pty) Ltd who is developing the land on behalf of Gauteng Department of Housing.

1.2 Development Information and Proposed Zoning

The properties measures 71.67 hectares in extent of which 55.25ha is developable land and the remaining 16.42ha is non-developable land adjacent to the stream along the northern boundary of the development.

The following township applications form part of the Jabulani CBD and Hostel development, which will be developed in parcels, as indicated below and drawing 1479.00.02AU01 (Appendix A).

a) Parcel A - Erf 2612 (10.35ha in extent)
b) Parcel B - Remainder of Erf 2605 (3.98ha in extent)
c) Parcel C - Remainder of Erf 2332 (5.53ha in extent)
d) Parcel D - Erf 2613 (1.89ha in extent)
e) Parcel K - Erf 2614 (12.85ha in extent)
f) Hostels - Erf 2584 (41.05ha in extent)

The majority of the developable land will be used to provide housing. The number of residential units planned is shown in Table 1 below are based on the **maximum** allowable densities that have been approved in the development framework. Lower number of stands may be achieved after final layout planning of the individual townships. Infrastructure requirements are based on the maximum development potential.

Table 1 – Land Table: Jabulani CBD and Hostels

Land Parcel	Quantity Units	Developable Area ha
Parcel A	512	10.35
Parcel B	712	3.98
Parcel C	949	5.53
Parcel D	272	1.89
Parcel K	1 594	12.84
Hostels	2 764	20.66
Total	6803.00	55.25

2 SITE DESCRIPTION

2.1 Locality

The development site is situated in Soweto, south west of Johannesburg. The planned development is near the existing Jabulani Mall and Zola District Hospital. A Locality Plan is included in Appendix B.

2.2 Climate

The development area falls within the temperate plateau climatic region. The mean annual temperature is 16°C with a range of more than ±11°C. The seasonal weather is characterised by warm wet summers and cold dry winters.

The average annual precipitation is approximately 750mm occurring mostly in the form of thunderstorms in summer. Frost is common in winter.

3 ROAD INFRASTRUCTURE AND SERVICES

3.1 Access points and external road upgrades

Regional access to the proposed development sites is along the Koma Street (M72), and a north-south route to the west of the development.

Direct access to the various Parcels and Hostel will be via the following access points:

- Parcel K, northern portion of Parcel A and Hostel – access point from Link Road (Bolani Road).
- Southern Portion of Parcel A – access point from Legogo Street.
- Parcels B, C & D – access point from the proposed Matjhabeng Road.

The proposed access points to the development are shown in the Road Access Layout Plan in Appendix C.

A traffic impact assessment was conducted by Mariteng Management Solutions in order to assess what impact the development will have on the existing and future road network. The study indicates that the Johnnesburg Bus Rapid Transport (BRT) service will operate in Jabulani CBD. Various upgrades to the road network have been recommended in order to accommodate the BRT. These include upgrades to access points on the development. These recommendations have been adopted and are to be incorporated into the detailed design of the development.

For additional detail please refer to the TIA attached in Appendix C.

Funding for the various access upgrades indicated in the TIA will be sought from the Municipal Infrastructure Grant funding.

3.2 Standards and Specifications

All roads and access points will be constructed according to the prevailing standards of the Johannesburg Roads Agency and Gautrans, where applicable.

Pavement design for roads will take the site geotechnical conditions into account and based on accepted norms and standards. Geometric design will take overland stormwater drainage and movement of emergency vehicles into account. All aspects of the road cross section, vertical and horizontal alignments will be designed to meet JRA standards.

4 STORMWATER MANAGEMENT PLAN

4.1 Summary of Stormwater Management Plan

The stormwater drainage system will combine surface drainage on surfaced roads and underground pipe system that will collect stormwater from the roads, at low

points and where required, before intersections of roads. The 1:5 year recurrence period will be used to determine the minor flood. The underground pipe system will be designed to handle this flood flow. The major flood will be determined based on the 1:25 year recurrence period. The roads and underground stormwater pipes will be designed to accommodate the major flood flow. Low points within the development will be provided with drainage channels or pipes sufficient to accommodate the major flood flow. This is done with the aim of avoiding flooding or damage to adjacent property as well as to allow emergency vehicles to travel in the distributors and high order roads.

Stormwater drains radially from the highpoint near the reservoir next to Parcel K. The storm water drainage system, incorporating the roads, directs the drainage to the east and north of the site.

The general principle of onsite attenuation is to be used for each development within Jabulani CBD and Hostels. The developable land for the site is 55.25ha. Based on Johannesburg Water's guideline of 350m^3/ha a total storage of 19340m^3 is required. Five positions on the site have been identified as locations for attenuation facilities (see drawing 1479.00.ZA.04.A007). These provide approximately 14000m^2 for attenuation. The target average depth for all attenuation facilities is 1.2m. This would provide an attenuation storage capacity of 16900m^3. The remaining of 2440m^3 will have to be obtained from offsite attenuation adjacent to the site.

An additional site for attenuation of storm water flow has been identified on land adjacent to the development site. This additional space is required in order to overcome space restrictions in low lying areas in the development.

The internal drainage system across will be designed to direct flow into these attenuation facilities. The discharge from the attenuation facilities will be channeled into existing bulk storm water structures.

Jabulani Hostels

The development of Jabulani Hostels will involve the infill construction of new residential units to replace the existing structures. The position of the attenuation facility north of the Hostels is currently covered by existing Hostels. Construction of the attenuation facility will have to be programmed to follow after the relocation of the residents and demolition of these existing structures. In order to attenuate stormwater generated by the initial phase of the construction of Jabulani Hostels a pond has been provided north of the hostel. This attenuation pond has a capacity of 1674m^3.

The initial phase covers an area of approximately 4.3ha. Based on Johannesburg Water guideline of 350m^3/ha the storage required is 1505m^3. This will be verified in the detailed design calculations.

This pond will also carry out the auxiliary function of settling out silt from runoff during the construction of the hostels.

Jabulani CBD

The drainage system for parcels in Jabulani CBD will be attenuated at source. From the various parcels the attenuated flow will be directed to the attenuation pond east of the railway station. This facility will further attenuated in order to reduce the discharge flow rate. The reduction achieved will depend on the actually storage capacity available. This will be calculated in the detailed design. From this facility the flow will be channeled east to an existing bulk stormwater canal. The reduction in the discharge flow rate will allow this channel to be optimized for both size and alternative, non-concrete channel linings. The required channel is shown in drawing 1479.00.ZA.04.A007 (Appendix D). This channel will also be able to drain areas through which it passes, thereby relieving existing stormwater drainage problems in these areas.

The complete storm water management plan is illustrated in drawing 1479.00.ZA.04.A007 (Appendix D).

Bulk costs for the attenuation and drainage of subsidized housing will be sought through MIG funding. This will include the costs for the attenuation facility for Jabulani Hostels and the bulk stormwater pipe and channel.

4.2 Stormwater Catchment Areas

The development consists of the redevelopment of the existing Jabulani Hostels and the full development of the existing developed open land. The development is bordered by existing developed areas to the north and west. To the east of the development is a railway line which acts as a major storm water cutoff. North of Jabulani Hostels is a stream that flows west to east.

The catchment areas that cover the development site and the areas that immediately affect it are shown in drawing no. 1479.00.ZA.04.A007.

4.3 Standards and Specifications

All storm water infrastructures will be designed according to the prevailing standards of the Johannesburg Roads Agency.

The major and minor flood flows will be defined according to JRA requirements and the associated drainage systems designed accordingly.

The minor storm water drainage system will be a combination of surface drainage and underground pipe system that will collect storm water at low points of roads and where necessary along the roads and before intersections of roads.

Stormwater will be conveyed on the streets as far as possible. During minor floods up to 80% of the Class 5 roads may be flooded, but kerb overtopping will not be permitted. Kerb and inlet structures are selectively placed to collect the minor stormwater flood into the pipe system.

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 into the streets. The layout and vertical alignment of streets will be designed to achieve this.

The major stormwater flood is drained at the low points of the development by inlet structures and pipe system designed to accommodate the major flood. The pipe system will direct this flood flow to attenuation facilities before discharging into existing infrastructure.

5 WATER INFRASTRUCTURE AND SERVICES

5.1 Available Information

Reference has been made to the following reports during the investigation of the capacity of water infrastructure required for Jabulani CBD and Hostels development.

Network Analysis: Jabulani and Chiawelo Reservoir and Jabulani Tower Water District – GLS Consulting, November 2009, Project No: PS610

5.2 Bulk Services and Supply Capacity

According to the report referenced above, Jabulani CBD is in the Jabulani Tower Water District while Jabulani Hostels falls in the Jabulani Reservoir Water District. The water supply requirements for the development of Jabulani Hostels will be supplied by the 46Mℓ Jabulani Reservoir. Jabulani CBD will be supplied from the 1.1Mℓ Jabulani Tower which is part of the infrastructure at the Jabulani Reservoir.

Jabulani Reservoir and Jabulani Tower are supplied from the 700mm diameter RW963 Rand Water connection.

Jabulani Ring Main

The network analysis for Jabulani Reservoir and Tower water districts indicates that a ring main is required to supply water to the higher portions of Jabulani from the Jabulani Tower. The planned route of this ring main is shown in drawing 1479.00.ZB.05.U003 (Appendix E).

This has been identified in Johannesburg Water's network analysis as a high priority project. According to the report a 250mm diameter pipe with estimated length of 1875m is required at a cost of approximately R2.2 million. The proposed Jabulani developments have higher unit densities than assumed in the Johannesburg Water Network Analysis. In order to meet the demand from the proposed development the ring main would have to be 315mm in diameter along the same route.

Jabulani Hostels

The current water supply to Jabulani hostels is from Jabulani reservoir. The supply pressure at the hostels has been observed to be low. This observation is confirmed in the Johannesburg Water network model which indicates that pressures are marginal. Static pressure requirements at the hostels will also have to be taken into consideration for the planned three and four storey housing units. The current supply is deemed insufficient to provide an acceptable level of service to the redeveloped Jabulani Hostels.

In order to provide the required level of service, it is proposed that the Jabulani Hostels be incorporated into the Jabulani Tower water supply zone. Connection to the Jabulani Tower supply will require the planned ring main supply pipeline (mentioned above) to be constructed. A short link pipeline can then constructed to provide the required supply at suitable operating pressure to Jabulani Hostels (see drawing

1479.00.ZB.05.U003 – Appendix E).

Funding to provide the required water supply infrastructure to supply Jabulani Hostels will be sought through the Municipal Infrastructure Grant programme.

Jabulani CBD

In order to connect Jabulani CBD to the bulk supply from the Jabulani Tower, connections to the planned ring main is required.

The development plan for Jabulani CBD involves the phased development of the various parcels included. The initial phase involves development of parcels B and C (see Cadastral Layout Appendix C). In order to supply water to this initial phase it is proposed that a section of the planned ring main long enough to supply parcels B and C be constructed (see drawing 1479.00.ZB.05.U003 – Appendix E).

The remainder of the ring main construction would then have to be completed to coincide with the development of other land portions along its route.

Existing water reticulation lines currently cross portions of the development area at various locations. Parcel A and K layouts will be planned in order to avoid pipeline routes where possible. It may be necessary to reroute portions of these existing lines in order to tie into the planned development layouts.

The proposed water supply connection points and the areas they supply, are shown in drawings (Appendix E).

5.3 Proposed Design Standards

The design of water supply services will be carried out according to the requirements outlined in Johannesburg Water's *Guideline and Standards for Design and Maintenance of Water and Sanitation Services.*

For draw-offs directly from the reticulation a peak factor of 4 will be used to determine the instantaneous peak flows (i.e. peak hour demands) anticipated.

City of Johannesburg by-laws relating to fire flow conditions will be adhered to. For residential (low risk) areas a fire flow of 38 ℓ/s (2,300 ℓ/min) is adopted while for industrial (moderate risk) areas a fire flow of 95 ℓ/s (5,750 ℓ/min) will be utilized. A

minimum hydrant delivery flow of 15 ℓ/s (900 ℓ/min) and 19 ℓ/s (1,150 ℓ/min) will be utilized for each respective risk category.

The level of service for this development will be the high service level (level 3) of Johannesburg Water's Service delivery options. This service consists of a metered house connection to each residential 1 and 3 units or site and is classified as service level 4 in the 'Guidelines for the Provision of Engineering Services and Amenities in Township Development' (Red Book).

5.4 Water Demand

The design of the internal reticulation required for the development will accommodate the ultimate demands anticipated. The total average annual daily demand (AADD) and design peak flows for the Jabulani Hostels and the Parcels of Jabulani CBD are summarized in Table 5.1 below.

Table 5.1: Projected Water Demand

Portion	Quantity	Unit Water Demand	Water Demand			
	Units	kℓ/unit/day	AADD kℓ/day	SDD ℓ/sec	Inst. Peak Flow ℓ/sec	
Parcel A	512.000	0.8	409.6	7.111	18.963	
Parcel B	712.000	0.8	569.6	9.889	26.370	
Parcel C	949.000	0.8	759.2	13.181	35.148	
Parcel D	272.000	0.8	217.6	3.778	10.074	
Parcel K	1594.000	0.8	1275.2	22.139	59.037	
Hostels	2764.000	0.8	2211.2	38.389	102.370	
Total			**5442**	**94**	**251.96**	**ℓ/sec**
Plus 15% loss					**37.79**	**ℓ/sec**
Largest Fire Flow					**38.33**	**ℓ/sec**
Total Water Plus Fire flow					**328.09**	**ℓ/sec**

6 SEWER INFRASTRUCTURE AND SERVICES

6.1 Available Information

Reference has been made to the following during the investigation of the capacity of sewer infrastructure required for the proposed development.

- Master plan of the sewer system of Bushkoppies Phase 1 Southern sub basin – CES, August 2006.
- Master plan for the sewer system in the Olifantsvlei Sewer Basin – CES, December 2007.
- Master plan for the sewer system in the South western Outfall – GLS. July 2009.

6.2 Bulk Services and Supply Capacity

The development site spans three Johannesburg Water Sewer Basins. Jabulani Hostels drains into the Bushkoppies Phase 1 Southern Basin, Jabulani Parcels B+C drains into the South Western Outfall Basin and the remainder of Jabulani CBD drains into the Olifantsvlei Sewer Basin,

Jabulani Hostels

Jabulani Hostels is in the Dube Sub-basin of the Bushkoppies Phase 1 Southern Sewer Basin. This sub-basin drains through the Dube Link outfall into Klipspruit Outfall to the Bushkoppies/ Olifantsvlei Diversion structure. Here the flow is split between diversion to Bushkoppies WWTW (via the Bushkoppies Phase 1 Tunnel) and Olifantsvlei WWTW (via the Olifantsvlei Outfall). According the information available in the report all the flow is currently being treated at the Bushkoppies WWTW.

To connect Jabulani Hostels to Dube outfall a 200mm diameter collector sewer line running through the hostels development is proposed. This will direct sewer flow north to a connection point with the Dube Link Outfall (see drawing no. 1479.00.ZB.06.U003 - Appendix F).

According to the Master Plan of the Bushkoppies Phase 1 Southern Sub-basin the following upgrades are required downstream of connection for Jabulani Hostels.

Table 6.1: Dube Link Upgrades Required

Item	Pipe Length m	Existing Pipe Dia	New Pipe Dia
B5	206	150	200
B6.1	110	300	375
B6.2	23	300	375
B6.3	30	300	375
B9	448	1200	1500

Jabulani CBD

Parcels B and C are in the Naledi Sub-basin of the South Western Outfall Basin. This flow drains via the South Western Outfall Sewer (SWOS) and is treated at the Olifantsvlei WWTW. In order to connect Parcels B and C to the Naledi Sub-basin a pipe upgrade of an existing 750m long, 150mm diameter is required. This line needs to be replaced with a 200mm diameter link sewer. Due to topographical constraints and the small size of the downstream pipe portions of the line will have to be laid at less than the minimum slopes indicated in the Johannesburg Standards. This link sewer will connect the Parcel B and C internal sewer network to the collector sewer line at the corner of Koma Street and Rangwana Street.

Parcels A and D are lower than the available existing connection points west of the railway line. In order to provide sewer services to these areas a sewer line will have to be constructed across the railway line to connect to existing services within the Olifantsvlei Sewer Basin.

The remainder of Jabulani CBD in is the Moroka-Jabavu Sub-basin of the Olifantsvlei Sewer Basin. This area drains through the Moroka-Jabavu Link Outfall into the Olifantsvlei Tunnel. Treatment is at the Olifantsveli WWTW. Two alternative connections to bulk sewer have been investigated.

- Option 1
  Connection to the Moroka-Jabavu sewer network can be obtained at the collector sewer line which terminates just north of Inhlazane Train Station.

  The available capacity along the route of this collector sewer is not sufficient to accommodate the projected sewer flows from all the planned developments in the Jabulani CBD area (see drawing no. 1479.00.ZB.06.U003 - Appendix F).

- Option 2
  It is therefore proposed that the flow from Parcel K of Jabulani CBD be directed to the Dube Link outfall via the collector sewer line proposed for the Jabulani Hostels development (see drawing no. 1479.00.ZB.06.U004 - Appendix F).

Neither of the two options would require additional bulk pipelines to be constructed.

Treatment capacity is supplied by the Bushkoppies and Olifantsvlei WWTWs which currently have treatment capacities of 200Mℓ and 220Mℓ respectively. According to the SWOS Master plan the Olifantsvlei WWTW has spare capacity of 45Ml. Sewer flows from all parts of Jabulani Hostels and CBD can be directed to the Olifantsvlei WWTW. Flows that form part of the Bushkoppies Phase 1 Southern Sub-basin will have to be diverted to the Olifantsvlei Outfall via the Bushkoppies/ Olifantsvlei Diversion structure at the top of the Bushkoppies Phase 1 tunnel.

6.3 Proposed Design Standards

The design of sanitation services will be carried out according to the requirements outlined in Johannesburg Water's *Guideline and Standards for Design and Maintenance of Water and Sanitation Services.*

6.4 Sewer Flows

The design of the internal reticulation required for the development will accommodate the effluent flows anticipated. The total dry weather flow (DWF) and peak wet weather flows (PWWF) for the Jabulani Hostels and the Parcels of Jabulani CBD are summarized in Table 6.2 below.

Table 6.2: Projected Sewer Flows

Density	Quantity Units	Unit Sewage Discharge kℓ/unit/day	Sewerage DWF kl/d	Sewerage PDWF l/s	Sewerage PWWF l/s	
Parcel A	512.00	0.6	307.2	8.9	10.2	
Parcel B	712.00	0.6	427.2	12.4	14.2	
Parcel C	949.00	0.6	569.4	16.5	18.9	
Parcel D	272.00	0.6	163.2	4.7	5.4	
Parcel K	1 594.00	0.6	956.4	27.7	31.8	
Hostels	2 764.00	0.6	1658.4	48.0	55.2	
Total			**4081.80**	**118.11**	**135.82**	**ℓ/sec**

Percentage Infiltration **15%**
Peak Flow Factor **2.5**

7 Summary of Bulk Services Requirements

Based on the information available from the relevant Johannesburg Water reports the following bulk services are required in order to supply services to Jabulani Hostels and Jabulani CBD:

Stormwater Alternative 1 (pipe + channel combination):

Pipeline	-	994m	1500mm Diameter Concrete
Channel	-	766m	Earth-lined Channel
Attenuation Ponds	-	1.70ha	

Stormwater Alternative 2 (all piped):

Pipeline	-	1760m	1500mm Diameter Concrete
Attenuation Ponds	-	1.70ha	

Water:

Pipeline	-	1880m	315mm Diameter uPVC

Sewer:

Link Pipeline	-	750m	200mm Diameter uPVC

Table 7.1: Bulk Infrastructure Costs

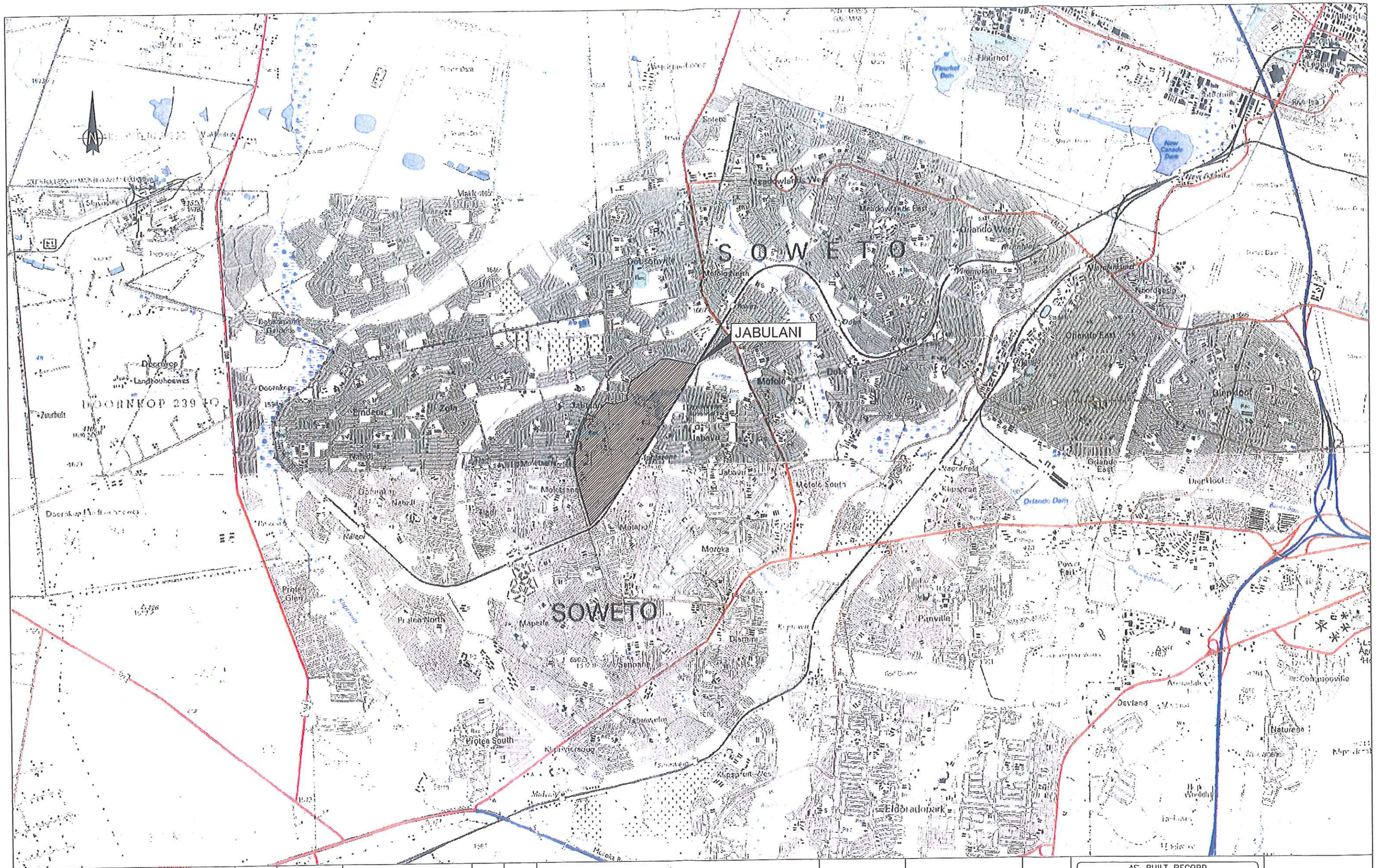
Bulk Service		Cost
Stormwater		
Alternative 1:	Attenuation Ponds	R 2 796 000.00
	Pipeline	R 6 583 000.00
	Channel	R 1 138 000.00
	Total	**R 10 517 000.00**
Alternative 2:	Attenuation Ponds	R 2 796 000.00
	Pipeline	R 11 084 000.00
	Total	**R 13 880 000.00**
Water:		
Parcel B + C	Pipeline	R 760 000.00
Parcel A + K	Pipeline	R 848 000.00
Remainder of CBD	Pipeline	R 1 524 000.00
	Total	**R 3 132 000.00**
Sewer:	Pipeline	R 633 000.00
	Total	**R 663 000.00**

The total cost of bulk works based on the proposals contained in this reports:

R14 282 000 - Alternative 1 used for stormwater
R17 645 000 - Alternative 2 used for stormwater.

Appendix A

Locality Plan



BIGEN AFRICA Services (PTY) LTD
Allen 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

BIGEN AFRICA

SURVEYED	
DESIGNED	LD Jacobs
DRAWN	P Valentine
CHECKED	V Strauss
SERVICES CHECKED	-
GEOTECHNICAL INVESTIGATION	-
SERVITUDES	-
APPROVED	LD JACOBS

PRIVATE DRAWING No.: 1479.00.AA.01.S001
REVISION: A.0
APPROVED: LD. Jacobs
Pr. TechEng. No.: 200670095
DATE: 2006

APPROVED ON BEHALF OF BIGEN AFRICA:
NAME: LD Jacobs
SIGNATURE: ....
DATE: ....

AMENDMENTS	APPROVED	DATE

Jo'burg
Gateway to Africa

JABULANI HOSTELS

LOCALITY PLAN

Johannesburg Water
Johannesburg Water (Pty) Limited
58 Frederick Street, Marshalltown
P. O. BOX 61542, Marshalltown, 2107
TEL: 011-407-6614
FAX: 011-403-3941

SCALE
1 : 25000
ON
ORIGINAL
A1
DRAWING

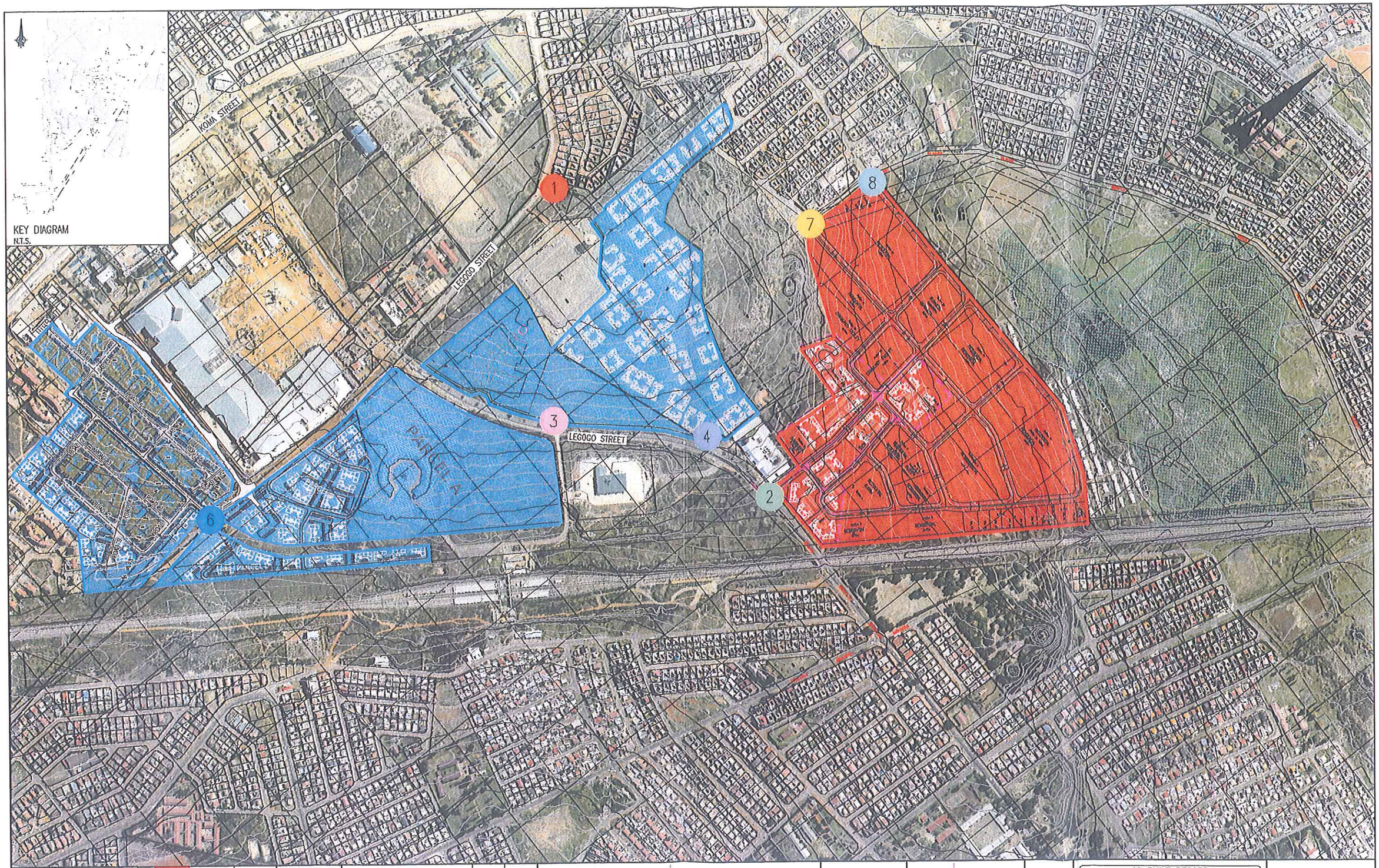
AS-BUILT RECORD

CONTRACT No.	CONTRACT DESCRIPTION	CERTIFIED	DATE

CERTIFIED AS-BUILT FOR CONTRACT :
ENGINEER
DATE

DRAWING No.

FILE No.



BIGEN AFRICA Services (PTY) LTD A...an Cormack Street The Innovation H...Pretoria PO Box 29 The Innovation H...Pretoria 0087 Tel: + 27 (0) 12 8... Fax: + 27 (0) 12 8... E-mail: pretoria@bigenafrica.com www.bigenafrica.com	BIGEN AFRICA	SURVEYED		APPROVED ON BEHALF OF BIGEN AFRICA: NAME: LD Jacobs SIGNATURE: ..... DATE:	AMENDMENTS	APPROVED	DATE
		DESIGNED	T Mulovane				
		DRAWN	P Valentine				
		CHECKED	LD Jacobs				
		SERVICES CHECKED	–				
		CO-ORDINATE SYSTEM	WG 27				
		SERVITUDES	–				
		APPROVED	LD Jacobs				

PRIVATE DRAWING No. 479.00.ZB.03.U003	REVISION 1.0	APPROVED: LD. Jacobs Pr. Eng. No: 20070005 DATE: November 2009	

Joburg
City of Joburg

JABULANI PARCEL B & C

ROADS OUTLINE SCHEME REPORT

Johannesburg Roads Agency
Private Bag X 30, Braamfontein, Johannesburg, 2017
Gauteng, South Africa
TEL: 011-407-6687
FAX: 011-332-1807

SCALE
1 :3000 ON ORIGINAL A1 DRAWING

AS-BUILT RECORD

CONTRACT No.	CONTRACT DESCRIPTION	CERTIFIED	DATE

CERTIFIED AS-BUILT FOR CONTRACT :

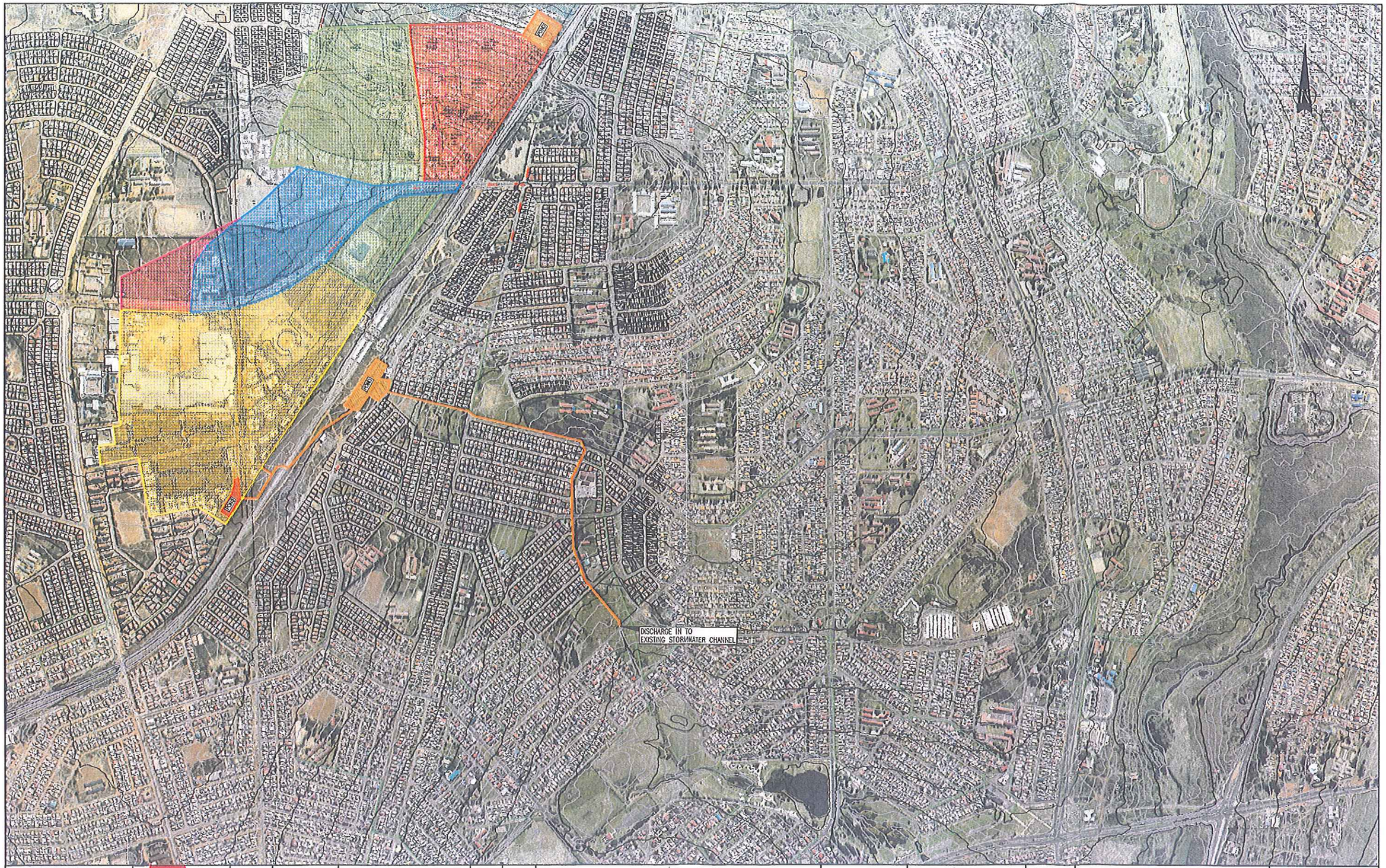
ENGINEER DATE

DRAWING No.

FILE No.

Appendix D

Bulk Stormwater Layout Plan



BIGEN AFRICA Services (PTY) LTD
A Jan Cilliers Street
The Innovation Hub, Pretoria
PO Box 29, The Innovation Hub, 0087
Tel: +27 (0) 12 842 8000
Fax: +27 (0) 12 843 9000/9001
E-mail: pretoria@bigenafrica.com
www.bigenafrica.com

SURVEYED		
DESIGNED	T Mulovhedzi	
DRAWN	P Valentine	
CHECKED	L D Jacobs	
SERVICES CHECKED	–	
CO-ORDINATE SYSTEM	–	
SERVITUDES	–	
APPROVED	J duV STRAUSS	

APPROVED ON BEHALF OF BIGEN AFRICA:
NAME: LD Jacobs
SIGNATURE: .....
DATE: .....

AMENDMENTS	APPROVED	DATE

PROJECT DRAWING No.: 1479.00.ZA.04.A007
REVISION: 1.0
APPROVED: L.D. Jacobs
Pr. Eng. No.: 20020005
DATE: November 2009

Joburg
Customised for Africa

JABULANI HOSTELS

STORMWATER OUTLINE SCHEME REPORT

Johannesburg Roads Agency
Private Bag X 70, Braamfontein, Johannesburg, 2017
Gauteng, South Africa
TEL: 011-407-6487
FAX: 011-339-1607

SCALE: N.T.S ON ORIGINAL A1 DRAWING

AS-BUILT RECORD

CONTRACT No.	CONTRACT DESCRIPTION	CERTIFIED	DATE

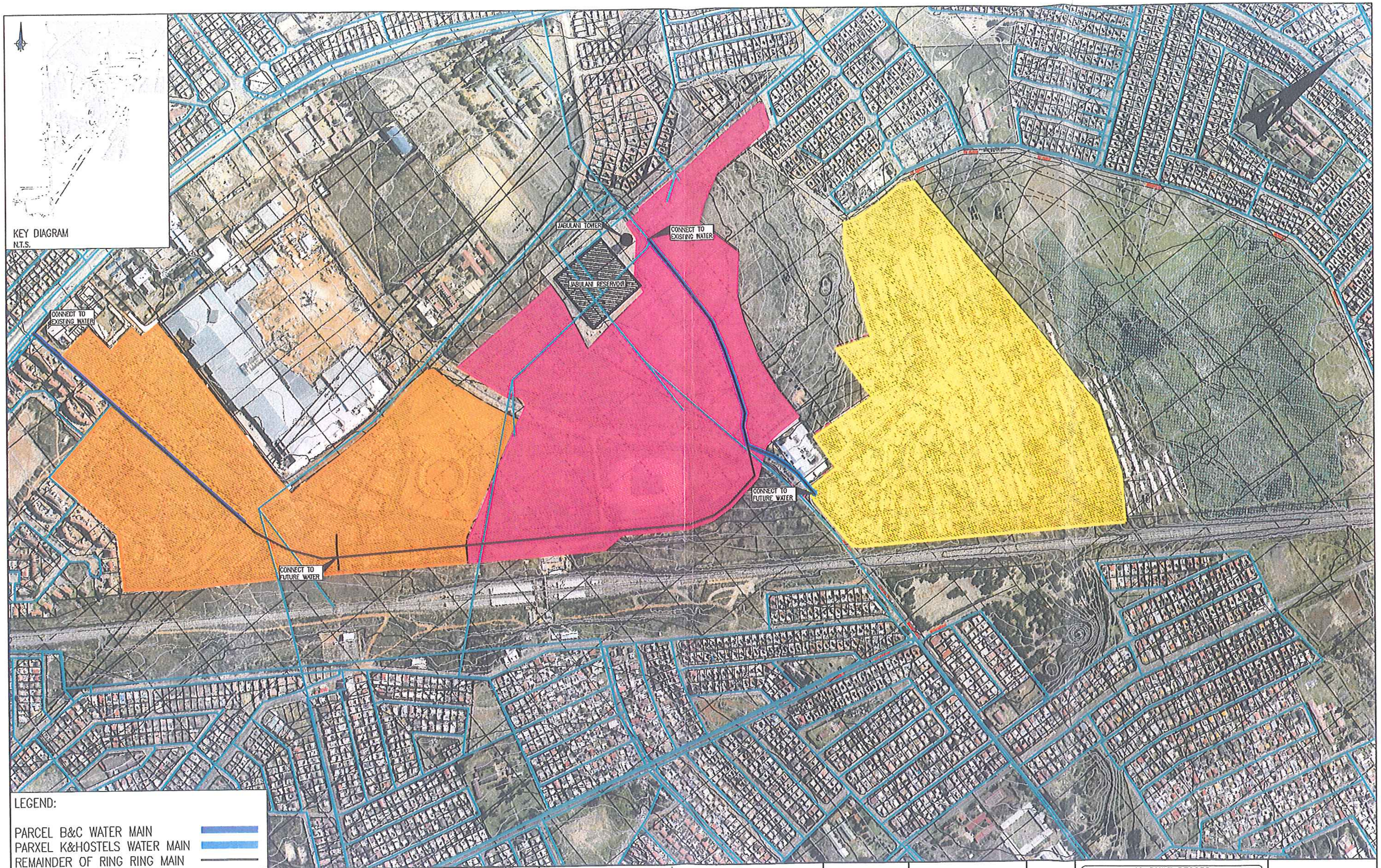
CERTIFIED AS-BUILT FOR CONTRACT :
ENGINEER DATE

DRAWING No.

FILE No.

Appendix E

Bulk Water Layout Plans



BIGEN AFRICA Services (PTY) LTD
The Innovation Hub, Pretoria
www.bigenafrica.com

SURVEYED	
DESIGNED	T Mukwano
DRAWN	P Valentine
CHECKED	LD Jacobs
SERVICES CHECKED	–
CO-ORDINATE SYSTEM	WG 27
SERVITUDES	–
APPROVED	LD Jacobs

PRIVATE DRAWING No. 479.00.ZB.05.U003 — REVISION 1.0 — APPROVED: LD. Jacobs, Pr. Eng. No: 20070095, DATE: November 2009

APPROVED ON BEHALF OF BIGEN AFRICA:
NAME: LD Jacobs
SIGNATURE:
DATE:

AMENDMENTS	APPROVED	DATE

Jo'burg

JABULANI PARCEL B & C

WATER OUTLINE SCHEME REPORT

Johannesburg Water (Pty) Limited
TEL: 011-407-6614
FAX: 011-403-3841

SCALE 1 :3000 ON ORIGINAL A1 DRAWING

AS-BUILT RECORD

CONTRACT No.	CONTRACT DESCRIPTION	CERTIFIED	DATE

CERTIFIED AS-BUILT FOR CONTRACT :
ENGINEER DATE

DRAWING No.

FILE No.

Appendix F

Bulk Sewer Layout Plans

BIGEN AFRICA Services (PTY) LTD
A..a1 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

BIGEN AFRICA

SURVEYED	
DESIGNED	T Mulovano
DRAWN	P Valentine
CHECKED	LD Jacobs
SERVICES CHECKED	–
CO-ORDINATE SYSTEM	WG 27
SERVITUDES	–
APPROVED	LD Jacobs

APPROVED ON BEHALF OF BIGEN AFRICA:
NAME: LD Jacobs
SIGNATURE: ....
DATE: ....

PRIVATE DRAWING No. 1479.00.ZB.06.U003
REVISION 1.0
APPROVED: LD. Jacobs
Pr. InEng. No.: 20070095
DATE: November 2009

AMENDMENTS		APPROVED	DATE

Jo'burg
Gateway to Africa

JABULANI PARCEL B & C

SEWER OUTLINE SCHEME REPORT OPTION 1

Johannesburg Water
Johannesburg Water (Pty) Limited
58 Frederick Street, Marshalltown
P. O. BOX 61542, Marshalltown, 2107
TEL: 011-407-6614
FAX: 011-403-3841

SCALE
1 :3000
ON
ORIGINAL
A1
DRAWING

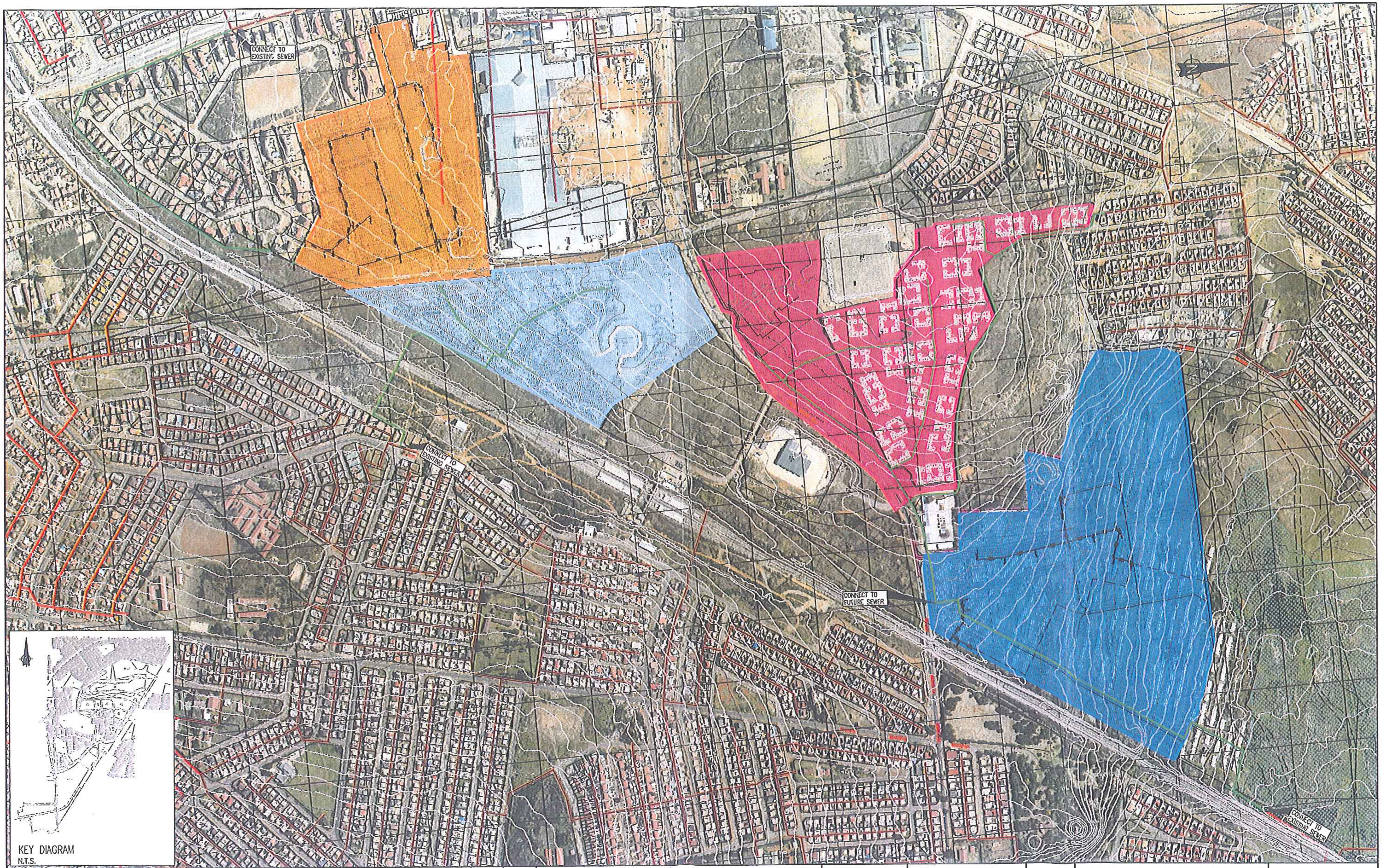
AS-BUILT RECORD

CONTRACT No.	CONTRACT DESCRIPTION	CERTIFIED	DATE

CERTIFIED AS-BUILT FOR CONTRACT :
ENGINEER DATE

DRAWING No.

FILE No.



BIGEN AFRICA Services (PTY) LTD
The Innovation Hub, 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

BIGEN AFRICA

SURVEYED	
DESIGNED	T Mulovana
DRAWN	P Valentine
CHECKED	LD Jacobs
SERVICES CHECKED	–
CO-ORDINATE SYSTEM	WG 27
SERVITUDES	–
APPROVED	LD Jacobs

PRIVATE DRAWING No.: 1479.00.ZB.06.U004
REVISION: 1.0
APPROVED: LD. Jacobs
Pr. IrEng. No.: 20070095
DATE: November 2009

APPROVED ON BEHALF OF BIGEN AFRICA:
NAME: LD Jacobs
SIGNATURE: ....
DATE: ....

AMENDMENTS	APPROVED	DATE

Jo'burg

JABULANI PARCEL B & C

SEWER OUTLINE SCHEME REPORT OPTION 2

Johannesburg Water (Pty) Limited
58 Frederick Street, Marshalltown
P. B. BOX 61542, Marshalltown, 2107
TEL: 011-437-6614
FAX: 011-403-3411

SCALE
1 :3000 ON ORIGINAL A1 DRAWING

AS-BUILT RECORD

CONTRACT No.	CONTRACT DESCRIPTION	CERTIFIED	DATE

CERTIFIED AS-BUILT FOR CONTRACT :

ENGINEER DATE

DRAWING No.

FILE No.