DEVELOPMENT OF CLAYVILLE EXTENSIONS
45, 50, 71, 76, 77, 78, 79 and 80

STORMWATER MANAGEMENT PLAN
DECEMBER 2015

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Doc No.2374/00/00/IR01

VALUMAX MIDRAND (PTY) LTD

CLAYVILLE EXTENSIONS 45, 50, 71, 76, 77, 78, 79 and 80

CIVIL ENGINEERING SERVICES

STORMWATER MANAGEMENT PLAN

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VALUMAX MIDRAND (PTY) LTD

CLAYVILLE EXTENSIONS 45, 50, 71, 76, 77, 78, 79 and 80

CIVIL ENGINEERING SERVICES

STORMWATER MANAGEMENT PLAN

1 INTRODUCTION

1.1 Background

BIGEN AFRICA Services (Pty) Ltd were appointed by Valumax Midrand (Pty) Ltd to plan and design the civil engineering services for the proposed Clayville Extensions 45, 50, 71, 76, 77, 78, 79 and 80 developments in the Ekurhuleni Metropolitan area of Clayville north of Tembisa.

The Clayville Ext 45, 50, 71, 76, 77, 78, 79 and 80 developments form part of the larger Clayville/Tembisa Mega Housing Project which consists of Clayville Ext 45, 50, 71, 76, 77, 78, 79 and 80, mixed typology and mixed tenure housing development, in accordance with the Breaking New Ground Policy of national government.

1.2 Purpose of this report

The purpose of this report is to agree with, and get the approval of the relevant authorities regarding the following:

- Stormwater management plan and objectives,
- Design of the internal stormwater system to the proposed development,
- Connection to existing stormwater systems.

1.3 Summary of Stormwater Management Plan

The minor stormwater drainage system is an underground pipe system that will collect stormwater at low points on roads and where justified, before intersections of roads. All commercial, educational, residential 2 & 3 stands will be provided with direct stormwater connections. The major stormwater floods are drained at the low points of the development by the pipe systems designed to accommodate the major flood.

All stormwater is to be collected in attenuation ponds at the low points of the catchments and discharged into the downstream stormwater systems to the south and east of the development.

2 SITE DESCRIPTION

2.1 Locality

The Site of approximately 162 hectares is located directly west of Clayville Extension 45, north of Kaalfontein Extension 22 and south of the proposed Clayville Extension 50 and 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 71 will be developed on Portion 207 (A Portion of Portion 183) of the farm Olifantsfontein 410 JR and Clayville Ext 50 on the Remainder of Portion 183 of the farm Olifantsfontein 410-JR. The northern portion of Ext 45 is also taken into account in this stormwater management plan. These two sites are to be developed in phases and subsequently have been divided into extensions 50, 71, 76, 77, 78, 79 and 80.

2.2 Site characteristics

The approximate coordinates of the centre of the site are S25° 58' 30.4" E28° 11' 00.5" and the site slopes primarily to the south and east from the higher pan area in the western portion of the site with slopes varying around 4%. The highest point on the site is the western portion (about 1602m amsl.) sloping towards the south and eastern portions of the site with a lowest points of about 1563m and 1553m amsl respectively. The north-west corner of the site slopes towards the north.

The site is bordered by three road reserves to the west, east and north – provincial route K109 to the west, provincial route K111 to the east and the national PWV5/Olifantsfontein Road R562 to the north.

The Site falls in the temperate eastern plateau climatic region. The mean annual temperature is 16℃ with a range of more than 11℃ above or below. The climate is generally having wet, warm summers with cold, dry winters. The average annual precipitation is 700mm occurring mostly in the form of thunderstorms in summer. Frost is common in winter.

2.3 Site Geology

The following are extracts taken direct from the Intraconsult Geotechnical Report of July 2014.

The proposed township is to be established on portions of the farm Olifantsfontein 4101R. The township is located west of Glen Austin Agricultural Holdings Ext.1 and North of Kaalfontein Ext 23.

Natural vegetation consists of veld grasses. There are areas of medium hard rock and hard rock and sub-outcrop in sectors of this site which lies immediately north of the Glen Austin fault belt.

The approximate extent and nature of near surface features observed on this site are shown on Figures 3 to 6 of the geotechnical report.

• Figure 3 shows sub-areas of the site mantled by solid and organic waste materials which will require removal before developments are started in these sections of the site (see Plate 8).

• Figure 4 shows sub-areas of the site where hard rock (r3) or boulder medium and hard rock (r1, r2, r4 and r5) were observed during this survey. It should be noted that other areas of rock outcrop could occur firstly below the waste area (shown on Figure 3) and secondly in other areas of the site currently covered by veld grasses.

• Figure 5 delineates pans and other sub-areas of the site potentially impacted during rainy seasons. In our experience, stormwaters seep through the (leached-out) surface hillwash soils and run downslope on top of (typically) shallowly underlying pedocretes (see Plates 1 and 4). Such poor natural drainage can result in practically impassible conditions for wheeled vehicles after heavy rains.

• Figure 6 shows the general directions of natural surface drainage across this site.

Our broad recommendations for dealing with these near surface features for the proposed township development are given in Section 8 below. Photographs depicting aspects of the general area proposed for development are given in Appendix 3 of the geotechnical report.

Ground Water Drainage Recommendations

Signs of potential seepage and perched water tables were noted in many of the opened trial holes and are probably associated with the impermeable nature of the underlying pedocrete soils and bedrock across this site (see Figure 5, subareas W1, W2, W3, W4 & W5).

These seepage zones (prefixed 213W) require particular attention. The following comments and recommendations apply:

• The subsurface profile typically consists of a thin horizon of hillwash, overlying hardpan ferricrete grading into soft and hard rock granite.

• During the rainy season ground water accumulation and lateral seepage occurs within the soils horizons, on the soil-ferricrete/granite interface. This water gathers upslope of the seepage zone and migrates downslope until it is forced to "daylight" by the outcrop ping or dramatic shallowing of the granite or ferricrete.

• Our opinion is that these sub-areas can be developed from a geotechnical perspective provided certain precautionary measures are implemented, including:

o Use of cutoff drains topographically immediately above the delineated area and also the side drains in appropriately designed roads networks.

o Subsurface drains located strategically to capture the groundwater seepage e.g. below the sewer pipeline in sewer trenches. These drains could remove the water and discharge it downslope possibly into road side drains.

o Using spoil (from sub-areas shown on Figure 3) to backfill the deeper pan areas - later to be planned as POS.

o All structures and walls will need to have adequate freeboard and appropriate damp proofing, to preclude rising damp.

3 STORMWATER MANAGEMENT PLAN

3.1 Objectives

The objectives of the stormwater management plan are summarized as follows:

- To provide a stormwater drainage system for the convenience of the community and the protection of property from damage by the run-off from frequent storms,
- To prevent loss of life and reduce damage to property by the run-off from severe storms,
- To prevent land and watercourse erosion due to uncontrolled runoff,
- To enhance water infiltration into the subsoil where possible,
- To achieve the foregoing objectives at optimal total cost.

3.2 Design philosophy and principles

The Rational Method was used in calculating the peak run-off discharge for the various stormwater catchment areas.

A recurrence interval of 1:5 years was adopted for the design of the minor flood system and a recurrence interval of 1:25 years for the design of the piped major flood system.

As commercial, educational, residential 2 & 3 stands are provided with a stormwater connection, most stormwater will be accommodated in the stormwater pipe system and attenuation pond. During minor floods all the stormwater will be accommodated in the stormwater pipe system. Two primary access roads will be constructed into these extensions Clayville 45, 50, 71, 76, 77, 78, 79 and 80, and will only be allowed to be partly flooded during a major storm event.

The stormwater management and mitigation will be approached primarily from the intention of Sustainable Urban Drainage Systems that will enhance the existing natural waterways, minimise or remove impact on the downstream systems and allow easy and continued maintenance such that the systems can function properly indefinitely.

Subsoil drainage will be kept and incorporated into the proposed stormwater systems. Overland flow systems will prevent flooding and hazards and direct major floods to safe discharge points that are protected from erosion. Underground piped systems will meet Ekurhuleni engineering standards and also discharge at outlets that are protected from erosion.

3.3 Drainage Routes to Be Utilised:

Each commercial, educational, residential 2 & 3 stand will be provided with a stormwater connection. The site is essentially is three major catchment areas draining to the north, south and east each into their own attenuation pond to be constructed as part of the works. All three ponds will be compensate for the smaller areas in the west and north that cannot drain into these three ponds.

The pond in the south will be constructed at the low point on the original extension 71.

The pond in the east will be constructed inside the northern area of extension 45 within the natural low point just above the origin of the water course there, thus maintaining the flow route into the watercourse.

The stormwater pond in the north will be constructed in the south-east corner of the future K111-PWV5 interchange which is on the northern edge of the original extension 50.

3.4 Design details

A mean annual rainfall precipitation of 750mm/year was used to calculate the precipitation intensity to be used in the run-off discharge calculations. The stormwater run-off calculations for each catchment area are attached as Appendix B.

The minor stormwater drainage system is an underground pipe system that will collect stormwater at specific stands, low points on roads and interim locations where necessary. Kerb and field inlet structures are selectively placed to collect the minor stormwater flood into the piped systems.

Stormwater collected at the commercial, educational, residential 2 & 3 stands and on the roads is discharged into an attenuation pond. The ponds will then discharge into the existing stormwater systems to the north, south and east. Piped systems passing between erven will be constructed in appropriately registered servitudes in favour of the local authority.

The stormwater layout is included in Appendix C, and details of the stormwater attenuation are included in Appendix D. Energy dissipation measures were implemented at all outlets of channels or pipes according to the Ekurhuleni standard requirements.

3.5 Attenuation

It is a requirement of the Ekurhuleni Metropolitan Municipality that provision is made for stormwater attenuation to reduce the increased stormwater run-off resulting from the development to pre-development flow rates through the incorporation of stormwater attenuation ponds in the stormwater system. As such and because the pre-development site is disturbed due to earthwork and dumping activities on it the C value has been calculated in accordance with the National Drainage Manual and the calculation provided in Appendix B.

The estimated pre-development flow of the area calculated with an infiltration factor of 0.3 and post-development flow with an infiltration factor of 0.67 is as follows:

Table 1: Attenuation Pond S Summary (m^3/s)

m^3/s	Pre Development Flow (existing)	Post Development Flow (attenuated)	Inflow into Attenuation pond	Post Development Flow Nett Effect	Pond Free Board (m)
1:2	1.675	1.215	3.740	- 2.525	2.450
1:5	2.417	2.127	5.397	- 3.270	2.131
1:20	3.901	3.398	8.711	- 5.313	1.433
1:50	5.303	5.048	11.843	- 6.795	0.930
1:100	6.304	6.253	14.079	- 7.826	0.658

The attenuation is achieved with an attenuation pond in the public open space at the south of X71. The volume of the attenuation pond is 63,130m³ with outlets of; 1 x 1050mm dia, 1 x 750mm dia and an overflow broad crest weir of 1.8m width as a back-up safety overflow.

Table 2: Attenuation Pond E Summary (m^3/s)

m^3/s	Pre Development Flow (existing)	Post Development Flow (attenuated)	Inflow into Attenuation pond	Post Development Flow Nett Effect	Pond Free Board (m)
1:2	2.740	2.221	6.119	- 3.898	2.455
1:5	3.954	3.378	8.830	- 5.452	2.074
1:20	6.382	6.023	14.253	- 8.230	1.412
1:50	8.676	8.329	19.375	- 11.046	0.864
1:100	10.314	9.761	23.035	- 13.274	0.494

The attenuation is achieved with an attenuation pond in the public open space at the top of the water course in X45. The volume of the attenuation pond is 73,939m³ with outlets of; 2 x 750mm dia, 2 x 1050mm dia and an overflow broad crest weir of 1.0m width as a back-up safety overflow.

Table 3: Attenuation Pond N Summary (m^3/s)

m^3/s	Pre Development Flow (existing)	Post Development Flow (attenuated)	Inflow into Attenuation pond	Post Development Flow Nett Effect	Pond Free Board (m)
1:2	0.792	0.722	1.768	- 1.046	2.491
1:5	1.143	1.032	2.552	- 1.520	2.152
1:20	1.844	1.384	4.119	- 2.735	1.362
1:50	2.507	1.775	5.600	- 3.825	0.829
1:100	2.981	2.386	6.658	- 4.299	0.594

The attenuation is achieved with an attenuation pond in the public services erf in the north of X50. The volume of the attenuation pond is 23,979m³ with outlets of; 3 x 450mm dia and an overflow broad crest weir of 1.8m width as a back-up safety overflow.

The values indicated in the attached calculation sheets are as follows:
Pre-Development Inflow Hydrograph Peak flow – Pre-development peak flow
Post-Development Inflow Hydrograph Peak flow – Post-development peak flow into the attenuation pond.
Attenuated Outflow Hydrograph Peak flow – Peak flow of water flowing out of the attenuation pond.

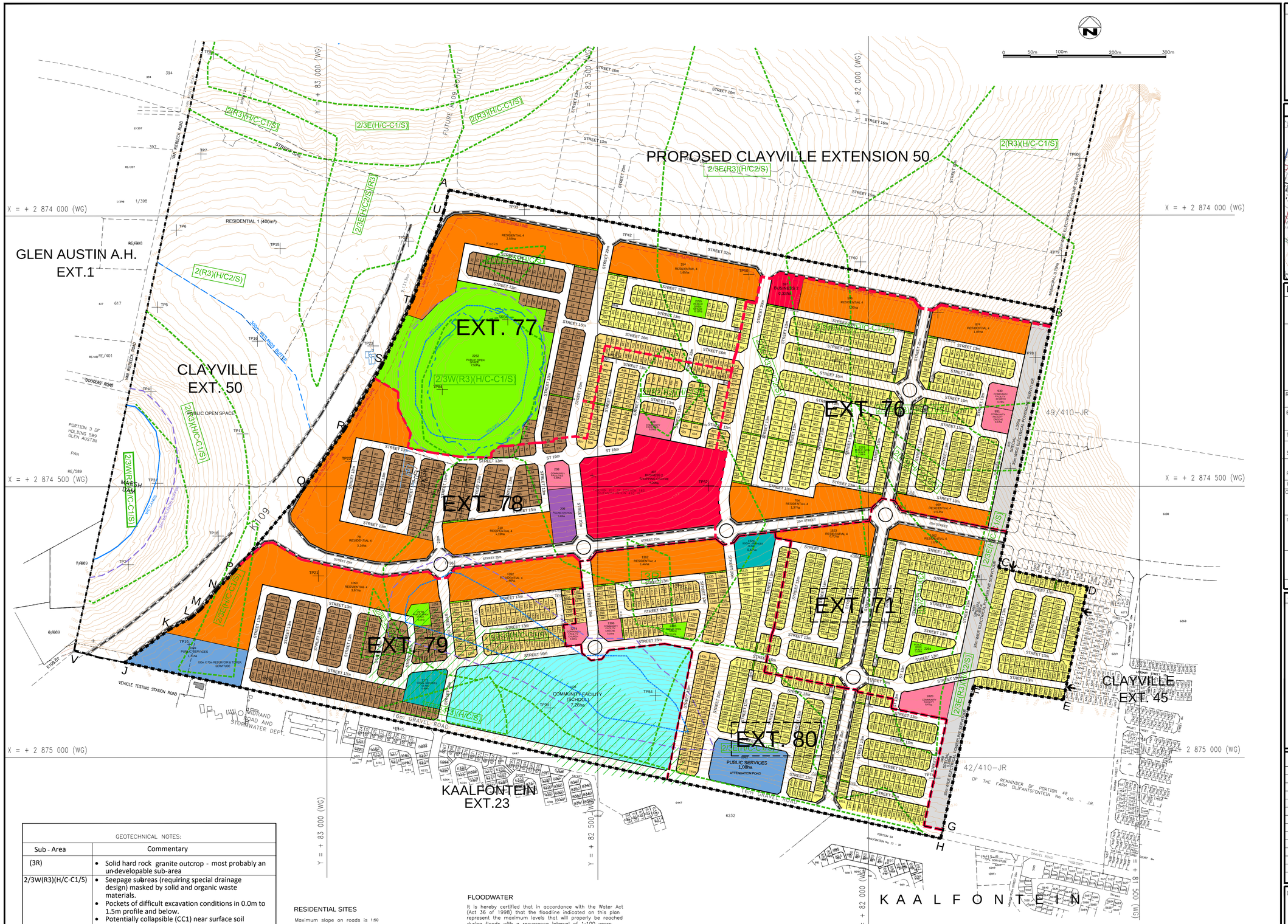
4 SUMMARY

The stormwater management master plan proposed for Clayville Extensions 71, 50 and 45N will consist of the following elements:

- Minor and a major stormwater system to convey water to the existing stormwater systems without causing damage to property, and furthermore designed according to accepted principles and standards.
- Ground water will be diverted to the piped stormwater systems via sub-soil drains or cut off drains at applicable locations to protect services and life.
- The stormwater design includes stormwater attenuation systems will decrease the peak flow to pre-development conditions.
- All elements are constructed in a way to blend in with the environment and will be barely noticeable once fully established.
- Attenuation ponds will be located in areas that are public open space, zoned for public services or even better where they can enhance and maintain existing water courses and wetlands to facilitate mitigation as close to natural conditions as possible.

Appendix A

Locality plan



GEOTECHNICAL NOTES:	
Sub - Area	Commentary
(3R)	• Solid hard rock granite outcrop - most probably an un-developable sub-area
2/3W(R3)(H/C-C1/S)	• Seepage sub-areas (requiring special drainage design) masked by solid and organic waste materials. • Pockets of difficult excavation conditions in 0.0m to 1.5m profile and below. • Potentially collapsible (CC1) near surface soil conditions
2/3E(H/C-C1/S)	• Natural soils masked by solid and organic waste • Potentially collapsible (C C1) near surface soil conditions
2/3E(R3)(H/C2/S)	• Natural soils masked by solid and organic waste • Pockets of difficult excavation conditions in 0.0m to 1.5m profile and below, otherwise - • Thick layers of potentially collapsible near surface soils (C2) in these sub areas of the site.
2(R3)(H/C2/S)	• Pockets of difficult excavation conditions in 0.0m to 1.5m profile and below, otherwise - • Thick layers of potentially collapsible near surface soils (C2) in these sub areas of the site.
2(R3)(H/C -C1/S)	• Pockets of difficult excavation conditions in 0.0m to 1.5m profile and below, otherwise - • Thick layers of potentially collapsible near surface soils (CC1) in these sub-areas of the site.
2(R2R3)H/C/S	• Scattered outcrop and sub outcrop of medium and hard rock boulder conditions in these sub -areas of the site.

RESIDENTIAL SITES

Maximum slope on roads is 1:50
Minimum slope on roads is 1:18

CONTOURS

The contours on this plan are in accordance with the stipulations of Regulation 18(1)(a)(1) of the Town Planning– and Township Ordinance, Ord. 15 of 1986. The contours on this plan were obtained from

26/3/2015

CO-ORDINATES

The Co–ordinate reference is based on WG27 system. Base Plan mapping was done by

26/3/2015
date

DIMENSION AND SIZES

1. All dimensions shown on the plan are approximate, scaled in meters and subject to final survey.
2. Township Layout Sketch Plan. Only calculated survey drawing to be used for Engineering Design and Construction purposes.

FLOODWATER

It is hereby certified that in accordance with the Water Act (Act 36 of 1998) that the floodline indicated on this plan represent the maximum levels that will properly be reached during floods with a recurrence interval of 1:100 years.

CONSULTING ENGINEER ..... date

GEOTECHNICAL

It is hereby certified that the layout of the township complies with the recommendations and requirements set out in the geotechnical report no. IR1252 dated July 2014

Engineering Geologist ..... 14 2015.
Firm ..... INTRA CONSULT cc

WETLAND

I hereby certify that the Wetland Delineation and the 30m Wetland Buffer as indicated on the layout are correct.

Dr. Gwen Theron — Date 26/03/2015

CLAYVILLE COMPILATION

PROPOSED EXTENSIONS

NOT TO SCALE

PHASES	STANDS	± UNITS
EXT. 71	434	315
EXT. 76	523	772
EXT. 77	252	756
EXT. 78	257	797
EXT. 79	274	912
EXT. 80	480	262
TOTAL	2220	3814

PROJECT

PROPOSED TOWNSHIP

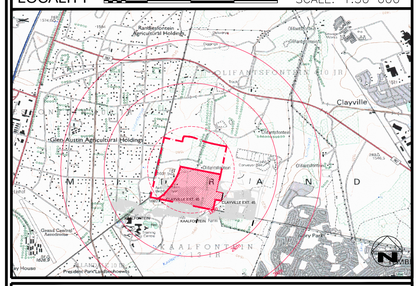
CLAYVILLE COMPILATION

SITUATED ON PORTION 207 OF PORTION 183 OF THE FARM OLIFANTSFONTEIN 410 JR

LOCAL AUTHORITY : EKURHULENI LOCAL MUNICIPALITY
DISTRICT : KEMPTON PARK
GEODETICAL SYSTEM : WG27

LOCALITY

SCALE: 1:50 000



LAND USE TABLE

ZONING	LAND USE	ERF NUMBERS	No. OF STANDS	AREA OF STANDS & STREETS	% OF AREA
RESIDENTIAL 2	DWELLING HOUSES 9m x 18m = 160m²	255–363,543–595, 598–703,705–873, 875–929,932–968, 971–1048,1483–1522, 1525–1660,1663–1819, 1821–1867,1869–1962, 1964–2251	1,369	24,42	19,08
	DWELLING HOUSES 9m x 20m = 180m²	364–406,409–542, 1235–1273,1275–1281, 1283–1361,1363–1395, 1397–1433,1435–1482	420	8,05	6,29
	DWELLING HOUSES 9,8m x 22m = 216m²	2–77,79–207,211–253, 1051–1170,1172–1234	431	9,98	7,80
RESIDENTIAL 4	FLATS, TOWNHOUSES, GROUP HOUSING, RESIDENTIAL BUILDINGS, RESIDENTIAL UNITS MAXIMUM units per ha (381ha units)	1,78,910,054,596,704, 874,969,1050,1282, 1362,1523,1662	13	21,20	16,56
BUSINESS 2	LIGHT INDUSTRY, BANKS, OFFICES, PLACES OF PUBLIC WORSHIP, PLACES OF INSTRUCTION, PLACES OF EDUCATION, RESTAURANTS, SHOPS, CONFERENCE UNIT, SCHOOL, CONSULTING ROOMS, CINEMA/AML, CLUBS, HOTELS, MOTELS, PLACES OF PUBLIC WORSHIP, PLACES OF RESTRICTED CHILD CARE, PLACES OF ENTERTAINMENT, PLACES OF CONSUMPTION, PLACES OF PUBLIC ENTERTAINMENT	407,597	2	4,33	3,38
SPECIAL	ELECTRICAL POWERLINES, MUNICIPAL SERVICES	970,1661,1868	3	3,18	2,48
SOCIAL SERVICES	HOSPITALS, CLINICS, LIBRARIES, POLICE STATIONS, LAW COURTS, FIRE STATIONS, PLACES OF INSTRUCTION, PLACES OF EDUCATION, PLACES OF PUBLIC WORSHIP, PLACES OF RESTRICTED CHILD CARE, PLACES OF ENTERTAINMENT, PLACES OF CONSUMPTION	1171,1524	2	0,87	0,68
PUBLIC SERVICES	PRODUCE MARKETS, ABATTOIRS, CEMETERIES, WATER WORKS, RESERVOIRS, GAS WORKS, SEWAGE PURIFICATION WORKS, SEWAGE DISPOSAL, WORKS, WASTE DISPOSAL SITES, MUNICIPAL PURPOSES, POSTAL DEPOT, PUBLIC OPEN SPACE, RESTORATION AND ATTENUATION PONDS	1049,1963	2	2,39	1,87
PUBLIC GARAGE	FILLING STATION, CAR WASH, MOTOR DEALERS MOTOR WORKSHOPS	209	1	0,43	0,34
COMMUNITY FACILITY	PLACE OF EDUCATION	1434	1	7,25	5,66
	PLACES OF INSTRUCTION, PLACES OF EDUCATION, SOCIAL HALLS, PLACES OF ENTERTAINMENT, PLACES OF CONSUMPTION, SOCIAL FACILITIES, SPORT AND RECREATION CLUBS, HOTELS, MOTELS, PLACES OF PUBLIC WORSHIP, PLACES OF RESTRICTED CHILD CARE, WORKSHOPS, USED IN CONNECTION HEREWITH,MUNICIPAL PURPOSES, PUBLIC OPEN SPACE, SWIMMING POOLS, STORMWATER RETENTION AND ATTENUATION PONDS	208,408,930,931, 1274,1396,1820	7	1,75	1,37
PUBLIC OPEN SPACE	PARKS, GARDENS, BOTANICAL GARDENS, ZOOLOGICAL GARDENS, NATURE RESERVE, ART GALLERIES, SPORT AND RECREATION CLUBS, SWIMMING POOLS, PLAYING FIELDS, SHELTERS, AND BUILDINGS USED IN CONNECTION HEREWITH,MUNICIPAL PURPOSES, SWIMMING POOLS, STORMWATER RETENTION AND ATTENUATION PONDS	2252–2300	49	8,48	6,63
STREETS	STREET/ROADS, PRIVATE ROADS, TOLL GATES, WEIGH BRIDGES, PARKING, CYCLE LANES, BUS LANES, MUNICIPAL SERVICES AND INFRASTRUCTURE			35,69	27,86
TOTAL			2300	128,00ha	100%

GENERAL NOTES

THE FIGURE ABCDEFGFHJKLMNPQRSTUA REPRESENTS OUTSIDE BOUNDARY OF THE PROPOSED TOWNSHIP BEING APPROXIMATELY 128ha IN EXTENT.

- OUTSIDE BOUNDARY OF TOWNSHIP
- FARM PORTIONS
- LINE OF NO ACCESS
- WETLANDS
- WETLANDS BUFFER

GEOTECHNICAL NOTES:

- PRESUMED BOUNDARY OF SITE CLASS SUB–AREA
- TP7 — TRIAL HOLES POSITION AND NUMBER
- 2/3E(H/C-C1/S) — PRELIMINARY NHBRC SITE CLASS DESCRIPTION

REVISIONS

D : DRAFT C : CIRCULATED A : APPROVED

CLIENT:

valumax — Create more value

TOWN PLANNER: Nomfundo Sibanyoni

SCALE: 1:2 500

DRAWING REF: Clay71Lay D/2015.11.04

DRAWING STATUS: DRAFT

URBAN DYNAMICS
TOWN & REGIONAL PLANNERS
37 EMPIRE ROAD
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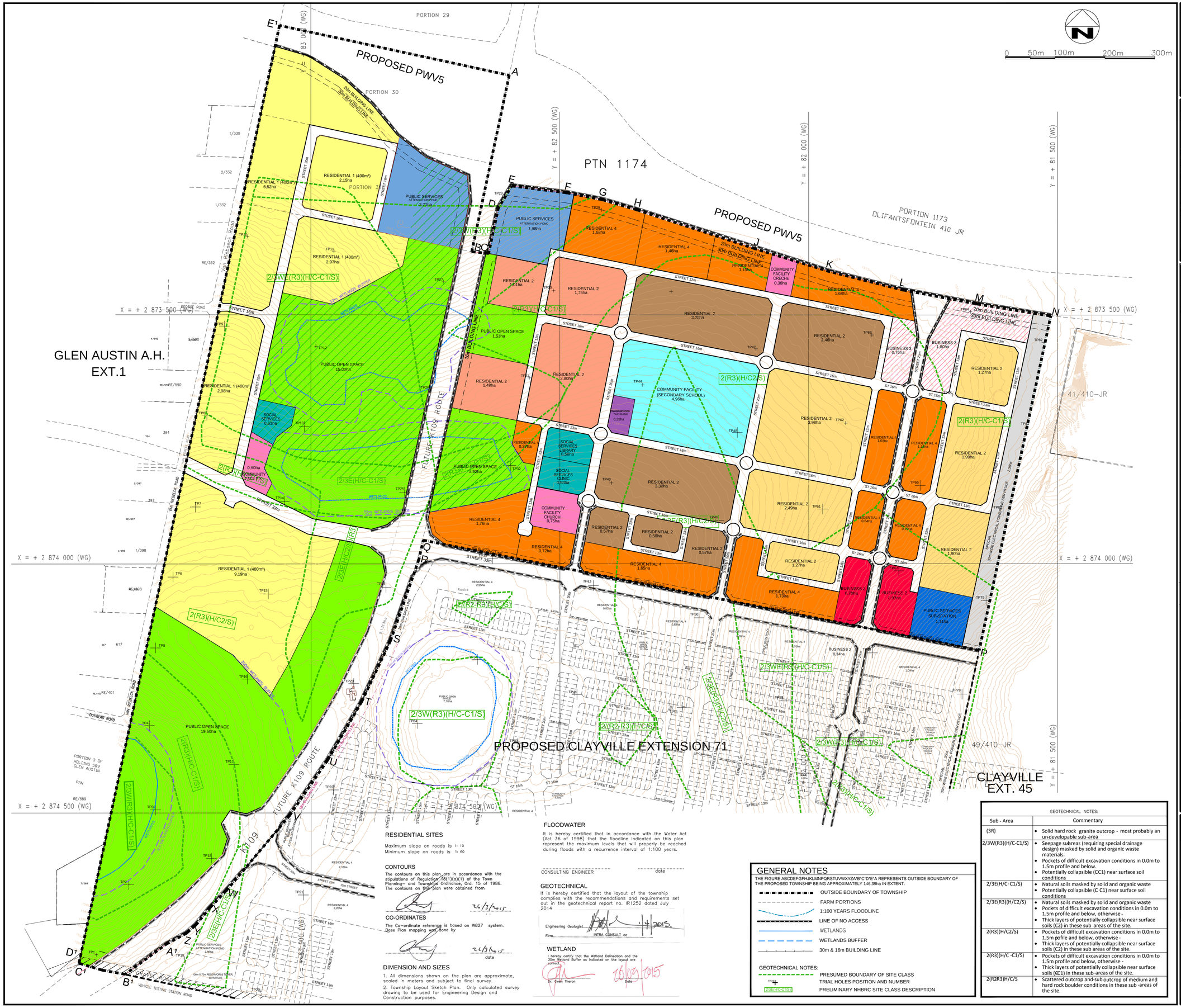
E–MAIL: nomfundos@urbandynamics.co.za



PROJECT

PROPOSED TOWNSHIP

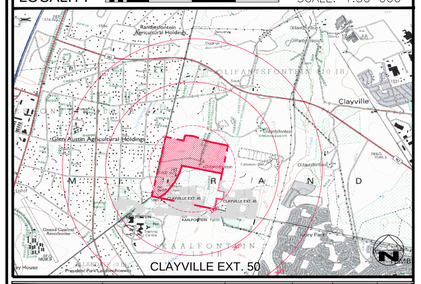
CLAYVILLE EXTENSION 50

SITUATED ON THE REMAINDER OF PORTION 183
AND PORTIONS 30 & 31 OF THE FARM OLIFANTSFONTEIN 410 JR

LOCAL AUTHORITY : EKURHULENI LOCAL MUNICIPALITY
DISTRICT : KEMPTON PARK
GEODETICAL SYSTEM : WG27

LOCALITY

SCALE: 1:50 000



ZONING	LAND USE	ERF NUMBERS	No. OF STANDS	AREA OF STANDS & STREETS	% OF AREA
RESIDENTIAL 1	400m² 25 dwelling units per ha		5	23,81	14,66
RESIDENTIAL 2	160m² 60 dwelling units per ha		6	12,90	7,94
	180m² 55 dwelling units per ha		6	10,76	6,63
	216m² 45 dwelling units per ha		4	7,05	4,34
RESIDENTIAL 4	180 DWELLING UNITS PER HA DWELLING HOUSES, DWELLING UNITS, RESIDENTIAL BUILDINGS, PRIVATE ROADS		13	15,74	9,69
COMMUNITY FACILITY	EDUCATION		1	4,96	3,05
	PLACES OF INSTRUCTION, PLACES OF EDUCATION, SOCIAL HALLS, PLACES OF PUBLIC WORSHIP, LIBRARIES, CHILD CARE FACILITIES, SPORT AND RECREATION CLUBS, SPORTS GROUNDS, MONASTERIES, CONVENTS		3	1,63	1,00
BUSINESS 2	FOR BUSINESS PURPOSES, SUCH AS PLACES OF PUBLIC WORSHIP,PLACES OF INSTRUCTION, PLACES OF EDUCATION,DWELLING UNITS,RESIDENTIAL BUILDINGS, RESTAURANTS,MEDICAL CONSULTING ROOMS, GYMNASIUM, PLANT NURSERIES,SERVICE INDUSTRIES, PARKING BAYS AND PARKING GARAGES		2	1,63	1,00
BUSINESS 3	OFFICES, MEDICAL CONSULTING ROOMS, DWELLING HOUSES		2	2,56	1,58
PUBLIC SERVICES	SUB-STATION		1	1,11	0,68
	ATTENUATION POND		2	4,69	2,89
SOCIAL SERVICES	CLINIC & LIBRARY		3	1,65	1,02
TRANSPORTATION	TAXI RANK		1	0,32	0,20
PUBLIC OPEN SPACE	FOR PUBLIC AND PRIVATE OPEN SPACE, SPORTS AND RECREATIONAL CLUBS AND OTHER USES AS THE LOCAL AUTHORITY MAY APPROVE THAT ARE COMPATIBLE WITH THE PRIMARY LAND USE RIGHTS.		4	38,95	23,99
SPECIAL	ELECTRICAL POWERLINES, MUNICIPAL SERVICES		1	2,39	1,48
STREETS				33,22	19,85
TOTAL			54	162,37ha	100%

RESIDENTIAL SITES

Maximum slope on roads is 1: 10
Minimum slope on roads is 1: 60

CONTOURS

The contours on this plan are in accordance with the stipulations of Regulation 18(1)(o)(1) of the Town Planning– and Townships Ordinance, Ord. 15 of 1986. The contours on this plan were obtained from

26/3/2015
date

CO-ORDINATES

The Co-ordinate reference is based on WG27 system. Base Plan mapping was done by

26/3/2015
date

DIMENSION AND SIZES

1. All dimensions shown on the plan are approximate, scaled in meters and subject to final survey.
2. Township Layout Sketch Plan. Only calculated survey drawing to be used for Engineering Design and Construction purposes.

FLOODWATER

It is hereby certified that in accordance with the Water Act (Act 36 of 1998) that the floodline indicated on this plan represent the maximum levels that will properly be reached during floods with a recurrence interval of 1:100 years.

CONSULTING ENGINEER ..... date

GEOTECHNICAL

It is hereby certified that the layout of the township complies with the recommendations and requirements set out in the geotechnical report no. IR1252 dated July 2014

Engineering Geologist 1/4/2015
Firm ..... INTRA CONSULT cc

WETLAND

I hereby certify that the Wetland Delineation and the 30m Wetland Buffer as indicated on the layout are correct.

Dr. Gwen Theron ..... 26/03/2015 Date

GENERAL NOTES

THE FIGURE ABCDEFGFHJKLMNPQRSTUVWXYZA'B'C'D'E'A REPRESENTS OUTSIDE BOUNDARY OF THE PROPOSED TOWNSHIP BEING APPROXIMATELY 146,39ha IN EXTENT.

- OUTSIDE BOUNDARY OF TOWNSHIP
- FARM PORTIONS
- 1:100 YEARS FLOODLINE
- LINE OF NO ACCESS
- WETLANDS
- WETLANDS BUFFER
- 30m & 16m BUILDING LINE

GEOTECHNICAL NOTES:

- PRESUMED BOUNDARY OF SITE CLASS
- TP12 TRIAL HOLES POSITION AND NUMBER
- 2/3E(H/C-C1/S) PRELIMINARY NHBRC SITE CLASS DESCRIPTION

GEOTECHNICAL NOTES:

Sub - Area	Commentary
(3R)	• Solid hard rock granite outcrop - most probably an un-developable sub-area
2/3W(R3)(H/C-C1/S)	• Seepage subreas (requiring special drainage design) masked by solid and organic waste materials. • Pockets of difficult excavation conditions in 0.0m to 1.5m profile and below. • Potentially collapsible (CC1) near surface soil conditions
2/3E(H/C-C1/S)	• Natural soils masked by solid and organic waste • Potentially collapsible (C C1) near surface soil conditions
2/3E(R3)(H/C2/S)	• Natural soils masked by solid and organic waste • Pockets of difficult excavation conditions in 0.0m to 1.5m profile and below, otherwise - • Thick layers of potentially collapsible near surface soils (C2) in these sub areas of the site.
2(R3)(H/C2/S)	• Pockets of difficult excavation conditions in 0.0m to 1.5m profile and below, otherwise - • Thick layers of potentially collapsible near surface soils (C2) in these sub areas of the site.
2(R3)(H/C -C1/S)	• Pockets of difficult excavation conditions in 0.0m to 1.5m profile and below, otherwise - • Thick layers of potentially collapsible near surface soils (CC1) in these sub-areas of the site.
2(R2R3)H/C/S	• Scattered outcrop and-sub outcrop of medium and hard rock boulder conditions in these sub -areas of the site.

CLIENT:

valumax Create more value

TOWN PLANNER: Nomfundo Sibanyoni

SCALE: 1:2 500

DRAWING REF: Clay50Lay D/2015.10.20

DRAWING STATUS: DRAFT

URBAN DYNAMICS
TOWN & REGIONAL PLANNERS
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Appendix B

Stormwater run-off calculations

Description of Catchment	CLAYVILLE EXTENSION 71						
River Detail	NIL						
Calculated By	J. WEBSTER		**Date**	11 November 2015			
Physical Characteristics							
Size of Catchment (A)	1.280	km^2	Rainfall Region	SUMMER			
Longest O/L Watercourse (L)	0.794	km	**Area Distribution Factors**				
Longest D/C Watercourse (L)	1.372	km					
Average Slope (S_{av})	4.00E-02	m/m	Rural (α)	Urban (β)	Lakes (γ)		
Dolomite Area ($D_{\%}$)	0%	%	0.10	0.90	0		
Mean Annual Rainfall (MAR)	750	mm	Surface Description Value (r)		0.4		
Rural (1)				**Urban (2)**			
Surface Slope	**%**	**Factor**	**C_s**	**Description**	**%**	**Factor**	**C_2**
Vleis and Pans	9%	0.03	0.00	**Lawns**			
Flat Areas	5%	0.08	0.00	Sandy, flat (<2%)	0%	0.10	0.00
Hilly	81%	0.16	0.13	Sandy, steep (>7%)	5%	0.20	0.01
Steep Areas	5%	0.26	0.01	Heavy Soil, flat (<2%)	0%	0.17	0.00
Total	100%	-	0.15	Heavy Soil, steep (>7%)	5%	0.35	0.02
Permeability	**%**	**Factor**	**C_p**	**Residential Areas**			
Very Permeable	15%	0.04	0.01	Houses	33%	0.50	0.17
Permeable	25%	0.08	0.02	Flats	17%	0.70	0.12
Semi-Permeable	50%	0.16	0.08	**Industry**			
Impermeable	10%	0.26	0.03	Light Industry	0%	0.80	0.00
Total	100%	-	0.13	Heavy Industry	0%	0.90	0.00
Vegetation	**%**	**Factor**	**C_v**	**Business**			
Thick Bush & Plantation	15%	0.04	0.01	City Centre	0%	0.95	0.00
Light Bush & Farm Lands	15%	0.11	0.02	Suburban	13%	0.70	0.09
Grasslands	60%	0.21	0.13	Street	28%	0.95	0.26
No Vegetation	10%	0.28	0.03	Maximum Flood	0%	1.00	0.00
Total	100%	-	0.46	Total (C_2)	100%	-	0.66

Time of Concentration (T_c)				**Notes:**		
Overland Flow (3)		Defined Watercourse				
$T_c = 0.604*(rL/\sqrt{S_{av}})^{0.467}$		$T_c = (0.87L^2/1000S_{av})^{0.385}$				
0.75	Hours	0.29	Hours	C3 =	0.00	*or calculate for special cases

Run-off Coefficient							
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**Max**
Run-off coefficient C_1 ($C_1 = C_s + C_p + C_v$)	0.74	0.74	0.74	0.74	0.74	0.74	0.74
Adjusted for Dolomite areas, C_{1D} ($= C_1(1 - D_{\%}) + (C_1 D_{\%}(\sum(D_{factor} \times C_{S\%}))$ (4)	0.74	0.74	0.74	0.74	0.74	0.74	0.74
Adjustment factor for initial saturation, Ft (5) — Steep and Impermeable Catchment	0.75	0.8	0.85	0.9	0.95	1	1
Adjusted run-off coefficient, C_{1T} ($= C_{1D} \times F_t$)	0.55	0.59	0.63	0.67	0.70	0.74	0.74
Combined Run-off coefficient C_T ($= \alpha C_{1T} + \beta C_2 + \gamma C_3$)	0.65	0.66	0.66	0.66	0.67	0.67	0.67
Rainfall							
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**Max**
Point rainfall (mm), P_T (6) [600-800]	30	40	53	65	88	112	112
Point Intensity (mm/hour), P_{IT} ($=P_T/T_c$) — Overland	40.02	53.36	70.70	86.71	117.39	149.41	149.41
Area reduction factor (%), ARF_T (7)	53%	53%	53%	53%	53%	53%	53%
Average intensity (mm/hour), I_T ($= P_{IT} \times ARF_T$)	21.01	28.01	37.12	45.52	61.63	78.44	78.44
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**Max**
Peak Flow (m^3/s), $Q_T = \frac{C_T I_T A}{3,6}$	4.88	6.55	8.72	10.76	14.64	18.74	18.74

STORMWATER RUNOFF CALCULATION

Ref Control: GERTLG_LG-04

CLAYVILLE EXTs 71, 50 45N

Project Number: 2374/00/00-N

Description	AREA	Over Land		Water Course		Stream		C	A	Time of Concentration		Tc	Intensity (I)						Run-off (Q)					
		L	H	L	H	L	H	Infiltr. Factor	Total area	OverL	WaterC	TOTAL	1:2	1:5	1:20	1:25	1:50	1:100	1:2	1:5	1:20	1:25	1:50	1:100
	(m^2)	(m)	(m)	(m)	(m)	(m)	(m)		(ha)	(minute)	(minute)	(minute)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)
																			0.75	0.8	0.9	0.91	0.95	1
Undev	372675							0.300	37.268	44.98	17.53	62.51	34.00	46.00	66.00	71.00	85.00	96.00	0.79	1.14	1.84	2.01	2.51	2.98
Dev	372675							0.670	37.268	44.98	17.53	62.51	34.00	46.00	66.00	71.00	85.00	96.00	1.77	2.55	4.12	4.48	5.60	6.66

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STORMWATER RUNOFF CALCULATION

Ref Control: GERTLG_LG-04

CLAYVILLE EXT 71

Project Number: 2374/00/00-S

Description	AREA	Over Land		Water Course		Stream		C	A	Time of Concentration		Tc	Intensity (I)						Run-off (Q)					
		L	H	L	H	L	H	Infiltr. Factor	Total area	OverL	WaterC	TOTAL	1:2	1:5	1:20	1:25	1:50	1:100	1:2	1:5	1:20	1:25	1:50	1:100
	(m^2)	(m)	(m)	(m)	(m)	(m)	(m)		(ha)	(minute)	(minute)	(minute)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)
																			0.75	0.8	0.9	0.91	0.95	1
Undev	788120							0.300	78.812	44.98	17.53	62.51	34.00	46.00	66.00	71.00	85.00	96.00	1.67	2.42	3.90	4.24	5.30	6.30
Dev	788120							0.670	78.812	44.98	17.53	62.51	34.00	46.00	66.00	71.00	85.00	96.00	3.74	5.40	8.71	9.48	11.84	14.08

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STORMWATER RUNOFF CALCULATION

Ref Control: GERTLG_LG-04

CLAYVILLE EXTs 71, 50 45N

Project Number: 2374/00/00-E

Description	AREA	Over Land		Water Course		Stream		C	A	Time of Concentration		Tc	Intensity (I)						Run-off (Q)					
		L	H	L	H	L	H	Infiltr. Factor	Total area	OverL	WaterC	TOTAL	1:2	1:5	1:20	1:25	1:50	1:100	1:2	1:5	1:20	1:25	1:50	1:100
	(m^2)	(m)	(m)	(m)	(m)	(m)	(m)		(ha)	(minute)	(minute)	(minute)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)
																			0.75	0.8	0.9	0.91	0.95	1
Undev	1289428							0.300	128.943	44.98	17.53	62.51	34.00	46.00	66.00	71.00	85.00	96.00	**2.74**	**3.95**	**6.38**	**6.94**	**8.68**	**10.32**
Dev	1289428							0.670	128.943	44.98	17.53	62.51	34.00	46.00	66.00	71.00	85.00	96.00	**6.12**	**8.83**	**14.25**	**15.50**	**19.38**	**23.04**

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N1
X50
N2
X45 – NORTH
E
W
S
X71
X45 – SOUTH

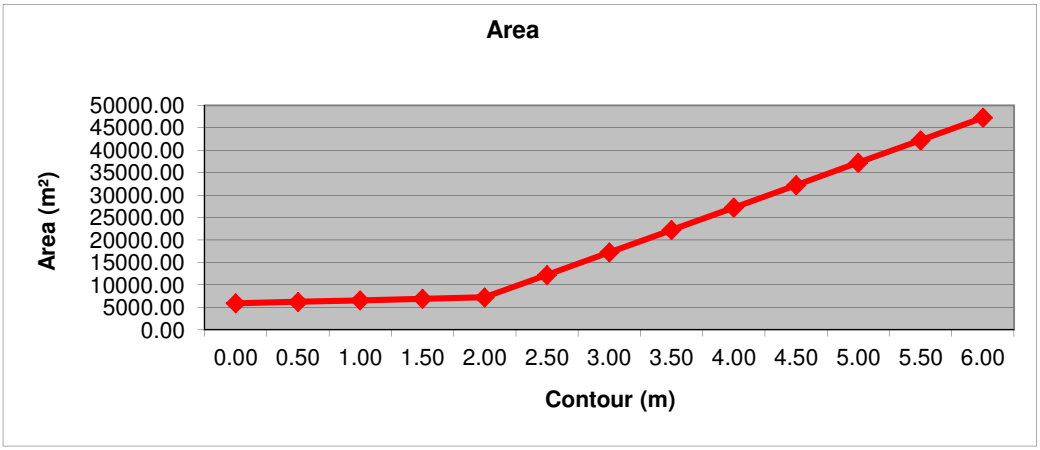
Appendix C

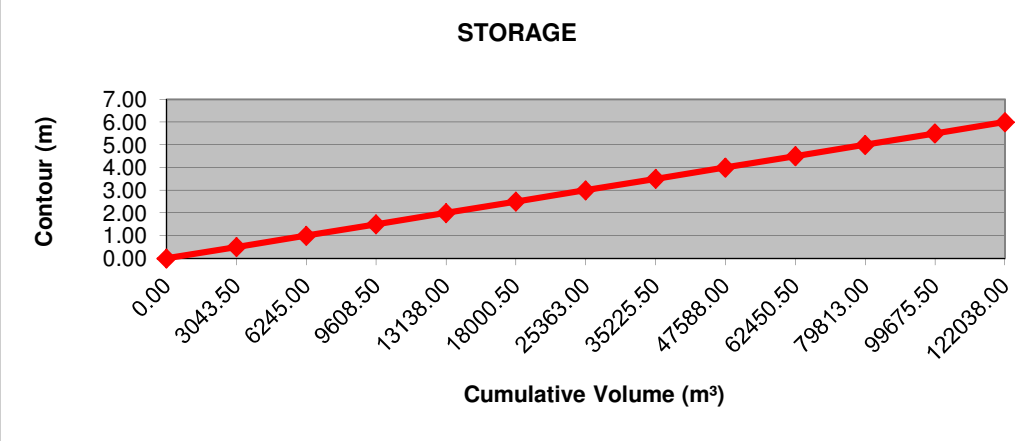
Attenuation Details

DAM BASIN DEFINITION
CLAYVILLE EXTs 71, 50 45N
Project Number: 2374/00/00-N
Ref Control: GERTLG_LG-04

H (m)	Contour (m)	Area (m^2)	Cumulative Volume (m^3)
0.00	0.00	5929.00	0.00
0.50	0.50	6245.00	3043.50
1.00	1.00	6561.00	6245.00
1.50	1.50	6893.00	9608.50
2.00	2.00	7225.00	13138.00
2.50	2.50	12225.00	18000.50
3.00	3.00	17225.00	25363.00
3.50	3.50	22225.00	35225.50
4.00	4.00	27225.00	47588.00
4.50	4.50	32225.00	62450.50
5.00	5.00	37225.00	79813.00
5.50	5.50	42225.00	99675.50
6.00	6.00	47225.00	122038.00

5000.00 Openspace Area Increment





INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.445	m	0.445	m	0.445	m
Number of:	No.	=	1		2		0	
Invert level	I1	=	0.00	m	0.50	m	1.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.1555	m²	0.1555	m²	0.1555	m²
Q at Peak flow	Qp	=	0.3459	m³/s	0.3866	m³/s	0.0000	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

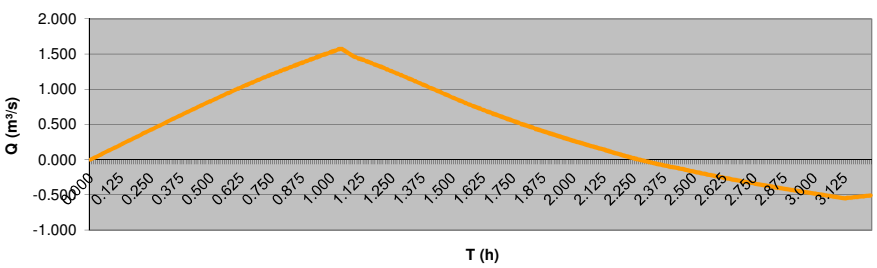
Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.8000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.5000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.000	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	18000.50	m³	0.00	m³	0.00	m³

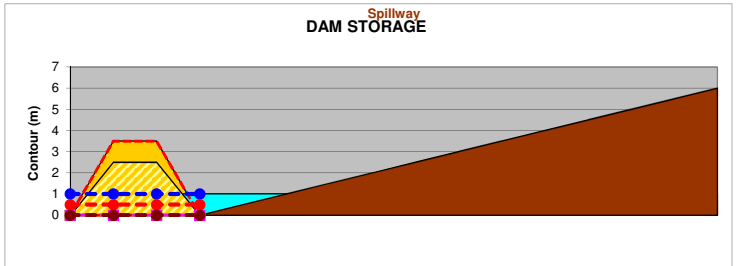
					Simulated	
Dam break height			3.500	m	1.009	m
Dam Break Volume	V	=	35225.50	m³	6303.21	m³
Actual Freeboard					2.491	m

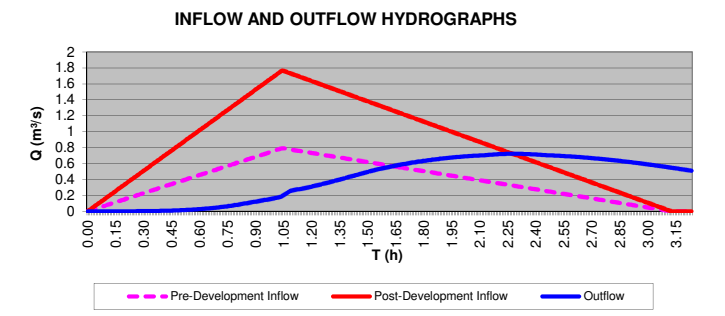
Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	1.1E-04	2.4E-04	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	2
	g	=		9.810

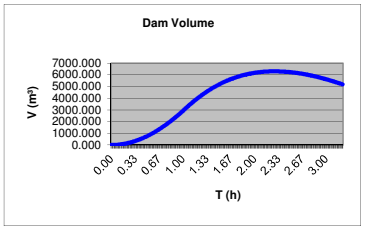


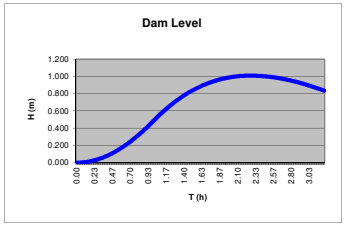




Post-Development Inflow Hydrograph Peakflow = 1.768 m³/s
Pre-Development Inflow Hydrograph Peakflow = 0.792 m³/s
Attenuated Outflow Hydrograph Peakflow = 0.722 m³/s

Attenuation = 1.046 m³/s (Post Development)
Translation = 1.242 h (Post Development)





Max Dam Volume during 1:2 Year storm event = 6303.21m³
Max rise in water level during 1:2 Year storm event = 1.01m

CLAYVILLE EXTs 71, 50 45N
SW ATTENUATION POND N
Project Number: 2374/00/00-N

SOUTHERN CATCHMENT
1 : 2 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

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INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.445	m	0.445	m	0.445	m
Number of:	No.	=	1		2		0	
Invert level	I1	=	0.00	m	0.50	m	1.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.1555	m²	0.1555	m²	0.1555	m²
Q at Peak flow	Qp	=	0.3999	m³/s	0.6343	m³/s	0.0000	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.8000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.5000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.000	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	18000.50	m³	0.00	m³	0.00	m³

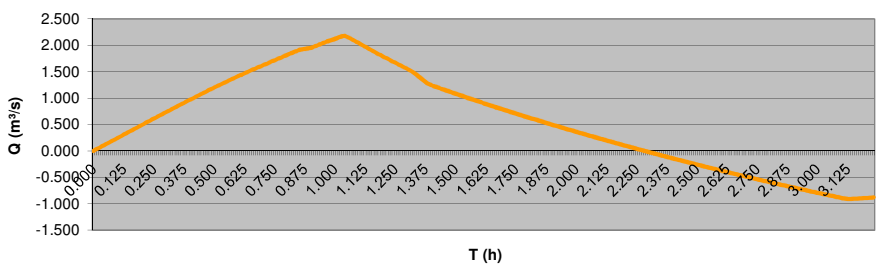
					Simulated	
Dam break height			3.500	m	1.348	m
Dam Break Volume	V	=	35225.50	m³	8584.55	m³
Actual Freeboard					2.152	m

Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

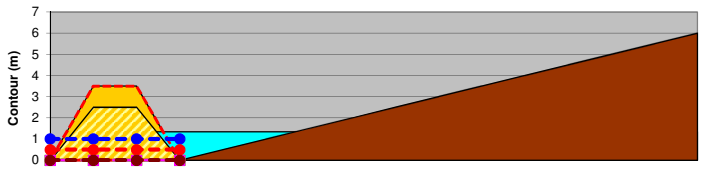
	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	1.6E-04	3.5E-04	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	5
	g	=		9.810

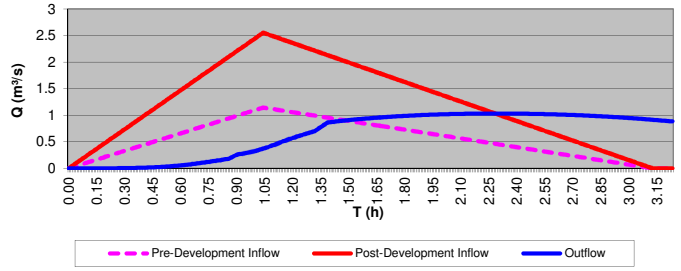
Combined Influence of Inflow and Outflow Hydrographs



DAM STORAGE

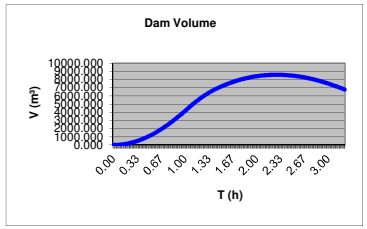


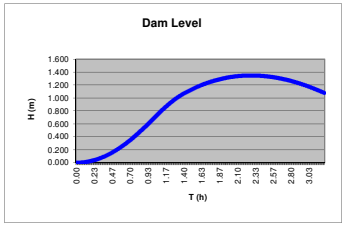
INFLOW AND OUTFLOW HYDROGRAPHS



Post-Development Inflow Hydrograph Peakflow = 2.552 m³/s
Pre-Development Inflow Hydrograph Peakflow = 1.143 m³/s
Attenuated Outflow Hydrograph Peakflow = 1.032 m³/s

Attenuation = 1.52 m³/s (Post Development)
Translation = 1.25 h (Post Development)





Max Dam Volume during 1:5 Year storm event = 8584.55m³
Max rise in water level during 1:5 Year storm event = 1.35m

CLAYVILLE EXTs 71, 50 45N
SW ATTENUATION POND N
Project Number: 2374/00/00-N

SOUTHERN CATCHMENT
1 : 5 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam N.xls]Input-0

INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.445	m	0.445	m	0.445	m
Number of:	No.	=	1		2		0	
Invert level	I1	=	0.00	m	0.50	m	1.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.1555	m²	0.1555	m²	0.1555	m²
Q at Peak flow	Qp	=	0.5037	m³/s	0.8817	m³/s	0.0000	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

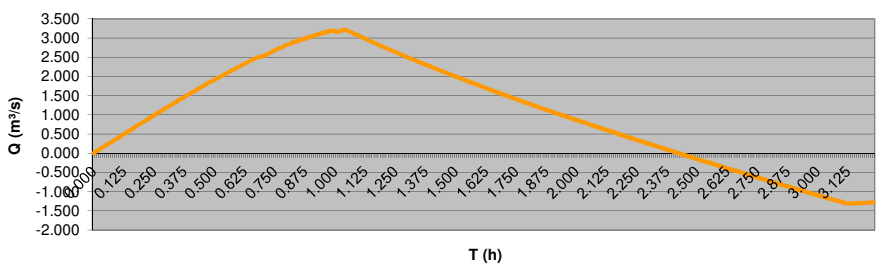
Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.8000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.5000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.000	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	18000.50	m³	0.00	m³	0.00	m³

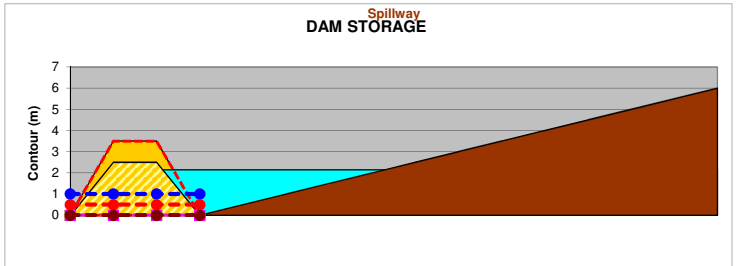
					Simulated	
Dam break height			3.500	m	2.138	m
Dam Break Volume	V	=	35225.50	m³	14480.22	m³
Actual Freeboard					1.362	m

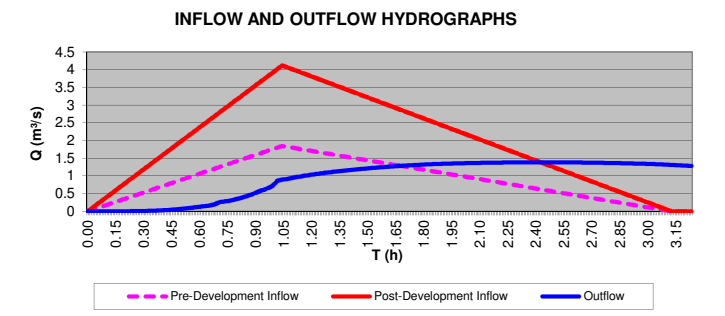
Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	2.6E-04	5.7E-04	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	20
	g	=		9.810

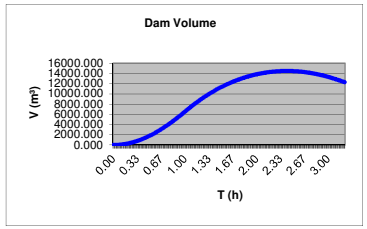


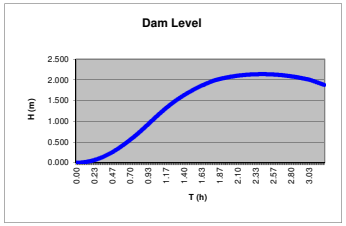




Post-Development Inflow Hydrograph Peakflow = 4.119 m³/s
Pre-Development Inflow Hydrograph Peakflow = 1.844 m³/s
Attenuated Outflow Hydrograph Peakflow = 1.384 m³/s

Attenuation = 2.736 m³/s (Post Development)
Translation = 1.392 h (Post Development)





Max Dam Volume during 1:20 Year storm event = 14480.22m³
Max rise in water level during 1:20 Year storm event = 2.14m

CLAYVILLE EXTs 71, 50 45N
SW ATTENUATION POND N
Project Number: 2374/00/00-N

SOUTHERN CATCHMENT
1 : 20 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam N.xls]Input-0

INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.445	m	0.445	m	0.445	m
Number of:	No.	=	1		2		0	
Invert level	I1	=	0.00	m	0.50	m	1.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.1555	m²	0.1555	m²	0.1555	m²
Q at Peak flow	Qp	=	0.5629	m³/s	1.0150	m³/s	0.0000	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

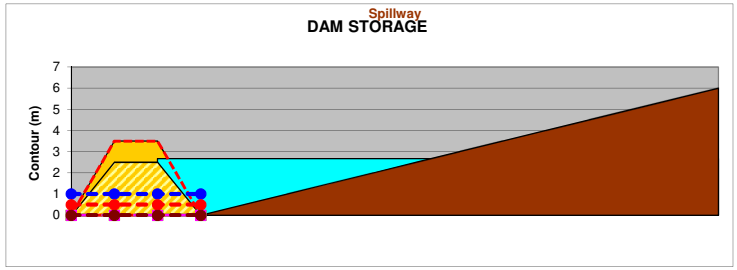
Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.8000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.5000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.000	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.2048	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	18000.50	m³	0.00	m³	0.00	m³

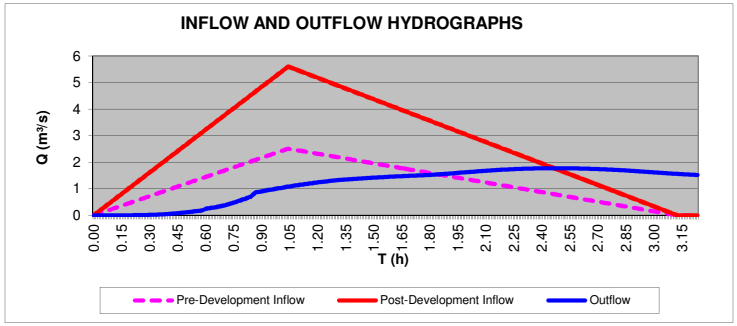
					Simulated	
Dam break height			3.500	m	2.671	m
Dam Break Volume	V	=	35225.50	m³	20514.57	m³
Actual Freeboard					0.829	m

Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	3.5E-04	7.7E-04	m³/s

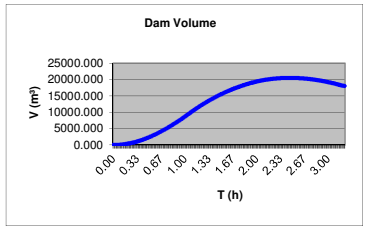
				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	50
	g	=		9.810

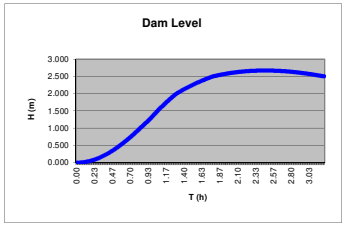




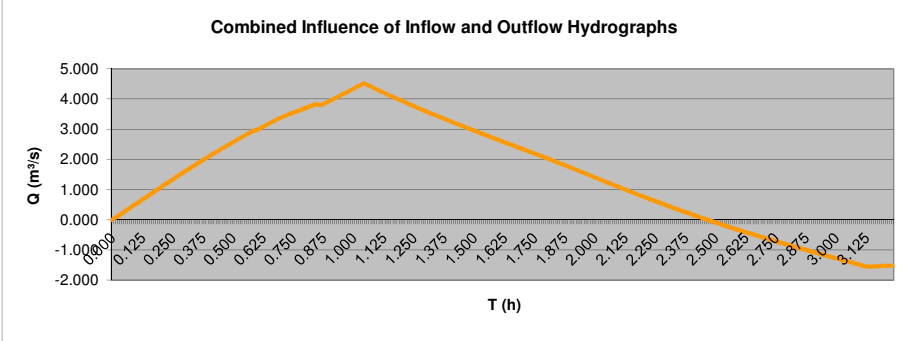
Post-Development Inflow Hydrograph Peakflow = 5.6 m³/s
Pre-Development Inflow Hydrograph Peakflow = 2.507 m³/s
Attenuated Outflow Hydrograph Peakflow = 1.775 m³/s

Attenuation = 3.825 m³/s (Post Development)
Translation = 1.433 h (Post Development)





Max Dam Volume during 1:50 Year storm event = 20514.57m³
Max rise in water level during 1:50 Year storm event = 2.67m



CLAYVILLE EXTs 71, 50 45N
SW ATTENUATION POND N
Project Number: 2374/00/00-N

SOUTHERN CATCHMENT
1 : 50 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam N.xls]Input-0

INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.445	m	0.445	m	0.445	m
Number of:	No.	=	1		2		0	
Invert level	I1	=	0.00	m	0.50	m	1.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.1555	m²	0.1555	m²	0.1555	m²
Q at Peak flow	Qp	=	0.5872	m³/s	1.0686	m³/s	0.0000	m³/s

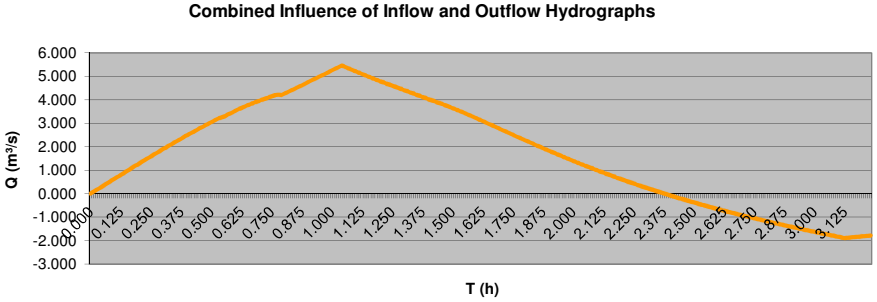
Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

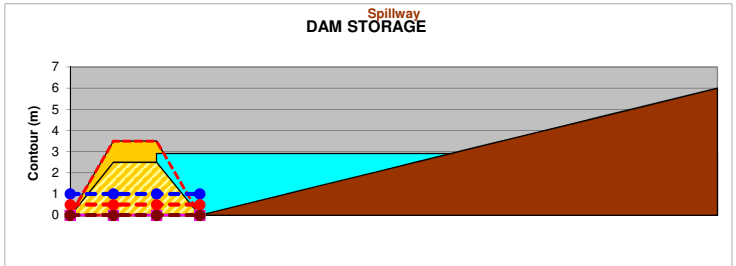
Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.8000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.5000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.000	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.7455	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	18000.50	m³	0.00	m³	0.00	m³

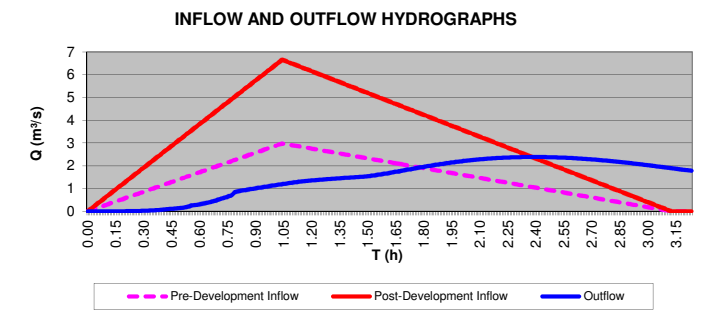
					Simulated	
Dam break height			3.500	m	2.906	m
Dam Break Volume	V	=	35225.50	m³	23979.15	m³
Actual Freeboard					0.594	m

						Pre	Post	
Base Flow	I_5	=	0.0000	m³/s				
Time Increment	Delta T	=	0.008	h = 30s	% error Qp(i)	0.01%	0.01%	
Dam Height Increment	Delta h	=	0.050	m = 50mm		4.1E-04	9.2E-04	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	100
	g	=		9.810

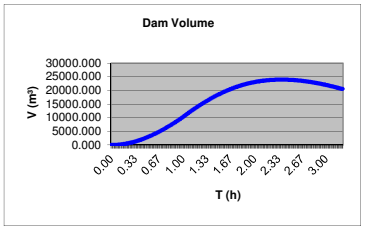


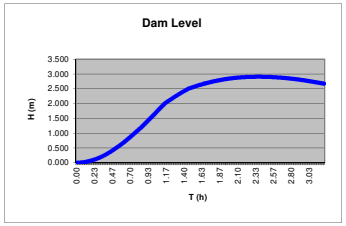




Post-Development Inflow Hydrograph Peakflow = 6.658 m³/s
Pre-Development Inflow Hydrograph Peakflow = 2.981 m³/s
Attenuated Outflow Hydrograph Peakflow = 2.386 m³/s

Attenuation = 4.271 m³/s (Post Development)
Translation = 1.342 h (Post Development)





Max Dam Volume during 1:100 Year storm event = 23979.15m³
Max rise in water level during 1:100 Year storm event = 2.91m

CLAYVILLE EXTs 71, 50 45N
SW ATTENUATION POND N
Project Number: 2374/00/00-N

SOUTHERN CATCHMENT
1 : 100 Year Storm Event

BIGEN AFRICA

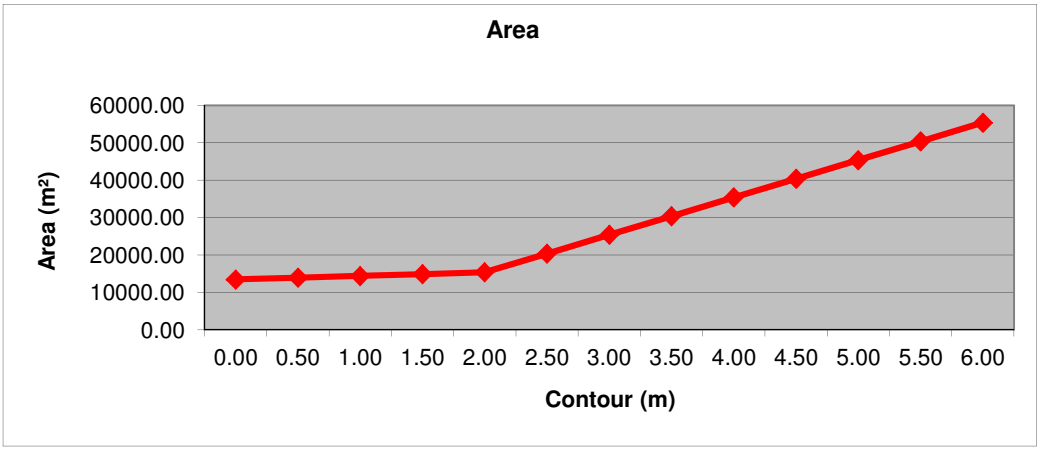
Ref Control: GERTLG_LG-04

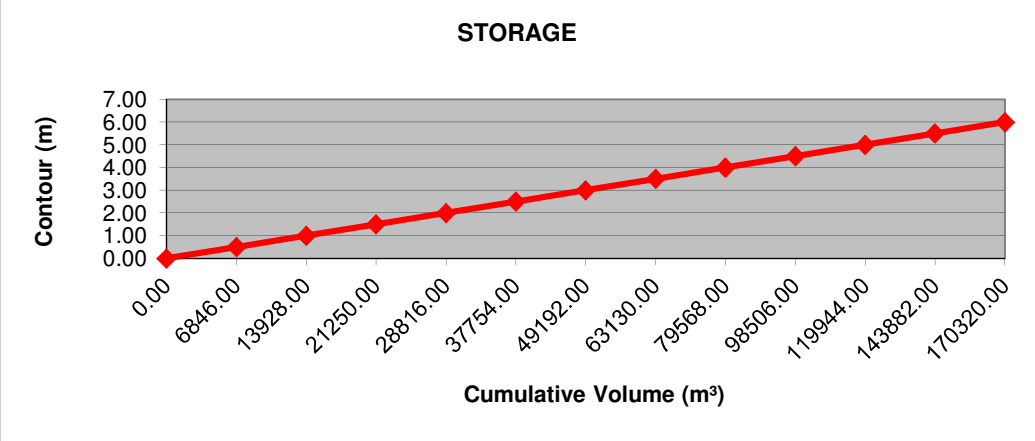
F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam N.xls]Input-0

DAM BASIN DEFINITION
CLAYVILLE EXT 71
Project Number: 2374/00/00-S
Ref Control: GERTLG_LG-04

H (m)	Contour (m)	Area (m^2)	Cumulative Volume (m^3)
0.00	0.00	13456.00	0.00
0.50	0.50	13928.00	6846.00
1.00	1.00	14400.00	13928.00
1.50	1.50	14888.00	21250.00
2.00	2.00	15376.00	28816.00
2.50	2.50	20376.00	37754.00
3.00	3.00	25376.00	49192.00
3.50	3.50	30376.00	63130.00
4.00	4.00	35376.00	79568.00
4.50	4.50	40376.00	98506.00
5.00	5.00	45376.00	119944.00
5.50	5.50	50376.00	143882.00
6.00	6.00	55376.00	170320.00

5000.00 Openspace Area Increment





INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.986	m	0.718	m	0.000	m
Number of:	No.	=	1		1		0	
Invert level	I1	=	0.00	m	1.00	m	0.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.7636	m²	0.4049	m²	0.0000	m²
Q at Peak flow	Qp	=	1.2160	m³/s	0.0035	m³/s	0.0000	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.8000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.0000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.500	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	28816.00	m³	0.00	m³	0.00	m³

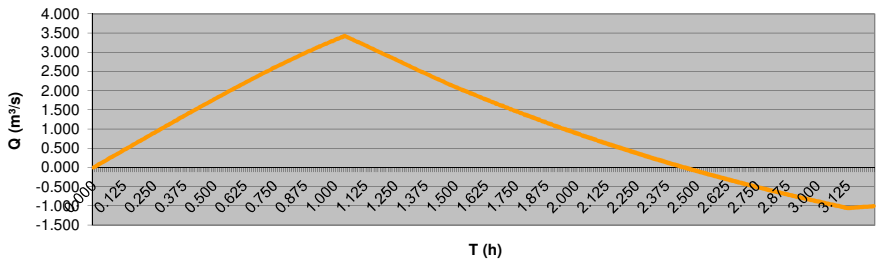
					Simulated	
Dam break height			3.500	m	1.050	m
Dam Break Volume	V	=	63130.00	m³	14662.66	m³
Actual Freeboard					2.450	m

Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

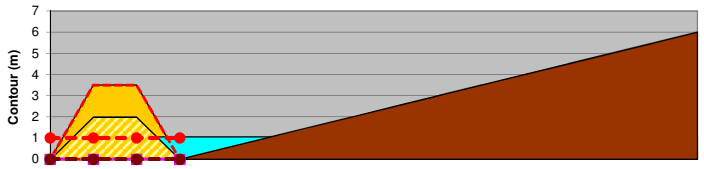
	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	2.3E-04	5.2E-04	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	2
	g	=		9.810

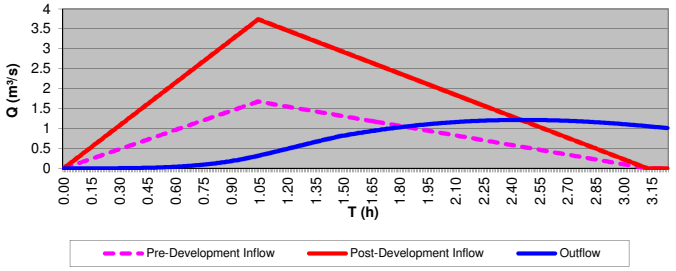
Combined Influence of Inflow and Outflow Hydrographs



DAM STORAGE

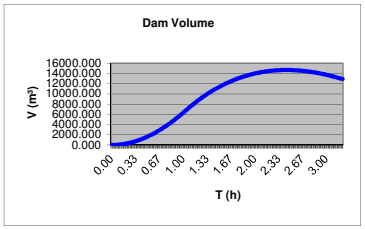


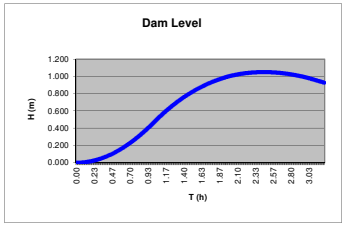
INFLOW AND OUTFLOW HYDROGRAPHS



Post-Development Inflow Hydrograph Peakflow = 3.74 m³/s
Pre-Development Inflow Hydrograph Peakflow = 1.675 m³/s
Attenuated Outflow Hydrograph Peakflow = 1.215 m³/s

Attenuation = 2.525 m³/s (Post Development)
Translation = 1.417 h (Post Development)





Max Dam Volume during 1:2 Year storm event = 14662.66m³
Max rise in water level during 1:2 Year storm event = 1.05m

CLAYVILLE EXT 71
SW ATTENUATION POND S
Project Number: 2374/00/00-S

SOUTHERN CATCHMENT
1 : 2 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam S.xls]Input-0

INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.986	m	0.718	m	0.000	m
Number of:	No.	=	1		1		0	
Invert level	I1	=	0.00	m	1.00	m	0.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.7636	m²	0.4049	m²	0.0000	m²
Q at Peak flow	Qp	=	1.9785	m³/s	0.1547	m³/s	0.0000	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

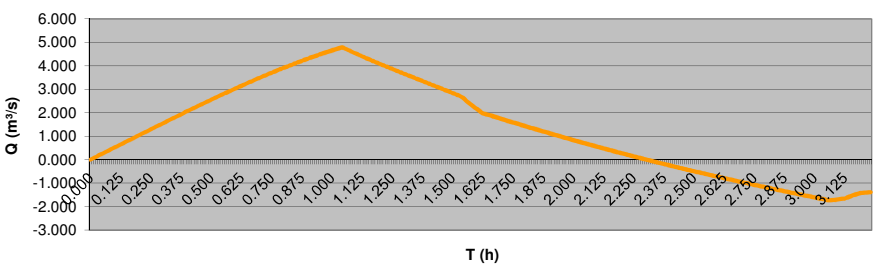
Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.8000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.0000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.500	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	28816.00	m³	0.00	m³	0.00	m³

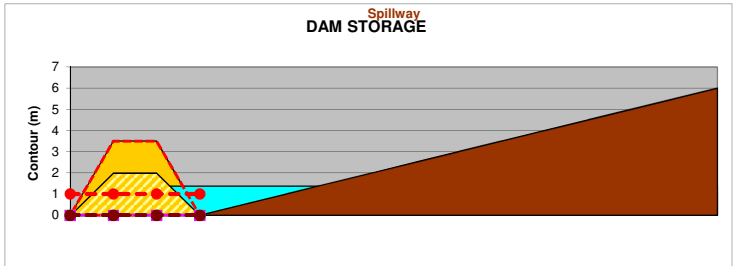
					Simulated	
Dam break height			3.500	m	1.369	m
Dam Break Volume	V	=	63130.00	m³	19331.45	m³
Actual Freeboard					2.131	m

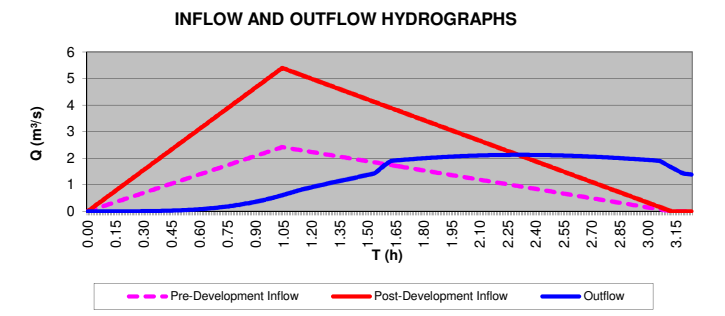
Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	3.3E-04	7.5E-04	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	5
	g	=		9.810

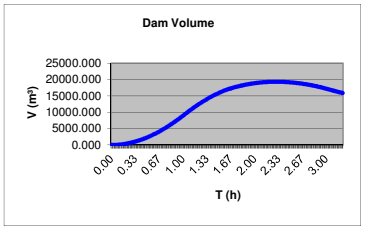


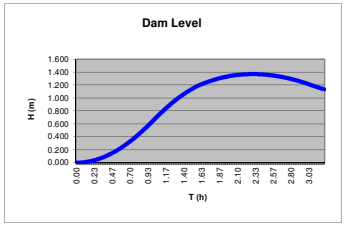




Post-Development Inflow Hydrograph Peakflow = 5.397 m³/s
Pre-Development Inflow Hydrograph Peakflow = 2.417 m³/s
Attenuated Outflow Hydrograph Peakflow = 2.127 m³/s

Attenuation = 3.27 m³/s (Post Development)
Translation = 1.275 h (Post Development)





Max Dam Volume during 1:5 Year storm event = 19331.45m³
Max rise in water level during 1:5 Year storm event = 1.37m

CLAYVILLE EXT 71
SW ATTENUATION POND S
Project Number: 2374/00/00-S

SOUTHERN CATCHMENT
1 : 5 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam S.xls]Input-0

INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.986	m	0.718	m	0.000	m
Number of:	No.	=	1		1		0	
Invert level	I1	=	0.00	m	1.00	m	0.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.7636	m²	0.4049	m²	0.0000	m²
Q at Peak flow	Qp	=	2.4314	m³/s	0.9264	m³/s	0.0000	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.8000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.0000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.500	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.0526	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	28816.00	m³	0.00	m³	0.00	m³

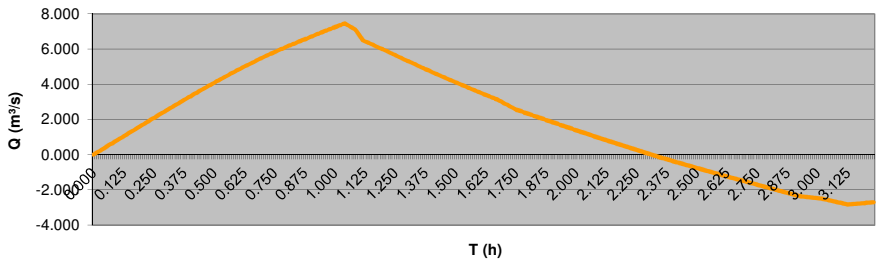
					Simulated	
Dam break height			3.500	m	2.067	m
Dam Break Volume	V	=	63130.00	m³	30019.27	m³
Actual Freeboard					1.433	m

Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

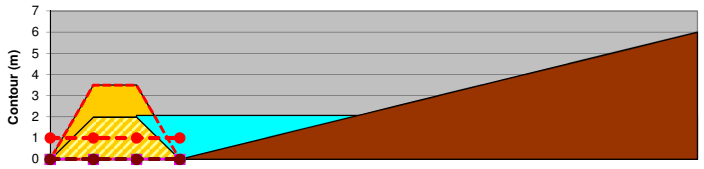
	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	5.4E-04	1.2E-03	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	20
	g	=		9.810

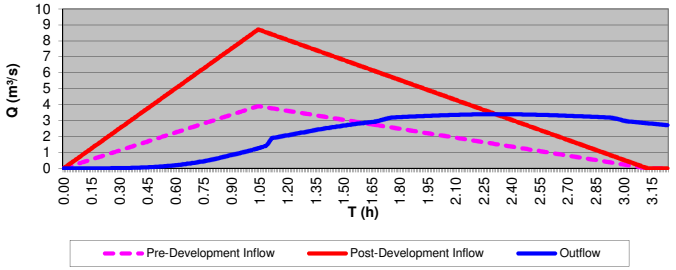
Combined Influence of Inflow and Outflow Hydrographs



DAM STORAGE

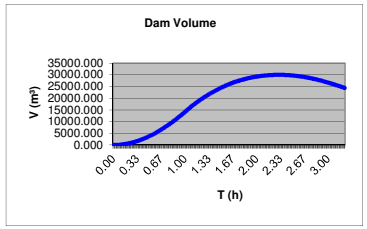


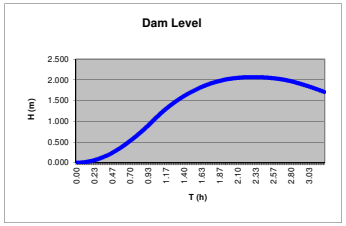
INFLOW AND OUTFLOW HYDROGRAPHS



Post-Development Inflow Hydrograph Peakflow = 8.711 m³/s
Pre-Development Inflow Hydrograph Peakflow = 3.901 m³/s
Attenuated Outflow Hydrograph Peakflow = 3.398 m³/s

Attenuation = 5.314 m³/s (Post Development)
Translation = 1.283 h (Post Development)





Max Dam Volume during 1:20 Year storm event = 30019.27m³
Max rise in water level during 1:20 Year storm event = 2.07m

CLAYVILLE EXT 71
SW ATTENUATION POND S
Project Number: 2374/00/00-S

SOUTHERN CATCHMENT
1 : 20 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam S.xls]Input-0

INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.986	m	0.718	m	0.000	m
Number of:	No.	=	1		1		0	
Invert level	I1	=	0.00	m	1.00	m	0.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.7636	m²	0.4049	m²	0.0000	m²
Q at Peak flow	Qp	=	2.7110	m³/s	1.1236	m³/s	0.0000	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.8000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.0000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.500	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	1.2406	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	28816.00	m³	0.00	m³	0.00	m³

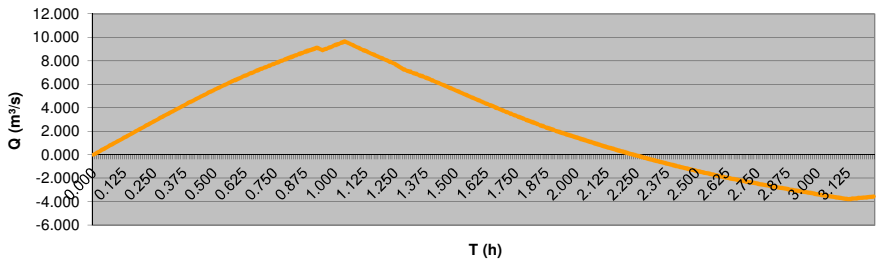
					Simulated	
Dam break height			3.500	m	2.570	m
Dam Break Volume	V	=	63130.00	m³	39358.06	m³
Actual Freeboard					0.930	m

Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

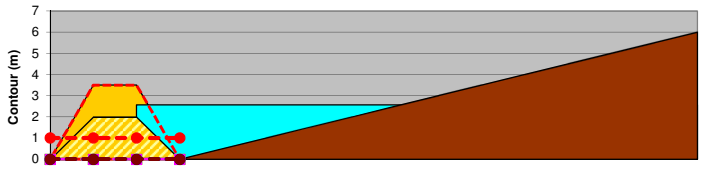
	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	7.3E-04	1.6E-03	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	50
	g	=		9.810

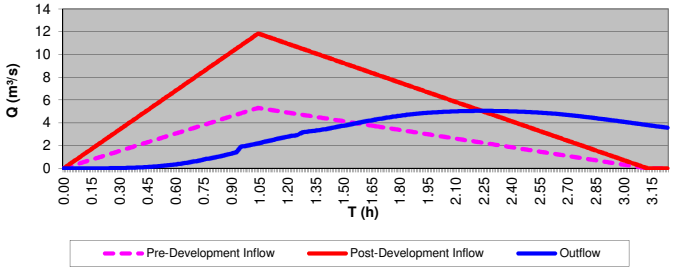
Combined Influence of Inflow and Outflow Hydrographs



DAM STORAGE

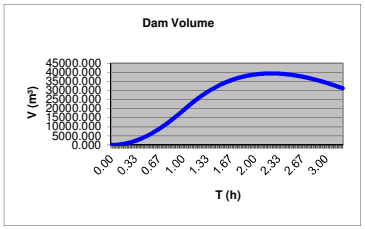


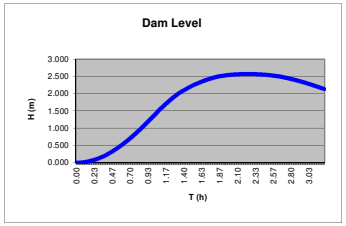
INFLOW AND OUTFLOW HYDROGRAPHS



Post-Development Inflow Hydrograph Peakflow = 11.843 m³/s
Pre-Development Inflow Hydrograph Peakflow = 5.303 m³/s
Attenuated Outflow Hydrograph Peakflow = 5.048 m³/s

Attenuation = 6.795 m³/s (Post Development)
Translation = 1.2 h (Post Development)





Max Dam Volume during 1:50 Year storm event = 39358.06m³
Max rise in water level during 1:50 Year storm event = 2.57m

CLAYVILLE EXT 71
SW ATTENUATION POND S
Project Number: 2374/00/00-S

SOUTHERN CATCHMENT
1 : 50 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam S.xls]Input-0

INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.986	m	0.718	m	0.000	m
Number of:	No.	=	1		1		0	
Invert level	I1	=	0.00	m	1.00	m	0.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.7636	m²	0.4049	m²	0.0000	m²
Q at Peak flow	Qp	=	2.8507	m³/s	1.2169	m³/s	0.0000	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.8000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.0000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.500	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	2.2241	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	28816.00	m³	0.00	m³	0.00	m³

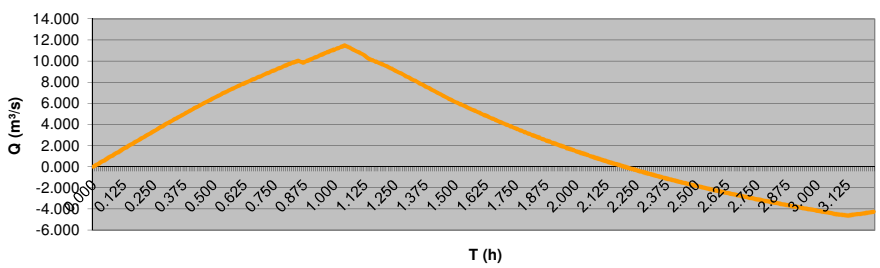
					Simulated	
Dam break height			3.500	m	2.842	m
Dam Break Volume	V	=	63130.00	m³	45569.12	m³
Actual Freeboard					0.658	m

Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

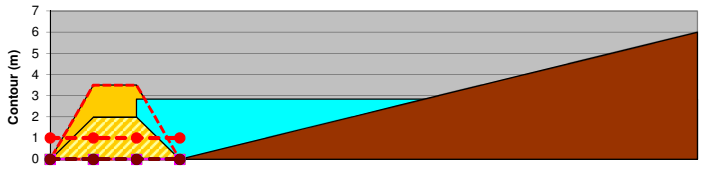
	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	8.7E-04	1.9E-03	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	100
	g	=		9.810

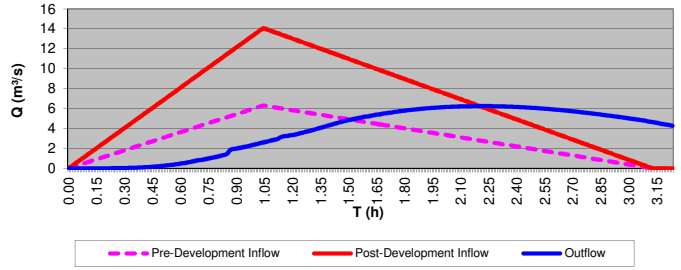
Combined Influence of Inflow and Outflow Hydrographs



DAM STORAGE

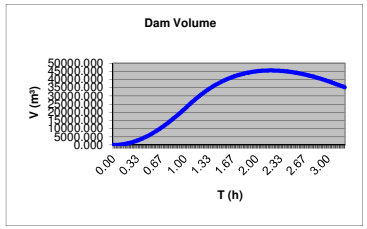


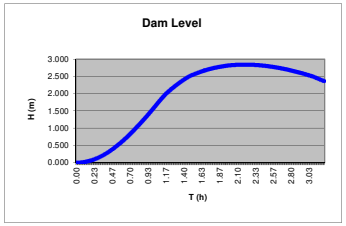
INFLOW AND OUTFLOW HYDROGRAPHS



Post-Development Inflow Hydrograph Peakflow = 14.079 m³/s
Pre-Development Inflow Hydrograph Peakflow = 6.304 m³/s
Attenuated Outflow Hydrograph Peakflow = 6.253 m³/s

Attenuation = 7.826 m³/s (Post Development)
Translation = 1.167 h (Post Development)





Max Dam Volume during 1:100 Year storm event = 45569.12m³
Max rise in water level during 1:100 Year storm event = 2.84m

CLAYVILLE EXT 71
SW ATTENUATION POND S
Project Number: 2374/00/00-S

SOUTHERN CATCHMENT
1 : 100 Year Storm Event

BIGEN AFRICA

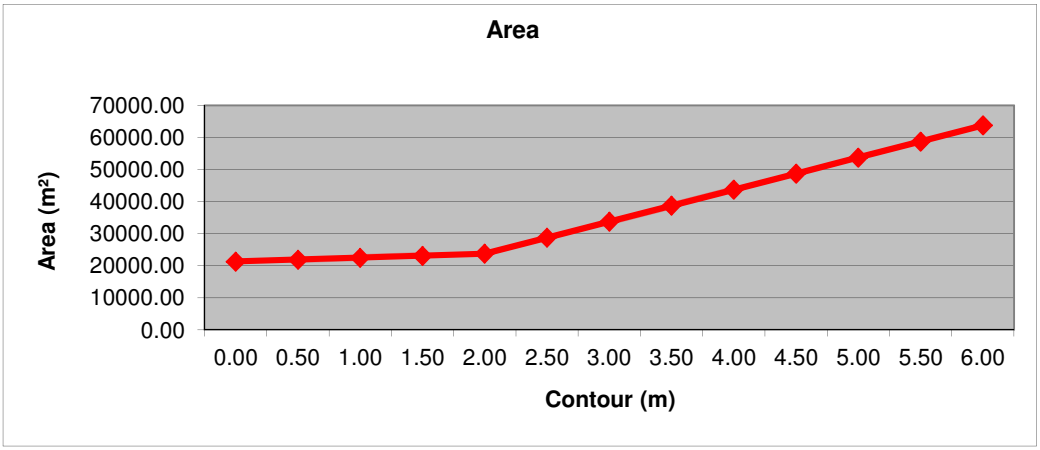
Ref Control: GERTLG_LG-04

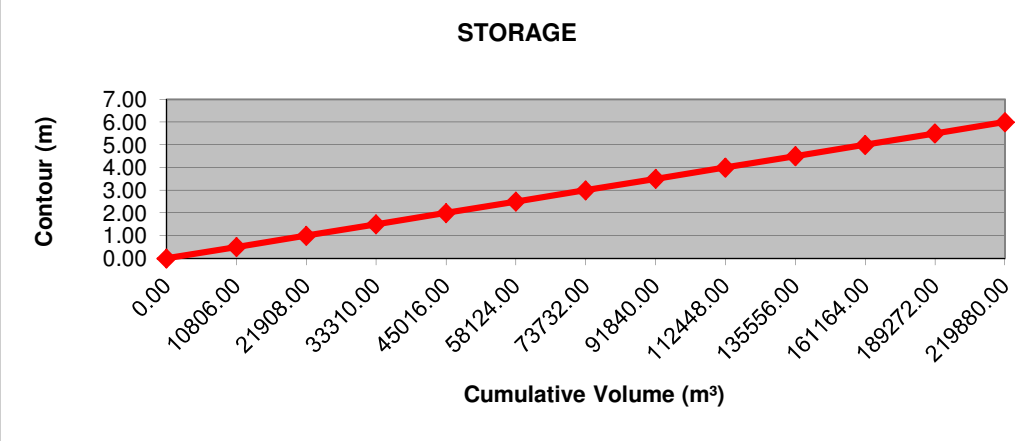
F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam S.xls]Input-0

DAM BASIN DEFINITION
CLAYVILLE EXTs 71, 50 45N
Project Number: 2374/00/00-E
Ref Control: GERTLG_LG-04

H (m)	Contour (m)	Area (m^2)	Cumulative Volume (m^3)
0.00	0.00	21316.00	0.00
0.50	0.50	21908.00	10806.00
1.00	1.00	22500.00	21908.00
1.50	1.50	23108.00	33310.00
2.00	2.00	23716.00	45016.00
2.50	2.50	28716.00	58124.00
3.00	3.00	33716.00	73732.00
3.50	3.50	38716.00	91840.00
4.00	4.00	43716.00	112448.00
4.50	4.50	48716.00	135556.00
5.00	5.00	53716.00	161164.00
5.50	5.50	58716.00	189272.00
6.00	6.00	63716.00	219880.00

5000.00 Openspace Area Increment





INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.718	m	0.986	m	0.986	m
Number of:	No.	=	2		1		1	
Invert level	I1	=	0.00	m	0.50	m	1.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.4049	m²	0.7636	m²	0.7636	m²
Q at Peak flow	Qp	=	1.8330	m³/s	0.3911	m³/s	0.0037	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.0000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.0000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.500	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	45016.00	m³	0.00	m³	0.00	m³

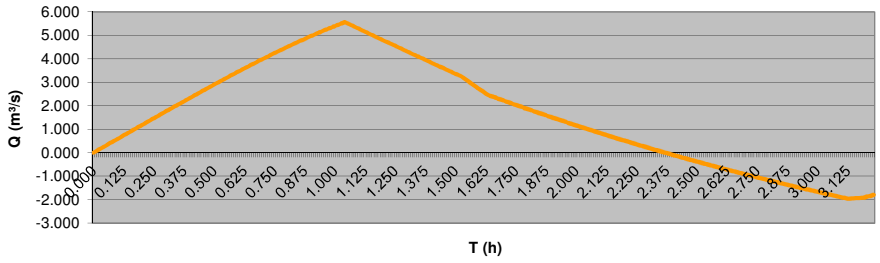
					Simulated	
Dam break height			3.500	m	1.045	m
Dam Break Volume	V	=	91840.00	m³	22927.12	m³
Actual Freeboard					2.455	m

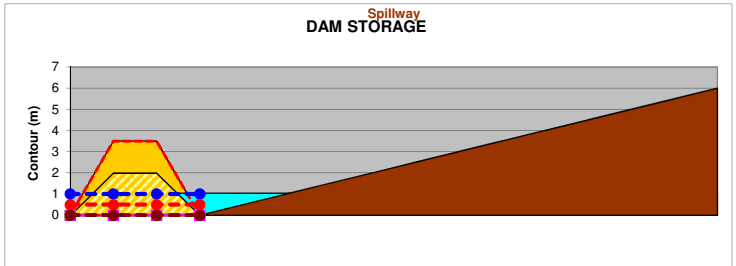
Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

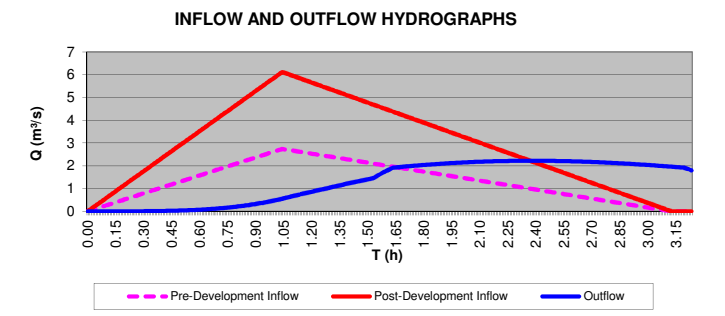
	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	3.8E-04	8.5E-04	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	2
	g	=		9.810

Combined Influence of Inflow and Outflow Hydrographs

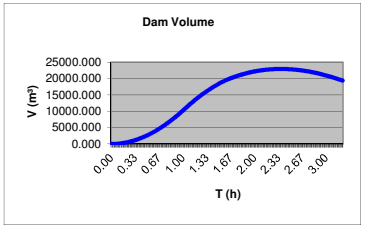


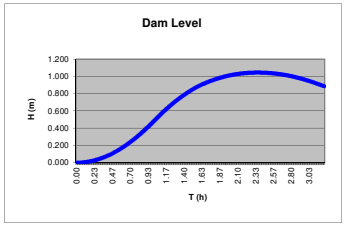




Post-Development Inflow Hydrograph Peakflow = 6.119 m³/s
Pre-Development Inflow Hydrograph Peakflow = 2.74 m³/s
Attenuated Outflow Hydrograph Peakflow = 2.221 m³/s

Attenuation = 3.897 m³/s (Post Development)
Translation = 1.333 h (Post Development)





Max Dam Volume during 1:2 Year storm event = 22927.12m³
Max rise in water level during 1:2 Year storm event = 1.04m

CLAYVILLE EXTs 71, 50 45N
SW ATTENUATION POND E
Project Number: 2374/00/00-E

EASTERN CATCHMENT
1 : 2 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam E.xls]Input-0

INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.718	m	0.986	m	0.986	m
Number of:	No.	=	2		1		1	
Invert level	I1	=	0.00	m	0.50	m	1.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.4049	m²	0.7636	m²	0.7636	m²
Q at Peak flow	Qp	=	2.1414	m³/s	1.0068	m³/s	0.2455	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

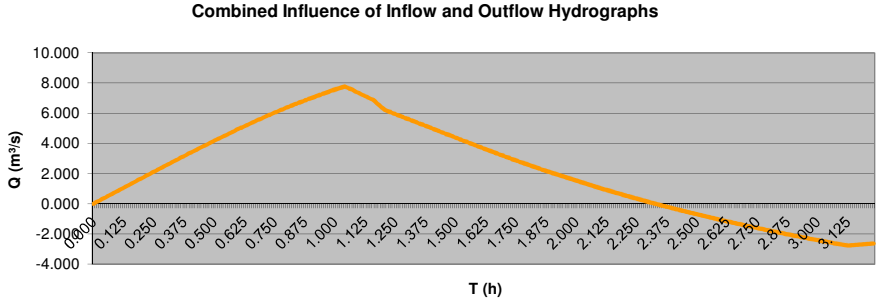
Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.0000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.0000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.500	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	45016.00	m³	0.00	m³	0.00	m³

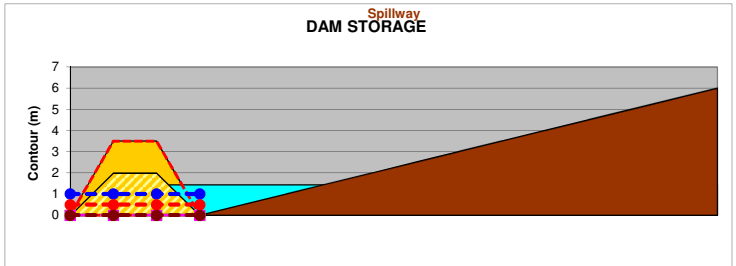
					Simulated	
Dam break height			3.500	m	1.426	m
Dam Break Volume	V	=	91840.00	m³	31617.89	m³
Actual Freeboard					2.074	m

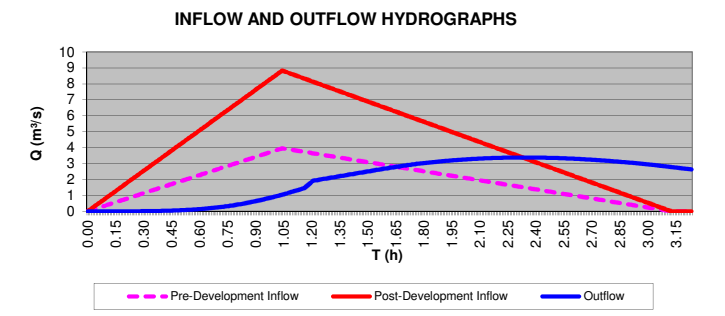
Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	5.5E-04	1.2E-03	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	5
	g	=		9.810

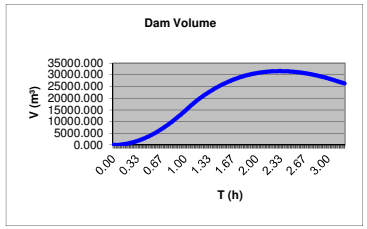


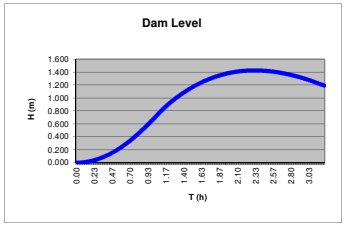




Post-Development Inflow Hydrograph Peakflow = 8.83 m³/s
Pre-Development Inflow Hydrograph Peakflow = 3.954 m³/s
Attenuated Outflow Hydrograph Peakflow = 3.378 m³/s

Attenuation = 5.452 m³/s (Post Development)
Translation = 1.292 h (Post Development)





Max Dam Volume during 1:5 Year storm event = 31617.89m³
Max rise in water level during 1:5 Year storm event = 1.43m

CLAYVILLE EXTs 71, 50 45N
SW ATTENUATION POND E
Project Number: 2374/00/00-E

EASTERN CATCHMENT
1 : 5 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam E.xls]Input-0

INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.718	m	0.986	m	0.986	m
Number of:	No.	=	2		1		1	
Invert level	I1	=	0.00	m	0.50	m	1.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.4049	m²	0.7636	m²	0.7636	m²
Q at Peak flow	Qp	=	2.5917	m³/s	2.1312	m³/s	1.2831	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.0000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.0000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.500	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.0430	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	45016.00	m³	0.00	m³	0.00	m³

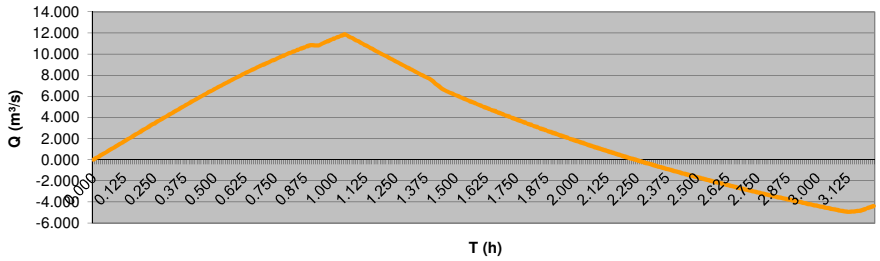
					Simulated	
Dam break height			3.500	m	2.088	m
Dam Break Volume	V	=	91840.00	m³	47332.12	m³
Actual Freeboard					1.412	m

Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

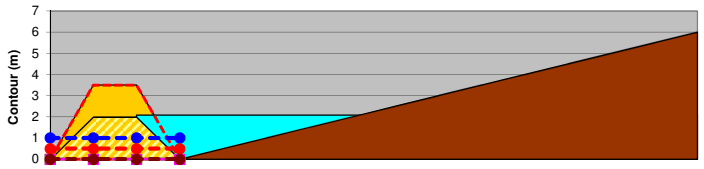
	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	8.8E-04	2.0E-03	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	20
	g	=		9.810

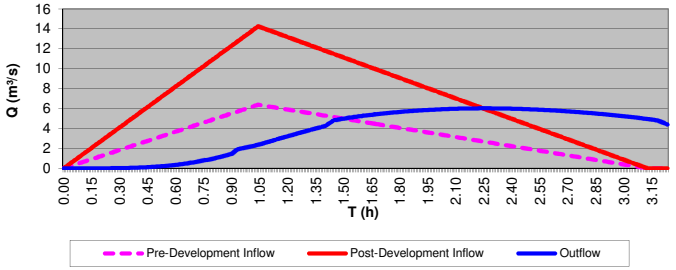
Combined Influence of Inflow and Outflow Hydrographs



DAM STORAGE

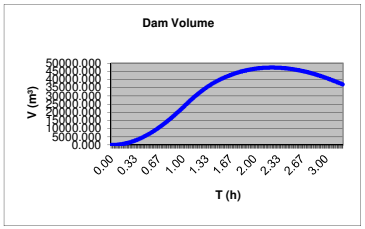


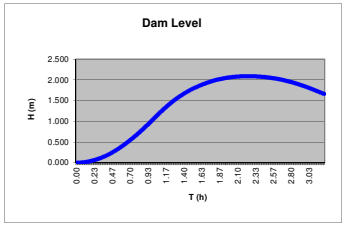
INFLOW AND OUTFLOW HYDROGRAPHS



Post-Development Inflow Hydrograph Peakflow = 14.253 m³/s
Pre-Development Inflow Hydrograph Peakflow = 6.382 m³/s
Attenuated Outflow Hydrograph Peakflow = 6.023 m³/s

Attenuation = 8.229 m³/s (Post Development)
Translation = 1.208 h (Post Development)





Max Dam Volume during 1:20 Year storm event = 47332.12m³
Max rise in water level during 1:20 Year storm event = 2.09m

CLAYVILLE EXTs 71, 50 45N
SW ATTENUATION POND E
Project Number: 2374/00/00-E

EASTERN CATCHMENT
1 : 20 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam E.xls]Input-0

INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.718	m	0.986	m	0.986	m
Number of:	No.	=	2		1		1	
Invert level	I1	=	0.00	m	0.50	m	1.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.4049	m²	0.7636	m²	0.7636	m²
Q at Peak flow	Qp	=	2.9118	m³/s	2.4715	m³/s	2.1630	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

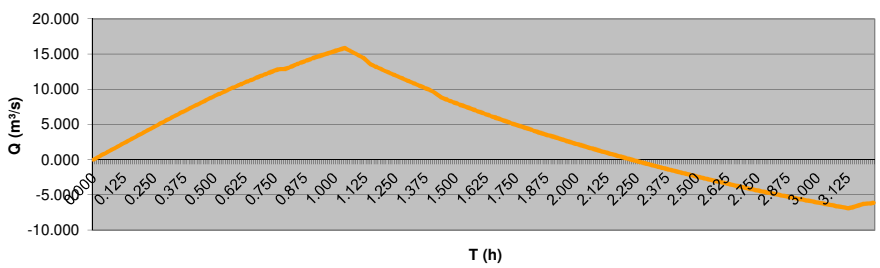
Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.0000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.0000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.500	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	0.8120	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	45016.00	m³	0.00	m³	0.00	m³

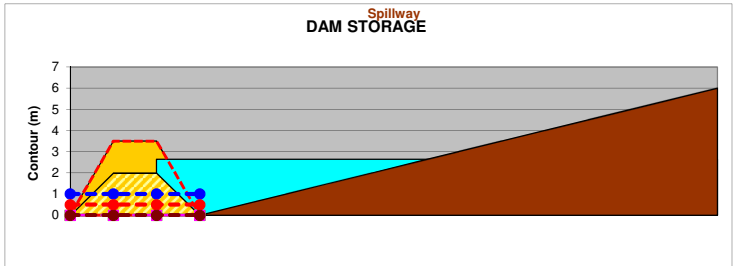
					Simulated	
Dam break height			3.500	m	2.636	m
Dam Break Volume	V	=	91840.00	m³	62371.53	m³
Actual Freeboard					0.864	m

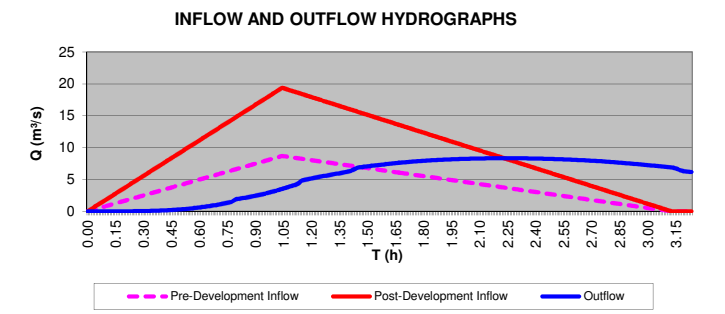
Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	1.2E-03	2.7E-03	m³/s

				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	50
	g	=		9.810

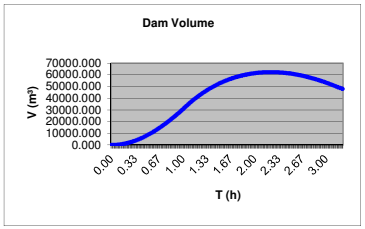


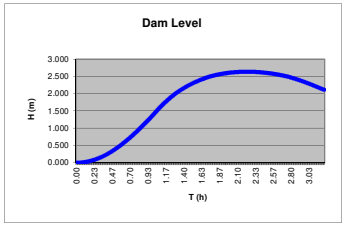




Post-Development Inflow Hydrograph Peakflow = 19.375 m³/s
Pre-Development Inflow Hydrograph Peakflow = 8.676 m³/s
Attenuated Outflow Hydrograph Peakflow = 8.329 m³/s

Attenuation = 11.047 m³/s (Post Development)
Translation = 1.2 h (Post Development)





Max Dam Volume during 1:50 Year storm event = 62371.53m³
Max rise in water level during 1:50 Year storm event = 2.64m

CLAYVILLE EXTs 71, 50 45N
SW ATTENUATION POND E
Project Number: 2374/00/00-E

EASTERN CATCHMENT
1 : 50 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam E.xls]Input-0

INPUT TABLE

Circular outlet			Outlet 1		Outlet 2		Outlet 3	
Outlet Diameter	D	=	0.718	m	0.986	m	0.986	m
Number of:	No.	=	2		1		1	
Invert level	I1	=	0.00	m	0.50	m	1.00	m
Outlet Cd (For H/D>1,2)	Cd1	=	0.500		0.500		0.500	
Outlet Slope	So	=	0.010	= 1%	0.010	= 1%	0.010	= 1%
Outlet area per outlet	A	=	0.4049	m²	0.7636	m²	0.7636	m²
Q at Peak flow	Qp	=	3.1093	m³/s	2.6769	m³/s	2.3949	m³/s

Rectangular outlet			Outlet 4		Outlet 5		Outlet 6	
Height	H1	=	0.0000	m	0.0000	m	0.0000	m
Width	W1	=	0.0000	m	0.0000	m	0.0000	m
Number of:	No.	=	0		0		0	
Invert level	m	=	0.00	m	0.00	m	0.00	m
	Cb	=	0.900		0.900		0.900	
	Ch	=	0.600		0.600		0.600	
Outlet area per outlet	A	=	0.0000	m²	0.0000	m²	0.0000	m²
Q at Peak flow	Qp	=	0.0000	m³/s	0.0000	m³/s	0.0000	m³/s

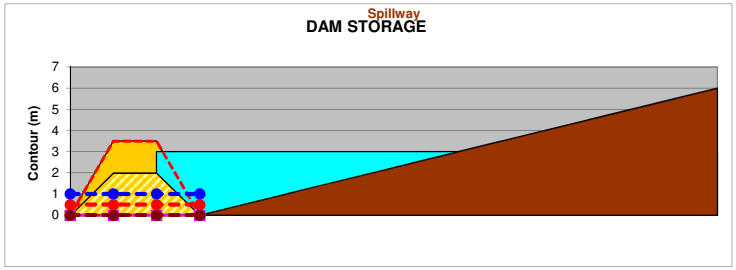
Broad Crest Weir			Overflow 1		Overflow 2		Overflow 3	
Length	L1	=	1.0000	m	0.0000	m	0.0000	m
Crest Height	H2	=	2.0000	m	0.0000	m	0.0000	m
Freeboard	H3	=	1.500	m	0.000	m	0.000	m
Cd	Cd3	=	1.60	(1.6-2.3)	1.60	(1.6-2.3)	1.60	(1.6-2.3)
Q at Peak flow	Qp	=	1.6139	m³/s	0.0000	m³/s	0.0000	m³/s
Dam Volume at spill Height	V	=	45016.00	m³	0.00	m³	0.00	m³

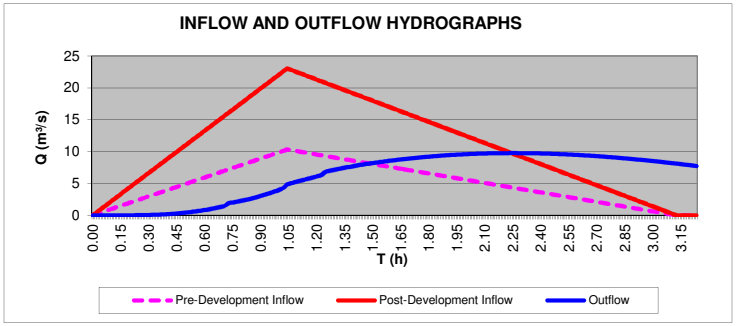
					Simulated	
Dam break height			3.500	m	3.006	m
Dam Break Volume	V	=	91840.00	m³	73939.25	m³
Actual Freeboard					0.494	m

Base Flow	I_5	=	0.0000	m³/s
Time Increment	Delta T	=	0.008	h = 30s
Dam Height Increment	Delta h	=	0.050	m = 50mm

	Pre	Post	
% error Qp(i)	0.01%	0.01%	
	1.4E-03	3.2E-03	m³/s

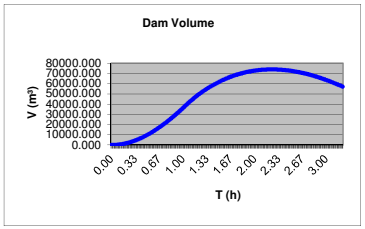
				Area1
Recurrance Interval (5 / 25 / 50 / 100)	n	=	1:	100
	g	=		9.810

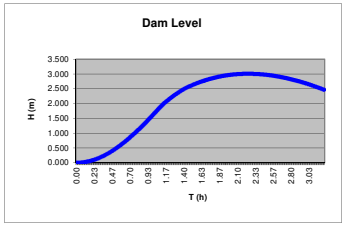




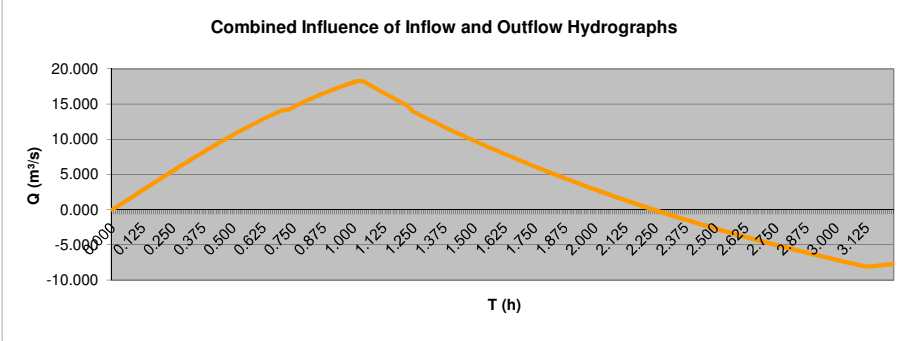
Post-Development Inflow Hydrograph Peakflow = 23.035 m³/s
Pre-Development Inflow Hydrograph Peakflow = 10.314 m³/s
Attenuated Outflow Hydrograph Peakflow = 9.761 m³/s

Attenuation = 13.274 m³/s (Post Development)
Translation = 1.208 h (Post Development)





Max Dam Volume during 1:100 Year storm event = 73939.25m³
Max rise in water level during 1:100 Year storm event = 3.01m



CLAYVILLE EXTs 71, 50 45N
SW ATTENUATION POND E
Project Number: 2374/00/00-E

EASTERN CATCHMENT
1 : 100 Year Storm Event

BIGEN AFRICA

Ref Control: GERTLG_LG-04

F:\Admin\2374\00\00\R(Reps)\d(Design)\SWMP\X71 NOV 2015\[CLAYVILLE X71 SW ATTENUATION - Dam E.xls]Input-0