VAALKOP NATURE RESERVE:
PORTION 2 OF THE FARM VAALKOP 76 JQ

FLOODLINE INVESTIGATION

29 JULY 2021

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PORTION 2 OF THE FARM VAALKOP 76 JQ

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LIST OF ABBREVIATIONS

A	Area
AEP	Annual Exceedance Probability
AGIS	Agricultural Geo-Referenced System
CD:NGI	Chief Directorate : National Geospatial Information
CSIR	Council for Scientific and Industrial Research
DTM	Digital Terrain Model
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry (pre 2009)
DWS	Department of Water and Sanitation (since 2014)
ECSA	Engineering Council of South Africa
HECRAS	Hydraulic Engineering Centre's River Analysis System
km	Kilometre
km^2	Square kilometres
LAT	Latitude
LON	Longitude
m	Metre
mm	Millimetre
m^3/s	Cubic metre per second
M2	1:2-year 24 hour rainfall event
MAE	Mean Annual Evaporation

m.a.m.s.l.	metres above mean sea level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
N	North
N1	National Road Route 1
NWA	National Water Act (Act 36 of 1998)
Pr Eng	Professional Engineer
Pr.Sci.Nat	Professional Natural Scientist
S	South
Sav	Average slope
SAWS	South African Weather Services
SANRAL	South African National Roads Agency
SDF	Standard Design Flood
UPD	Utility Programs for Drainage
W	West
WR90	Surface Water Resources 1990 study
WR2005	Water Resources of South Africa 2005 study
WR2012	Water Resources of South Africa 2012 study
W.S.	Water Surface

1 INTRODUCTION

1.1 BACKGROUND

Rian Coetzee, in association with Fanoy Consulting PTY LTD was appointed to undertake a hydrological evaluation and impact associated with the 1:100 year flood recurrence for **Portion 2 of Vaalkop 76 JQ, North West Province.**

The scope was to determine the 1:100 year floodline for the natural streams that drains to the Vaalkop Dam, once the main stem of the Elands River. Floodlines were could only be done and documented for the streams that are defined. Other possible drainage paths as shown on the 1:50 000 topographical map 2527AD were delineated with a 32m buffer zone, left and right of these.

In terms of the National Water Act (Act 36 of 1998) (NWA), the Department of Water and Sanitation (DWS) has a policy of not allowing developments within the 1:100 year floodline as described in their Guideline Document discussed in **Section 2.2** of this report.

The proposed site is located in the quaternary catchment B42B and falls within the B4C Rainfall Zone.

The locality of the property is shown in **Figure 1-1** below. The property can be located geographically by the co-ordinates 25°19'56" S and 27°26'40" E.

The closes rain station relevant to the site, no. 548747 Kafferskraal was adopted for the hydrological calculations.

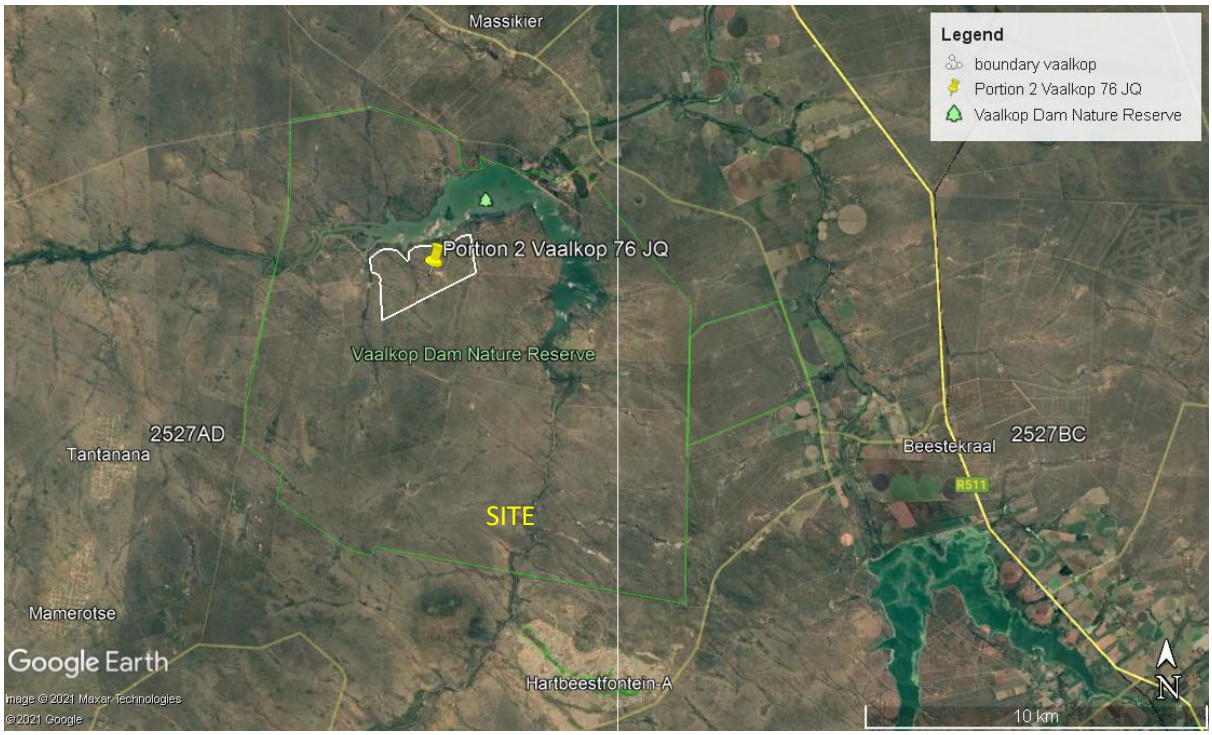

FIGURE 1: GENERAL LOCALITY MAP

1.2 OBJECTIVES OF STUDY

This flood risk assessment has the following objectives:

- Provide the reader with a general overview of the catchment area.
- Determine the hydrological flood characteristics for the catchment area.
- Hydraulically assess the river reach within the study area.
- Delineate the 1:100 year floodline for the streams, using the localised topographical survey provided by the client.

Note: The scope of the appointment as stated above excluded any further studies such as the delineation of riparian zones and buffers, wetlands and wetland buffer zones as part of this report.

1.3 INFORMATION USED DURING THE STUDY

The following sources were accessed to obtain hydrological information relative to the study area:

- Chief Directorate : National Geospatial Information (CD:NGI)
- 1:50 000 Topographical Maps of South Africa (CD:NGI)
- Water Resources of South Africa : 2005 Study (WR2005)
- South African Weather Services (SAWS)
- Google Earth Pro

Other sources of information:

- Topographical Survey from Trail Surveys.

2 REGULATIONS

2.1 NATIONAL WATER ACT, 1998 (ACT 36 OF 1998) (NWA)

The NWA describe the ***"regulated area of a watercourse"*** as:

The outer edge of the 1:100 year floodline and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam.

2.2 DWA GUIDELINES FOR DEVELOPMENTS WITHIN A FLOODLINE, MARCH 2007

"DWAF has a policy of no developments within the 1:100 year floodline should be allowed. This position is informed by the legislation administered by DWAF which clearly places the mandate for the protection of the watercourse with DWAF."

(The Guideline Document is included in the **Appendix A** for alternative exceptions)

3 PROBABLE MAJOR RISKS INVOLVED

3.1 FLOODING

Floods generally develop over a period of days. Flooding occurs when the accumulated run-off can no longer be conveyed in the beds and banks of the rivers and water spreads over the adjacent land into the 'floodplain'. However, this can also happen in a short period of time when high intensity rainfall events occur in the catchment area. These 'flash floods' occur with little or no warning and generally cause the biggest loss of human life in comparison to other types of flooding. Human settlement within the flood zone would increase the death toll in these events.

Buildings and associated infrastructures which are located near or within the regulated areas of a watercourse has a flood risk in terms of the National Water Act.

3.2 FLOOD-RELATED EROSION

Soil may be eroded by high flood volumes flowing at greater than commonly occurring velocities. Running water works as a sculptor to transform the earth's surface. The extent of water erosion naturally depends on the erodibility of surface deposits and the energy of water flowing over the receiving surface.

The soil stability of the stream banks within the vicinity of an affected property may need to be improved to mitigate water erosion and possible failure where no solid rock foundations are present.

4 BASELINE DESCRIPTION OF THE ENVIRONMENT

4.1 CATCHMENT AREA

The hydrological river catchment areas within the RSA were delineated in 1981 and studied in the subsequent South African Water Resources Study 1990 and lately in 2005. The primary basin areas are designated alphabetically (e.g."A" is the Limpopo River basin). The secondary areas are numbered numerically (e.g. "2" is the Limpopo River basin). Tertiary numbers would be A22". Lastly the smallest units are the quaternary catchment areas, for example "A22F" covers part of the upper reaches.

The site is located within the A22F quaternary catchment. The local catchment of the property is shown in **Figure 3**.

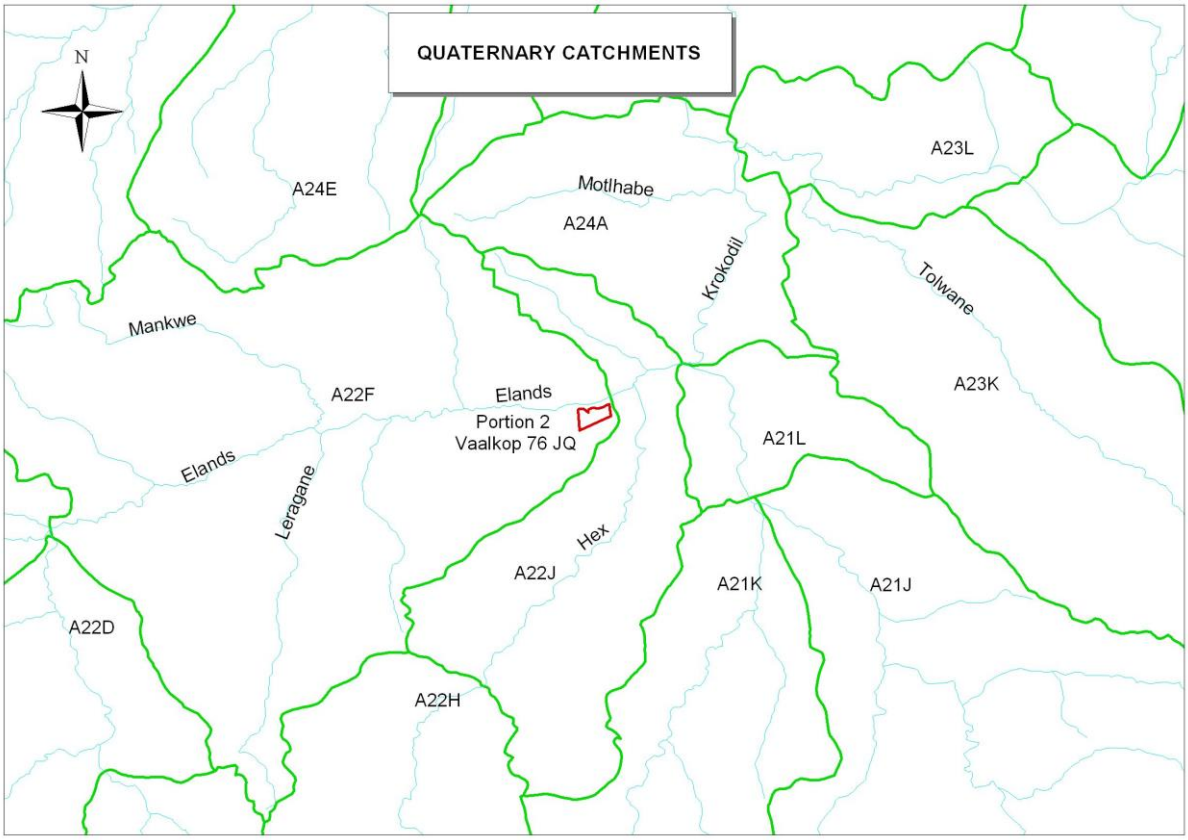

FIGURE 2: QUATERNARY CATCHMENTS

5 FLOOD PEAK ESTIMATION

This section of the report defines the return period in terms of an annual exceedance probability and also shows the required return period for which the flood peaks were calculated. The methodology used to determine the peak flow values is described and the catchment characteristics used in the calculations and the results of the peak flood values that was adopted for the study are given. Note that the underlying assumption is the following: a 1 in 100-year rainfall event will generate a 1 in 100-year flood event.

5.1 ANNUAL EXCEEDANCE PROBABILITY AND RISK POTENTIAL

The term **Annual Exceedance Probability (AEP)** is defined as the probability that a given recurring natural event, i.e. rainfall depth, or flood flow, accumulated over a given duration

(mm/day or cubic metres/second), will be exceeded in one year. Commonly used AEP values and the equivalent return period values are shown in **Table 5-1** below.

TABLE 5-1: ANNUAL EXCEEDANCE PROBABILITY

AEP (%)	50%	20%	10%	5%	2%	1%
Return Period (Years)	2	5	10	20	50	100

The 'recurrence', or 'return period' of floods is defined as the probable average period in which such a flood will occur, based on a very long flow record. Since our flood records are mostly not of a long duration, and floods are the result of highly variable meteorological events, there is a "risk" associated with the occurrence of a large flood in a given time period: i.e. the risk of a 1 in 100-year flood occurring in the next 10 years is 9.6%.

Table 5-2 below shows the risk of occurrence of the 1 in 100-year storm or flood event for a range of years.

TABLE 5-2: RISK or PROBABILITY OF OCCURRENCE of a RAIN or FLOOD EVENT

Rain storm or flood	**Occurring in the next N years listed below**	**Risk (%)**
1 in 100-years	5	4.9
	10	9.6
	15	14.0
	20	18.2
	25	22.2
	30	26.0
	40	33.1
	50	39.5

5.2 FLOOD PEAK ESTIMATION METHODOLOGY

5.2.1 Methods used to estimate the flood peaks

The following methods, as described in the SANRAL Drainage Manual (2013), were used to determine the flood peaks. The software 'Utility Programs for Drainage' which has been developed by Sinotech, using the methods in the Manual, was used to compute estimates of the site flood peaks.

5.2.2 Deterministic Analysis

Deterministic methods include those methods where the flood magnitude (the effect) is derived from an estimate of the catchment characteristics, including rainfall (the cause), for the required annual exceedance probability. Note that these methods have been calibrated according to selected regions and flood events and its application is usually limited to the size of catchment on which they can be applied.

Rational Method with alternative (Alexander) method of calculating rainfall intensity.

The Rational Method is based on a simplified representation of the law of conservation of mass and the hypothesis that the flow rate is directly proportional to the size of the contributing area and the rainfall intensity.

Rainfall intensity is an important input in the calculations, therefore representative rainfall data as calculated by the **Design Rainfall Estimation program**, implements procedures to estimate design rainfall in South Africa developed by JC Smithers and RE Schulze.

The parameters for the calculations are as follows:

- the time of concentration is calculated for stream and overland flow as applicable
- the rainfall intensity is per above mentioned program interpolated values up to the 24-hour rainfall event
- the runoff factor is calculated for each area respectively as it may differ, for instance in the slope, vegetation cover and land use
- the percentage reduction factor for estimating the average precipitation over the catchments is applied

Standard Design Flood method (SDF)

The SDF method is an empirical regionally calibrated version of the Rational Method. The only information required for its application is the area of the catchment, the length and the slope of the main stream, and the drainage basin in which it is located.

This method was developed to provide a simple and robust method to flood calculations. The method employs calibrated discharge parameters that are based on historical data that sufficiently define the flood frequency relationships for 29 homogeneous basins in South Africa.

Alexander (2003) stated that the SDF Method is valid for catchments ranging from 10 to 40 000 km^2.

Van Bladeren (2005) however found that the SDF method over-estimated design floods in 11 of the runoff basins in South Africa and under-estimated the results in 5 basins. It only had reasonable results in 8 of the basins, thus the results obtained in the SDF method should be critically evaluated. The lack of site specific rainfall and flood data in the catchment area considered here, as described above, would therefore also influence the reliability of any empirically calibrated method. The tendency of the developer of the method would be to rather be on the safe side and over-estimate the flood peaks.

The site falls within SDF Basin no.1

5.2.3 Empirical Analysis

Included in this category is the Regional Maximum Flood method developed by Kovaćs.

Empirical methods are mostly based on simple correlations between peak flow rate and other catchment characteristics derived in order to establish general regional parameters. This method is particularly suitable for obtaining an advance indication of the order of magnitude of peak discharges.

The same comments on the SDF method, given in the previous section, are applicable to these methods.

5.2.4 Statistical Analysis

Flood frequency analysis is a technique used by hydrologists to predict flow values corresponding to specific return periods or probabilities along a river were gauging stations are available.

Using annual peak flow data that is available for a number of years, flood frequency analysis is used to calculate statistical information such as mean, standard deviation and skewness which is further used to create frequency distribution graphs. The best frequency distribution is chosen from the existing statistical distributions such as Gumbel, Normal, Log-normal, Exponential, Weibull, Pearson and Log-Pearson.

The probability distribution that best fits the annual maxima data, flood frequency curves is plotted. These graphs are used to estimate the design flow values corresponding to specific

return periods which can be used for hydrologic planning purposes. Flood frequency plays a vital role in providing estimates of recurrence of floods which is used in designing structures such as dams, bridges, culverts, levees, highways, sewage disposal plants, waterworks and industrial buildings . In order to evaluate the optimum design specification for hydraulic structures, and to prevent over-designing or under designing, it is imperative to apply statistical tools to create flood frequency estimates. These estimates are useful in providing a measurement parameter to analyse the damage corresponding to specific flows during floods. Along with hydraulic design, flood frequency estimates are also useful in flood insurance and flood zoning activities. Accurate estimation of flood frequency not only helps engineers in designing safe structures but also in protection against economic losses due to maintenance of structures.

There are no gauging stations in the small stream evaluated.

5.3 FLOOD PEAKS

The relevant catchment characteristics used in the calculations of the peak flows for the three local catchments are shown in **Table 5-3** below. See **Figure 3** below for referencing.

TABLE 5-3: GENERAL CATCHMENT CHARACTERISTICS

Catchment 1	**Value**
Size of catchment (A) (km^2)	2.36
Longest watercourse (L) (km)	3.6
10-85 Slope (Sav) (m/m)	0.014
Equal Area Height Difference (m)	50
Mean Annual Precipitation (MAP) (mm)	585
SDF Basin Number	1
Kovać	K5

Catchment 2	**Value**
Size of catchment (A) (km^2)	2.88
Longest watercourse (L) (km)	2.36
10-85 Slope (Sav) (m/m)	0.015
Equal Area Height Difference (m)	35
Mean Annual Precipitation (MAP) (mm)	585
SDF Basin Number	1
Kovać	K5

Catchment 3	Value
Size of catchment (A) (km²)	0.9
Longest watercourse (L) (km)	1.1
10-85 Slope (Sav) (m/m)	0.019
Equal Area Height Difference (m)	20
Mean Annual Precipitation (MAP) (mm)	585
SDF Basin Number	1
Kovać	K5

The results of the peak flow calculations are shown in **Table 5-4** below. The results of the **Alternative Rational method** was adopted for the purpose of floodline modelling since it is site specific.

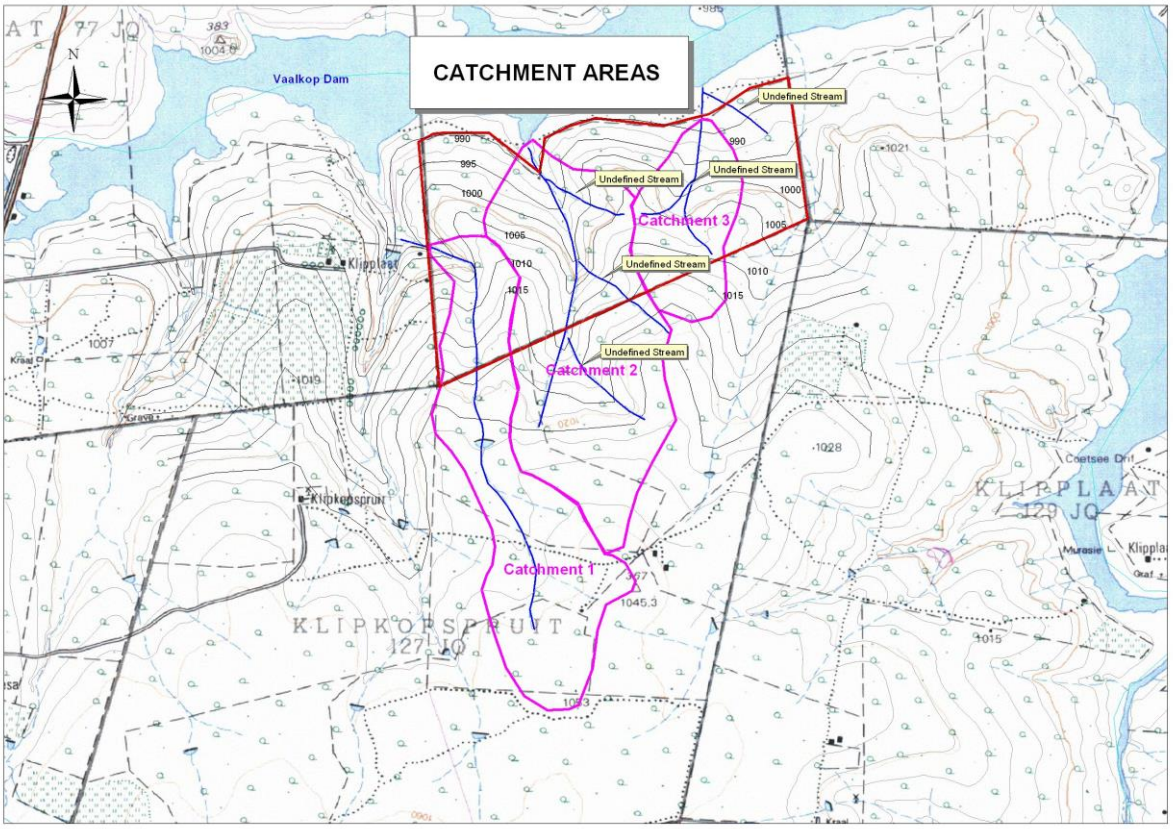

FIGURE 3: LOCAL CATCHMENT AREAS

TABLE 5-4: FLOOD PEAK RESULTS

Peak Results for method applied: (1:100 years)		
	Catchment no.	**1:100**
Alternative Rational	1	21 m^3/s
Alternative Rational	2	33 m^3/s
Alternative Rational	3	11 m^3/s

The floodline results is shown in **Figure 4** below.

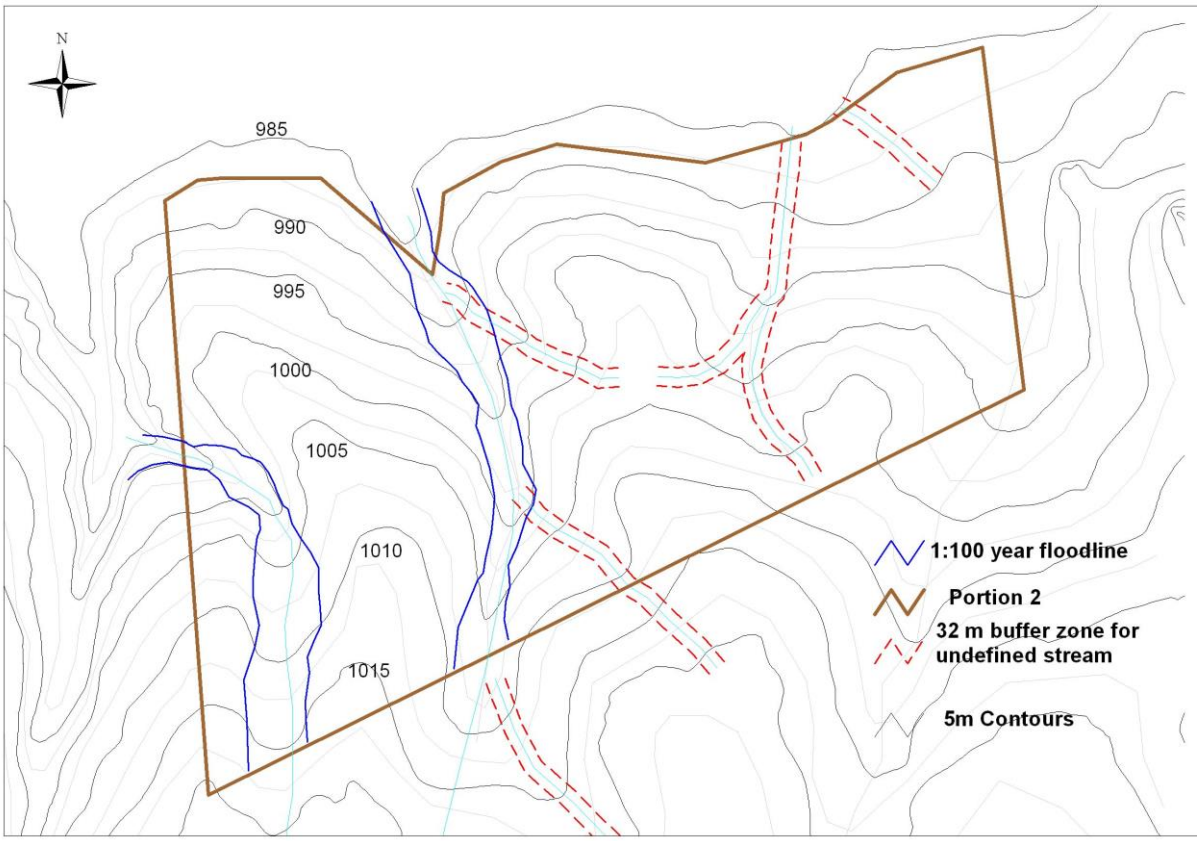

FIGURE 4: 1:100 YEAR FLOODLINES AND 32M BUFFER STRIPS

6 GENERAL DISCUSSION

- Should existing or planned infrastructure or any permanent infrastructures encroach upon the 1:100 year floodline of a watercourse, the following is required:
    - A water use authorisation will be required in terms of Section 21 of the National Water Act (Act No. 36 of 1998).
    - Mitigation measures shall be required according to the policies and guidelines for developments within a floodline which was developed by the Department of Water Affairs and Forestry, now Department of Water and Sanitation, in 2007. **(See Appendix A)**

7 RECOMMENDATIONS AND CONCLUSIONS

The guiding principle of this flood risk assessment is the establishment of the 1:100 year floodline for the property.

The 1:100 year peak runoff values were calculated by means of deterministic methods and empirical methods as described in SANRAL's Drainage Manual (2013). The Alternative Rational Method was adopted for the site.

In accordance with the National Water Act (Act 36 of 1998), we hereby **certify** that the peak runoff results included in this report have been properly determined and represent the maximum runoff peaks that will probably be encountered during a flooding event with an expected recurrence interval of 1:100 year.

Report by:

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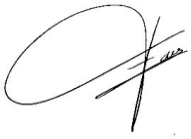
Approved by:



Mr Jan Fanoy Pr Eng ECSA Reg No 830195 (Fanoy Consulting (Pty) Ltd).

8 REFERENCES

ADAMSON P.T. (1981) *Southern African Storm Rainfall*. Technical Report TR102. Department of Environmental Affairs and Tourism, Pretoria, RSA.

ALEXANDER W.J.R. (2001) *Flood Risk Reduction Measures*. 2nd rev

Design Rainfall Estimation program, developed by JC Smithers and RE Schulze, University of KZN.

KOVAĆZ Z. *Regional Maximum Flood Peaks in Southern Africa*. Technical Report TR 137. Dept of Water Affairs. Dec 1988.

SANRAL (2013) *Drainage Manual. 6th Edition*. South African National Roads Agency Limited, Pretoria. RSA

9 APPENDICES

APPENDIX A: GUIDELINE FOR DEVELOPMENTS WITHIN A FLOODLINE

Guideline for Developments within a Floodline

March 2007

DEPARTMENT: WATER AFFAIRS AND FORESTRY

Document general reference information

Copies may be obtained from:

The Chief Directorate: Water Use

Directorate: Water Abstraction and Instream Use

Sub-Directorate: Environment and Recreation

Department of Water Affairs & Forestry

Private Bag x313

Pretoria

0001

This document is also available on www.dwaf.gov.za

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2.3. April 2007 EIA Regulations

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4.1. Information Requirements

4.2. Development Guidelines

Glossary

Banks “Banks” are the lateral strip of public bed situated above the low water level of a river

Beds “Bed” of a river is the land covered by water at the maximum ordinary rise

Characteristics “Characteristics” of a watercourse are the original features of the watercourse including the bed, banks and floodplain of the watercourse.

Construction “Construction” means any activity associated with the alteration of the landform, the installation of infrastructure, or the erections of buildings, including, but not limited to the clearing of vegetation, moving of earth, placing of fill, excavation of trenches, constructions of roads and erection of buildings etc.

Development “Development” means any man made change to property, including but not limited to construction or upgrading of buildings or other structures, filling, paving etc.

Develop “Develop” means to change the designated use of the land for any purpose including the provision of infrastructure, the construction of buildings, etc.

Fill “Fill” means the placement of fill material such as natural soil or rock, building rubble, concrete, etc. at a specified location to bring the ground level up to a desired elevation.

Floodplain “Floodplain” means the area susceptible to inundation by the 100 year recurrence interval flood

Original floodplain “Original floodplain” means the floodplain that would have existed prior to the placing of any fill or the alteration of the stream channel.

Protection “Protection” in relation to a water resource, means maintenance of the quality of the water resource to the extent that the water resource may be used in an ecologically sustainable way, prevention of the degradation of the water resource and the rehabilitation of the water resource.

Stormwater “Stormwater’ means water resulting from natural precipitation and or accumulation and includes rainwater, groundwater and spring water but excludes water or waste water reticulation system.

Riparian habitat “Riparian habitat” includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

Watercourse “Watercourse” means a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake or dam into which, or from which water flows.

Water resource “Water resource” includes a watercourse, surface water,

Wetland “Wetland” means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically

covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

1. Introduction

Increasingly DWAF is requested to provide input and guidance to developments within the 1:100 year or 1:50 year floodline. Often developers are willing to take the risk of developing within these zones without taking into account the impact on upstream and/or downstream users, leading to increased flooding or scouring of the watercourse.

Municipalities are often left with the management of higher flood peaks and damage to properties; infrastructure and the resource.

In addition, Developers have interpreted Section 144 of the National Water Act (Act No 36 of 1996) as merely notifying affected parties of the floodline and not as an activity under Section 21 (i) of the said Act.

As custodian of the water resource and the Water Sector Leader, DWAF is obliged to provide guidance to other organs of state such as municipalities to ensure the sustainable use of the resource and to reduce the potential harm to the public and damage to property and the resource. It is a well accepted fact that the prevention and/or control of development within the floodplain of a watercourse is importance to ensure the following:

· Protection of the natural floodplain;

· Reduction or Mitigation of adverse impacts on the natural watercourse;

· Enhance the social, ecological and amenity value of the watercourse and its floodplain;

· Prevention of wasteful public expenditure on remedial works due to damage caused during flood conditions;

· Minimise disaster management associated with floods; and

· Prevent the potential loss of life.

1.1. Purpose of the Document

The purpose of the guideline is to three fold namely:

· Provide a standard approach to developments within a floodplain of a

watercourse;

· Ensure that there is no misinterpretation of legislation and policies governing development within the floodplain; and

· Provide guidance to all spheres of government on addressing developments within the floodplain.

It is **not** the purpose of this guidance to indicate how floodlines should be calculated. Floodlline calculations remain a complex study and should be left to the Engineers.

2. Policy and Legislative Context

Although it is common knowledge that development within the 1:100 year floodline should not be allowed, this re-iterated in various Acts and policies. Below, is a summary of the interpretation of the key issues pertaining to floodlines.

2.1. National Water Act (Act No 36 of 1998)

Section 144 of the Act states the following,

"for the purpose of ensuring that all persons who might be affected have access to information regarding potential flood hazards, no person may establish a township unless the layout plan shows, in a form acceptable to the local authority concerned, lines indicating the maximum level likely to be reached by floodwaters on average once in every 100 years".

Section 144 relates only to the establishment of a township and requires the developer to make information regarding the location of the floodline available. It does not require the developer to consider how downstream or upstream users will be affected by the development. This is not seen as a shortfall of the Act as the need to consider the impact of the development on the environmental and social environment is captured in Section 21 (i) of the Act.

Section 21 of the Act identifies the types of water uses that need to be licensed. This guideline is concerned only with Section 21 (i) water use which is, "altering the bed, banks or characteristics of a water course".

Although the characteristics of a watercourse are not defined in the Act, DWAF defines it as the original features of the watercourse including the bed, banks and floodplain of the watercourse. By DWAF's understanding, any development that affects the 1:100 year flood or even 1:50 year flood must be licensed by DWAF. According to the Act a water course means a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake or dam into which, or from which water flows

2.2. Government Notice 704, 4 June 1999, Government Gazette 2019.

Regulations on use of water for mining and related activities aimed at the protection of water resources

According to Regulation 4, no person in control of a mine or activity may –

(a) locate or place any residue, deposit, dam reservoir, together with any associated structure or any other facility within the 1:100 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on waterlogged ground, or on ground likely to become waterlogged, undermined, unstable or cracked;

(b) except in relation to a matter contemplated in regulation 10, carry on any underground or opencast mining, prospecting or any other operation or activity under or within the 1:50 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, whichever is the greatest.

(c) Place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation; or

(d) Use any area or locate any sanitary convenience, fuel depots, reservoir or deports for any substance which causes or is likely to cause pollution of a water resource within the 1;50 year flood-line of any watercourse or estuary.

According to Regulation 10, additional regulations relating to winning sand and alluvial minerals from a watercourse or estuary, no person may –

(a) extract sand, alluvial minerals or other materials from the channel of a watercourse or estuary, unless reasonable precautions are taken to –

(i) ensure that the stability of the watercourse or estuary is not affected by such operations;

(ii) prevent scouring and erosion of the watercourse or estuary which may result from such operations or work incidental thereto;

(iii) prevent damage to in-stream or riparian habitat through erosion, sedimentation, alteration of vegetation or structure of the watercourse or estuary or alteration of the flow characteristics of the watercourse or estuary; or

(b) establish any slimes dam or settling pond within the 1:50 year flood-line or within a horizontal distance of 100 metres of any watercourse or estuary

(1) every person winning sand, alluvial minerals or other materials from the bed of a watercourse or estuary must-

(a) construct treatment facilities to treat the water to the standards prescribed in Government Notice No. R 991 dated 26 May 1984 as amended or by any subsequent regulation under the Act before returning the water to the watercourse or estuary; and

(b) limit stockpiles or sand dumps established on the bank of any watercourse or estuary to that realised in two days of production, and all other production must be stockpiled or dumped outside of the 1:50 year flood-line or more than a horizontal distance of 100 metres from any watercourse or estuary; and

(c) implement control measures that will prevent the pollution of any water resource by oil, grease, fuel or chemicals.

Regulation 3, Exemption from requirements of regulations, states that the Minister may

in writing authorise an exemption from the requirements of regulations 4,5,6,7,8, 10 or 11 on his or her own initiative or on application, subject to such conditions as the Minister may determine.

2.3. April 2007 EIA Regulations

According to Regulation 386 Section a basic assessment report must be completed for Section 1 (m) and Section 4 activities. Where Section 1 (m) refers to the construction of facilities or infrastructure, including associated structures or infrastructure, for any purpose in the one in ten year floodline of a river or stream or within 32 meters from the bank of a river or stream where the floodline is unknown, excluding purposes associated with existing residential use but including:

(i) canals;

(ii) channels;

(iii) bridges;

(iv) dams; and

(v) weirs.

and Section (4) refers to the dredging, excavation, inflling removal or moving of soil, sand or rock exceeding 5 cubic metres from a river, tidal lagoon, tidal river, lake, instream dam, floodplain or wetland.

According to Regulation 387 Section 4, the extraction of peat, a full environmental impact assessment report is required. Section 4 is applicable as peat is found in wetlands and the extraction of peat will result in a Section 21 (i) water use licence.

The EIA Regulation introduces the need to acknowledge development in the 1:10 year flood which is not considered in any other legislation.

2.4. Policy and guidelines for the acquisition of land rights at departmental Dams

The Policy and guidelines for the acquisition of land rights at departmental dams provides clarity on DWAF's requirements in terms of developments at the departmental dams. The

guideline is aimed reducing any potential harm to the public, damage of property and the impact on the resource quality in terms of Chapter 12 of the National Water Act (Act No 36 of 1998).

2.5. Guidelines for Health Settlements Planning and Design (Red Book).

The requirements laid down by the National Building Regulations and Building Standards Act (Act 103 of 1977) in terms of development within the 1:100 year flood line area are based only on safety considerations without proper consideration and understanding of the underlying natural stream flow process. The Town Planning and Township Ordinance (Ordinance 15 of 1986) also makes provision in Regulation 44(3) for the extension of flood line areas.

Policy and Guidelines for Developments within Floodlines

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3. Proposed DWAF Policy for Developments within the Floodline

3.1. Introduction

DWAFs has a policy of no developments within the 1:100 year floodline should be allowed. This position is informed by the legislation administered by DWAF which clearly places the mandate for the protection of the watercourse with DWAF.

3.2. Alignment of Terms

Currently, there appears to be different terminology, understanding and implementation of issues pertaining to developments within the floodplain. The intention of this guideline to present a standard approach across the country. This approach will result in less confusion for the developers.

3.3. Section 21 (c) and (i) Activities

The policy of the Department with regard to development within flood lines is as follows:

Development within floodlines is strictly controlled as section 21(c) and (i) water uses. In all cases where developments are proposed inside the floodlines, the developer is responsible for a thorough investigation of all effect the development may have on the natural, social or economic environment.

No developments of any type shall be authorised within the original floodplain below the RMF line if it results in rising of water levels sufficient to have an adverse impact on adjacent

properties. Buffer zones of 20m should be provided between the 1:100 year flood line area and any proposed development, to ensure that no development has a direct impact on the natural flow of rivers and streams. No earthworks are allowed within the buffer zone or any development.

Where the 1:100 year flood line and the buffer strip is not sufficient to cover areas frequently inundated by stream flow, additional land should be excluded from development to ensure that the stream and its natural processes are not directly impacted upon by a single development, to the detriment of all other developments upstream or downstream. Where properties are severely impacted upon by flood lines, buffer zones and wetland areas should not be modified to increase the development area.

Types of developments that will be **considered** within the different zones of the original floodlines are as follow (the restrictions at any level apply to all levels below)

(i) 100 year to Regional Maximum Flood

Any structure provided:

a. the risk is pointed out to occupants

b. adequate escape routes exist

(ii) 50 year to 100 year floodlines

a. No structure that results in a loss of flood storage from the system

b. No fill, dykes, levees or berms intended to restrict the area of

floodplain inundated

c. No structure that has not been designed by a structural engineer to withstand the floodwater load

d. No ground floor in which people sleep at night

e. No sewer lines

(iii) 20 year to 50 year floodline

a. No permanent structures except bridges (this includes swimming pools, tennis courts, brickwork gazebos)

b. Temporary structures that do not interfere with the function of the floodplain as an ecological corridor.

(iv) 10 year to 20 year floodline

a. Only ground level modifications that do not reduce the permeability of the floodplain soils

(v) Below the 10 year floodline a. approved water abstraction facilities

b. landscaping with very minor earthworks and planting with locally indigenous riparian vegetation only

4. Guidelines for Development within the Floodline

4.1. Information Requirements

Any proposal for development in the proximity of a watercourse shall contain an accurate floodline plan and technical report reflecting

· The boundaries of all wetlands and the edges of all watercourses.

· The edge of the existing and original floodlines for the following recurrence intervals, 5, 10, 20, 100 years and Regional Maximum Flood

Drawings showing floodlines for proposed developments shall be accompanied by a technical report containing the following information:

i. the name and technical competency of the certifying Engineer

ii. details of the hydrological calculations including the methods used, the peak flood discharges as calculated by each method with a comparative plot on Gumbel paper and the final design discharges used to determine the floodlines. Proportions of the RMF and where applicable the Standard Design Flood shall be included in the methods used to compute the design discharges.

iii. Details of the hydraulic calculations including a description of the method and software used, the locations of the cross sections used to compute the profile and the control levels and the hydraulic roughness at each section

iv. The calculations results shall show for each section and each design discharge:

1. the computed water surface elevation;

2. the computed energy line elevation

3. the distribution of discharges between the overbanks and the main channel

4. the average channel and overbank flow velocities

5. the energy slope

6. the Froude Number

v. if supercritical flow is expected to occur and to prevail during flood conditions the position of all hydraulic jumps shall be shown, and the floodlines for conjugate depths shall be indicated for the super critical reaches

· The stormwater management plan, containing the following:

i. A description of the calculation methods used

Pre-development

ii. A description of the topography, vegetation, soils and anything else that may influence stormwater runoff;

iii. Calculation of the critical storm duration using at least 2 methods one of which shall be the kinematic equation

iv. Stormwater runoff peak discharges and hydrographs for the critical storm duration for the 2, 5, 10, 20, 50 and 100 year recurrence interval events

Post-development

v. A description of the stormwater management techniques to be implemented on the site, including information on the maintenance requirements, probability and consequences of failure

vi. Effective stormwater management dissipates the energy of stormwater discharges and reduces potential for scouring and erosion.

vii. Stormwater runoff peak discharges and hydrographs for the range of storm durations for the 2, 5, 10, 20, 50 and 100 year recurrence interval events. These calculations shall identify the critical duration storm for each recurrence interval and indicate the change from the

predevelopment condition.

· The incremental effect of the development on a rare event such as the Regional Maximum Flood must be quantified

· The developer is responsible to communicate all possible effects to all likely stakeholders, to seek their approval and co-operation.