LONG TERM WATER BALANCE & ESTUARINE MECHANISM SIMULATION OF THE MFOLOZI RIVER FLOODPLAIN, SOUTH AFRICA

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Submitted in fulfilment of the requirements for the degree of

Master of Science in Engineering

in the

Civil Engineering Programme

University of KwaZulu-Natal

SUPERVISOR: PROFESSOR D. D. STRETCH

DATE OF SUBMISSION: AUGUST 2013

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ACKNOWLEDGEMENTS

I would like to acknowledge the following:

- Professor D. D. Stretch – for his tireless effort, guidance and kindness in this endeavour. I have always admired his brand of logic and method – it has been a privilege to work under his tutelage for the past three years.

- My family: Pravin, Usha & Namrata Jugwanth, and Vishane Ramharak – for the love, support and motivation. The lyric '*wind beneath my wings*' is a rather clichéd line, however it does aptly describe the *Atlas*-sized role they play in everything I achieve and work towards.

- My mentor Hennie van Staden and my colleagues at AECOM SA (Pty) Ltd – for the support. Working and studying concurrently becomes that much easier when one is part of a team that is as enthusiastic and supportive as ours.

- My UKZN counterparts working on the St Lucia project (Clinton Chrystal, Robynne Chrystal, Andrew Maro and Christopher Maine), as well as the *iSiLucia* group from TUDelft (Dirk-Jan Vinke, Kasper Stoeten, Bas Reijmerink, Henry Tuin and Sander van Alphen) – for the research and work done in their respective topics which formed the basis of my investigation.

- To Dr. Ricky Taylor (formerly of Ezemvelo KZN Wildlife), as well as Katrin Tirok and her band of biologists from the UKZN, who introduced me to literally the *wild side* St Lucia Lake and its expansive beauty.

ABSTRACT

The St Lucia estuarine lake is a World Heritage Site due to its size and its unique ecology. In the past, the mouths of the Mfolozi River and the St Lucia Lake were combined. During drought periods, the combined mouth would close and the Mfolozi River would provide fresh water to the estuary, thus preventing low water levels, hypersaline conditions and prolonged closed inlets to the sea from occurring – factors which are detrimental to the functioning of the estuary's ecology. In the 1950s, the mouths were forcibly separated. This separation deprives the lake of a much needed source of fresh water, which during drought periods results in extremely low water levels and high salinity – as seen in 2006 when approximately 90 % of the lake bed was exposed and hyper-saline conditions were prevalent.

Numerous solutions regarding the lack of freshwater entering the lake have been debated. One school of thought is that the fresh water from the Mfolozi River, diverted through an existing Backchannel which connects the two water bodies, could have a positive impact on the St Lucia Lake. However, as in the 1950s, the same concerns regarding the inundation of farmlands in the lower Mfolozi floodplain, as well as excessive sediments entering the lake through the Backchannel, were still relevant.

The aim of this study is to determine whether the use of the Backchannel is a feasible solution. To do so, a simplified model (consistent with the limited available data) of the river floodplain, inclusive of a functioning connection to the lake, is created. Trends are then evaluated using a long-term simulation of approximately 90 years – focussing not on flood and drought conditions (of which most water flows out to sea) but rather to study a combination of wet and dry periods, sometimes spanning decades. Optimum conditions, taking into consideration the potential concerns are recommended. The possible effects of the freshwater diversion on the St Lucia Lake are also quantified.

The optimum simulation performed, as part of this study, indicates whilst the diversion of freshwater through the Backchannel alleviates the problem of low water levels and high salinities in the St Lucia Lake, the inlet to the lake remains closed for prolonged periods. This prevents the recruitment of marine species through the inlet and is detrimental to the sustainability of the estuary's ecology.

DEDICATION

“For there is no friend like a sister
In calm or stormy weather;
To cheer one on the tedious way,
To fetch one if one goes astray,
To lift one if one totters down,
To strengthen whilst one stands.”

CHRISTINA ROSSETTI 1830-1894

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1. INTRODUCTION

1.1. MOTIVATION

Estuaries are coastal bodies of water that occur when the rivers meet the sea. The resultant ecosystems are unique as the estuaries generally consist of a saline gradient, with conditions digressing from freshwater at the river, to brackish waters at the interface and saline conditions at the mouth. The richness of estuaries' biodiversity, in plant and animal species, leads to them being recognised as highly prized areas of natural resources. This attracts both economic and tourist attention and can be used for both monetary gain and leisure if treated in a sustainable manner (Duck & da Silva, 2012). Unfortunately this treatment is generally not the case, and although unintentional, estuaries across the world have been affected negatively by anthropogenic activity.

This is evident in the Coorong Estuary in Australia where an increased demand in irrigation water and the construction of barrages has substantially decreased the river discharge at the mouth of the river resulting in reduced water levels and high salinities (Webster, 2010). In India, fish resources in the Chilika Lake on the east coast have been over exploited due to uncontrolled activities, thereby disturbing the natural ecology (Mishra & Griffin, 2010). Similarly, the Somone Estuary in Senegal has also endured a severe decrease in its natural mangrove population due to uncontrolled harvesting. High salinities caused by a reduction in river discharge due to damming upstream have not been conducive to the recovery of the mangroves (Sakho, et al., 2011). The Russian Neva Estuary suffers from the effects of eutrophication due to the high nutrient loads present in the Neva River discharge – of which approximately 60% of the phosphorus loading has anthropogenic origins (Golubkov & Alimov, 2010).

The mouth state of estuaries are crucial to their natural functioning, and when artificially manipulated can be detrimental to their health. The mouth of Ria de Aveiro, a Portuguese estuary which was naturally undergoing an infilling process, was maintained in its open state by the construction of an artificial inlet in the 1800s. The increased tidal prism that followed scoured and deepened the estuary to such an extent that the salinities greater than 30 currently extend 15km up the river, when in its natural state three centuries ago, the influence of the seawater was detected only 4km. The deepening of the estuary and the high salinities has resulted in the loss of plant species as well as large areas of both salt and freshwater swamps (Duck & da Silva, 2012).

The St Lucia estuarine lake is a World Heritage Site due to its size and its unique ecology. It has a wide range of fauna and flora (van Vuuren, 2009) and plays an important role as a nursery ground for juvenile aquatic species which restock the fish and prawn populations found off shore (Cyrus, et al., 2010). The lake also provides a protected environment for other species such as hippos and crocodiles (Whitfield & Taylor, 2009) and supports the indigenous people in the surrounding area through a booming tourism industry. Its economic importance to the province of Kwa-Zulu Natal is therefore substantial (Whitfield & Taylor, 2009).

The water level, salinity and open/closed mouth conditions of the estuary are influential factors on the structure and functioning of the estuary's ecology. Prolonged periods of a closed mouth, low water levels and high saline conditions result in the decrease of the biodiversity and health of the lake's ecological system (Cyrus, et al., 2010). Fresh water supply to the estuary is mainly provided by the Mkhuze, Mzinene, Hluhluwe, Nyalazi and the Mpate Rivers (Lawrie & Stretch, 2011a), with the ocean providing the saline water inputs when the mouth is open.

Historically, the mouths of the Mfolozi River and the St Lucia Estuary were combined. During drought periods, the combined mouth would close and the Mfolozi River would provide fresh water to the estuary, thus preventing low water levels and hypersaline conditions from occurring (van Vuuren, 2009). However, in 1952, due to concerns about excess sediments entering the estuary and the flooding of farmlands in the Mfolozi floodplain, the mouths were artificially separated (Lawrie & Stretch, 2011a). This separation deprives the estuary of a much needed source of fresh water during drought periods, which results in extremely low water levels and high salinity. This occurred in 2006 when approximately 90 % of the lake bed was exposed and hypersaline conditions were prevalent in areas of the lake system (Whitfield & Taylor, 2009).

To date, the merits and plausibility of various options have been evaluated by various academic and engineering institutions – these methods are reviewed and summarised in Chapter 3. Two notable solutions consist of diverting freshwater from the Mfolozi River into the St Lucia Lake – either by having a combined mouth system (as per pre-1952) or by the transfer of water via a channel that connects the two systems together. It is the focus of this study to assess the potential of using the Backchannel for the transfer of freshwater into the lake whilst curbing both the inundation of the lower lying farms in the Mfolozi floodplain as well as excess sediment from entering the lake system through the channel.

A water balance model , with a monthly time step, of the St Lucia Estuary was developed by (Lawrie & Stretch, 2011a) in order to provide a decision making tool regarding the management of the estuary. This model can also be used to determine the impact that the Mfolozi River could have on the water levels, salinity and mouth conditions of the St Lucia Lake estuary if an amount of fresh water from the river was allowed to be diverted into it. As discussed above, this can be achieved either through a channel of some sorts, which has a height and width control, or else through the St Lucia mouth during a closed combined mouth condition.

From the successful results of the above simulations performed by Lawrie & Stretch (2011b), the decision was made to re-combine the mouths of the two estuarine systems, and was implemented on the 6th July 2012 (iSimangaliso Wetland Park, 2012a). However, there still remains uncertainty regarding the preferred management interventions, and so the viable solutions are still under investigation – notably as part of the scope of works in the *GEF Tender No. 2011/01 for Consultancy Services,* which commenced at the end of 2012. The objectives of the tender are discussed further in Chapter 3.

In order to establish the effect of transferring fresh water through the channel, a simplified model (consistent with the limited available data) of the river floodplain, inclusive of a functioning connection to the lake, is created as part of this study. Optimum conditions are recommended, taking into consideration the potential concerns, and the possible effects of the freshwater diversion on the St Lucia Lake is quantified by feeding resultant transfer rates into the model produced by (Lawrie & Stretch, 2011a) of the St Lucia estuary.

1.2. RESEARCH QUESTION

Can freshwater diversions from the Mfolozi River, implemented through a connecting channel, provide an effective means to mitigate the negative impacts of droughts on the St Lucia estuary whilst:

- Limiting the inundation of the farmlands located in the lower Mfolozi floodplain
- Preventing excess sedimentation to enter the St Lucia Lake system?

1.3. AIMS AND OBJECTIVES

The aim of this research project is to model the water balance of the Mfolozi River floodplain, over a long period of time, in order to feed resultant transfer rates into the water balance model of the St Lucia Lake complex that was developed by Lawrie & Stretch (2011b). The combined results can then be used to determine an effective and holistic management plan for the estuarine system. Good management of the system will result in the safeguarding of its ecology, its tourist opportunities and the resulting economic benefits to the local communities.

The objectives of the study are:

- To determine the water inputs, outputs and mouth dynamics of the Mfolozi River floodplain and relate it to the water levels experienced during the periods when the river mouth is closed.
- To use the above information to predict the volume of fresh water that can be diverted from the Mfolozi floodplain into the St Lucia estuary.
- To investigate optimum dimensions of the sea berm height, the connecting channel's broad-crested-weir height and breadth that will allow the maximum amount of water to enter the St Lucia estuary without excessive sedimentation entering the estuary and unnecessary inundation of low lying existing farms.

The above objectives are evaluated using a long-term simulation of approximately 90 years – focussing not on flood and drought conditions (of which most water flows out to sea) but rather to study a combination of wet and dry periods, sometimes spanning decades.

1.4. RESEARCH METHODOLOGY

The creation of the water balance of the Mfolozi River floodplain commences with an investigation and comparison of available hydrological field measurements and validated simulation data. Water inputs and losses were quantified, and combined to calculate the resultant inflow into the floodplain.

Using the contours of the floodplain's *digital terrain model*, a relationship between the area and water level of the floodplain was estimated – which is then used to relate the resultant volume of water in the system to a water level (i.e. a hypsometric curve). The estuarine mechanics (including its mouth dynamics) can then be simulated. The maximum stored water level in the floodplain, which is dependent on the height of the sea berm, controls the level of inundation that occurs.

In order to quantify the amount of sediment allowed to enter the St Lucia Lake through the transfer flow via the connecting channel, the sediment trapping efficiency of the stored water in the floodplain is evaluated. This requires research into the sediment loading prevalent in the river discharge and suspended sediment particle characteristics in order to determine approximate settling velocities. The trapping capabilities of the floodplain is then simulated using a simple horizontal plug flow model and is compared to results from usage of a widely recognised empirical method.

A sensitivity analysis was performed to find the variables that require careful calibration or design. Optimum conditions are recommended; taking into consideration the potential concerns of excess sedimentation and inundation, and the possible effects of the freshwater diversion through the connecting channel into the St Lucia Lake is quantified using the model developed by Lawrie & Stretch (2011b). Results are compared to that of previous management strategies, as well as the current scenario of a combined mouth system – as recommended by Lawrie & Stretch (2011b).

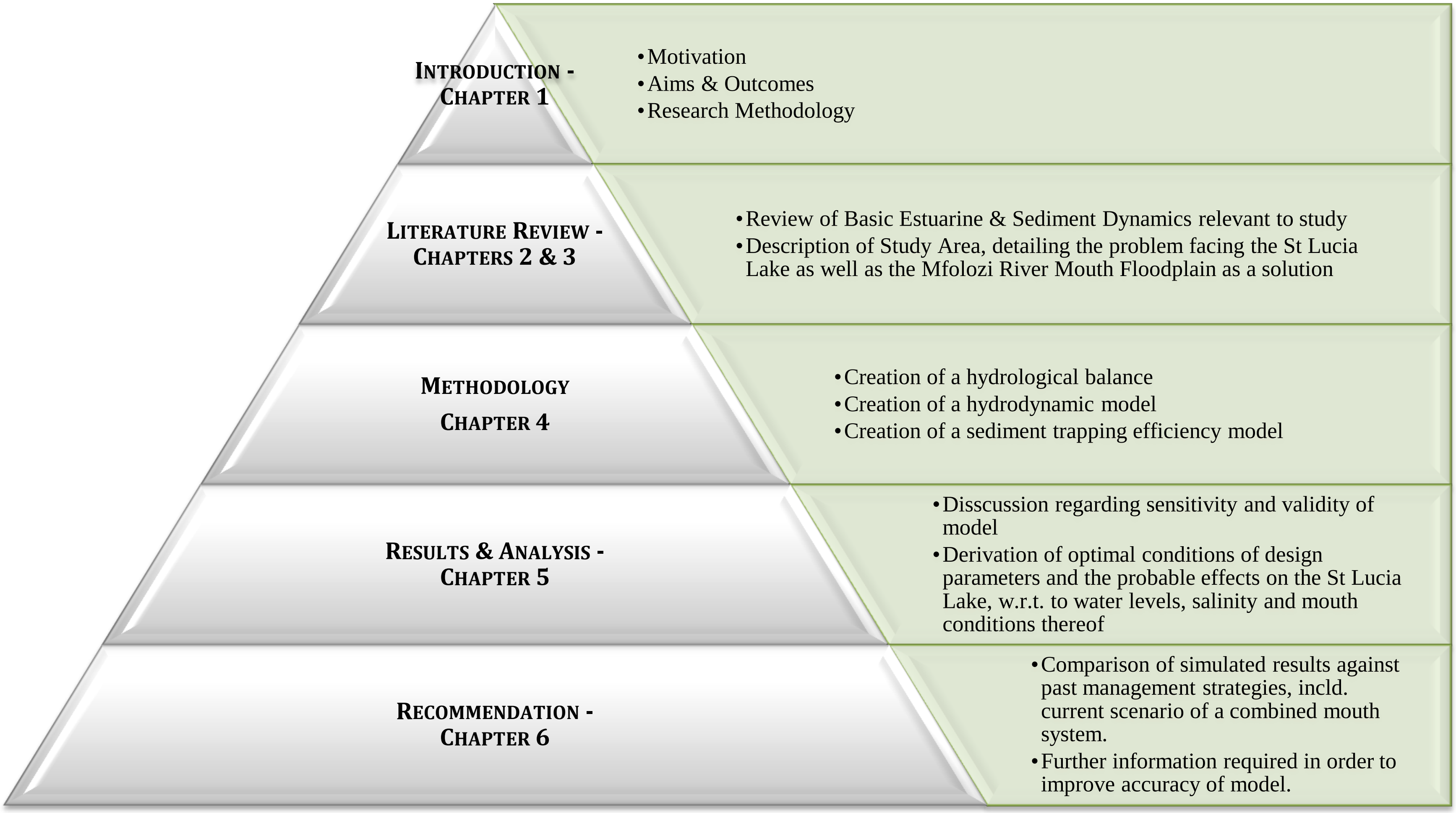
1.5. CHAPTER LAYOUT

The second chapter of this dissertation focuses on giving a broad introduction to estuaries – including their importance, how they function and the characteristics which are relevant to this study. Chapter three contains a brief description of the two estuarine systems' geographical features. It also explains the importance of the St Lucia Lake complex and expands on the problem that it faces, by clarifying the role of freshwater diversions from the Mfolozi River.

In Chapter four, the mechanics used to create a water balance and simulate the Mfolozi estuarine functioning is discussed in detailed, including the investigation and comparison of available hydrological field measurements and validated simulation data which is used to populate the model.

A review of the model's ability to simulate the estuarine functioning (including results of a sensitivity analysis and a validation against existing data) is discussed in Chapter five. Derivation of optimal conditions and the effects thereof on the health of the St Lucia Lake is also analysed in this chapter. Chapter six summarises the recommendations made as part of this study.

Figure 1-1 is a pictorial description of the layout of this study as discussed above.



INTRODUCTION - CHAPTER 1

- Motivation
- Aims & Outcomes
- Research Methodology

LITERATURE REVIEW - CHAPTERS 2 & 3

- Review of Basic Estuarine & Sediment Dynamics relevant to study
- Description of Study Area, detailing the problem facing the St Lucia Lake as well as the Mfolozi River Mouth Floodplain as a solution

METHODOLOGY

CHAPTER 4

- Creation of a hydrological balance
- Creation of a hydrodynamic model
- Creation of a sediment trapping efficiency model

RESULTS & ANALYSIS - CHAPTER 5

- Disscussion regarding sensitivity and validity of model
- Derivation of optimal conditions of design parameters and the probable effects on the St Lucia Lake, w.r.t. to water levels, salinity and mouth conditions thereof

RECOMMENDATION - CHAPTER 6

- Comparison of simulated results against past management strategies, incld. current scenario of a combined mouth system.
- Further information required in order to improve accuracy of model.

Figure 1-1: Chapter Layout

2. A BRIEF INTRODUCTION TO ESTUARIES

2.1. DEFINITION OF AN ESTUARY

Davies (1980, as referenced in Duck & da Silva, 2012), defines estuaries as being: “lower courses of rivers more or less invaded by the sea and which may or may not be partly blocked by marine barriers”. It is essentially a body of water that acts as an interface between land and sea - where saline sea water is diluted to varying concentrations by freshwater from inland, and where both fluvial and marine processes occur (Cooper, 2001). It is a subsidiary of coastal lagoons, bodies of water along a coastline, either partially or completely separated from the sea – however, estuarine systems include one or more rivers that have a varying degree of influence in both the hydrodynamics and ecology of the system (Duck & da Silva, 2012).

The South African coastline includes approximately 258 estuaries. The majority (71%) of these estuaries, including the Mfolozi River estuary and the St Lucia estuarine lake, are described as *temporarily opened/closed estuaries* (Perissinotto, et al., 2010). These estuaries have an intermittent surface water connection with the sea, and are defined as being open or closed, depending on which mouth state is more prevalent (Riddin & Adams, 2008). Begg (1984, as referenced in Cooper, 2001) states that estuaries in Kwa-Zulu Natal are generally open for either more than 70% of the time or less than 30% of the time.

The following description provided by Perissinotto, et al. (2010) indicates the typical functioning of a *temporarily opened/closed estuary*: fluvial discharge during dry seasons is unable to prevent a sand berm from building up and blocking an estuary’s inlet (the mouth). The water level in the closed estuary increases until it overtops the berm. The berm is scoured away and the water level in the estuary varies with the tide around an *Estuarine Mean Water Level* (EMWL). The berm can also be overtopped due to high wave energy. During the rainy seasons, the river flow is high enough to ensure that the berm cannot close due to sediment transported through long and cross-shore currents. The mouth can also be kept open if the tidal prism is large enough to prevent sediment from closing it. A tidal prism is defined by Douglass & Krolak (2008) as being the difference in the volume of water in a coastal body of water (such as a bay or estuary) during high tide and low tide.

2.2. DESCRIPTION OF RELEVANT ESTUARINE CHARACTERISTICS

There are many characteristics that influence the hydrodynamic mechanism of estuaries. The following brief descriptions are to serve as an introduction to characteristics that are relevant to the simulation of the water balance and estuarine mechanism for the Mfolozi floodplain, which is a temporarily open/closed estuary:

2.2.1. CATCHMENT CONDITIONS

The condition of an estuary's catchment area determines the water quality and flow rate of the freshwater input into an estuary. This in turn influences:

- the period in which the estuary is to remain closed until the estuarine water levels reach that of the sand berm, resulting in the berm being breached,

- the period in which the mouth is to remain open until the discharge through the inlet is low enough to allow marine sediment to accumulate and build up the sand berm,

- the salinity levels prevalent in the estuary, especially during closed-mouth conditions and periods of high evaporation rates,

- the influx of sediments along with the river discharge – during higher discharge rates, more sediment is flushed through the rivers into estuaries,

- the nutrient load introduced into the estuary which can possibly lead to eutrophication – a process that is detrimental to the ecology. With the increase in industrial development, and the subsequent waste discharge into rivers, the nutrient loading can be substantial. An example is the Neva Estuary in Russia, which suffers from the effects of eutrophication due to the high nutrient loads present in the Neva River discharge (Golubkov & Alimov, 2010).

The river discharge from a catchment depends on various factors. The first factor to be considered is the climatic condition of the area. This varies from the east coast of South Africa (termed as a subtropical climate which is humid and experiences a large amount of precipitation during the summer months) to the arid and dry west coast (Cooper, 2001). The climatic conditions directly affect the amount of rainfall experienced by a catchment area and therefore (as mentioned above) directly influence the river discharge entering the estuary, as well as the quantity of sediment carried by the river into the estuary. Besides seasonal variation, records of precipitation, also display trends of long-term wet and dry periods. An example of such is indicated in Figure 2-1. Figure 2-1 depicts the 'annual rainfall index, defined as the normalized deviation from the annual average' on the y-axis, which was plotted by Lawrie & Stretch (2011b) with reference to the catchment area which feeds the St Lucia Lake, against the year of the measurement on the x-axis. This factor does become critical as it influences the length of time (which can last a number of years) that the inlets of estuaries remain closed or open.

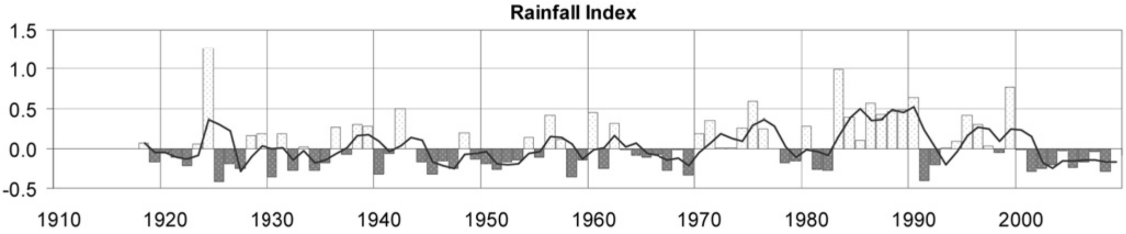


Figure 2-1: Annual rainfall index of the catchment feeding freshwater into the St Lucia Lake (Lawrie & Stretch, 2011b)

The terrain of the catchment area is the second factor for consideration. An example of the range of conditions experienced on our coastlines is the steep hinterland gradient off the Kwa Zulu Natal coastline compared to that of gentle gradients of the hinterland alongside the west coast of South Africa. The steeper the terrain, the faster the precipitation over the catchment area can drain into the rivers. This implies that the river flow rate entering the estuary will be greater, but that its distribution will be over a shorter period of time.

A reduction in discharge due to increased water demands and the construction of dams along rivers affects the functioning of estuaries negatively – it reduces the water levels and the amount of time estuaries have closed inlets. It can also result in less water to dilute saline seawater. The Coorang Estuary, in Australia, is typical example of such a case: increased demand in irrigation water and the construction of barrages has substantially decreased the river discharge at the mouth of the river resulting in reduced water levels and high salinities (Webster, 2010).

Other hinterland conditions, such as the size of the catchment and land usage, also contribute to the discharge rate of the river entering the estuary as well as amount of sediment and nutrients transported via rivers entering the estuaries. For example, precipitation over developed areas runs off faster into rivers as compared to areas which are heavily vegetated. This also implies a greater flow rate over a shorter period of time into the estuary (Perissinotto, et al., 2010). The higher the velocity of the fluvial discharge, the more sediment is able to be transported into the estuaries.

2.2.2. WAVE AND TIDAL CONDITIONS

Cooper (2001) indicates that all South African estuaries are generally *microtidal* (the spring tidal range experienced is less than 2.0m) and have high wave energy.

Perissinotto, et al. (2010) state that in estuaries, the tidal range is an important factor in determining the amount of sea water transported and removed from an estuary during ‘tide-driven exchange flows at open inlets’. There exist three tiers in order to classify tidal ranges along coastlines, which are defined in the Encyclopaedia Britannica (2010) as follows: microtidal (tidal range less than 2m), mesotidal (between 2 and 4m) and *macrotidal* (greater than 4m).

Wave energy plays a crucial role in the transportation and deposition of marine sediments into estuaries (Perissinotto et al 2010). It therefore plays a large role in the opening and closing of estuaries’ inlets. High wave energy can also result in the sand berm, blocking an estuary mouth, being overtopped by waves. This can result in salt water being added to a closed environment (increasing the salinity of the system) or the scouring of the berm – as seen in 2007 during *Cyclone Gamede*, when waves overtopped the St Lucia Lake berm (Whitfield & Taylor, 2009).

2.2.3. GEOMORPHOLOGY OF THE ESTUARY

Cooper (2001) suggests that South African estuaries should be classified using their geomorphology to differentiate between them as other factors, such as the “tidal range, wave energy and sea-level history” are relatively constant throughout the coastline. The basic functioning of an estuary is largely dependent on its geomorphology. It influences the inlet mechanism and as a result, also the water levels, salinity concentrations, sediment and scouring processes and the extent of marine species recruitment – all of which affect the health of the estuary’s ecology. As a result, the geomorphology of an estuary is a key attribute in the modelling of an estuarine system.

The volume of water stored as the water level increases behind the berm during closed conditions is termed as the hypsometric characteristic of the estuary. In large flat estuaries (such as the Mfolozi floodplain), a large storage is realised before the berm is breached. This is the opposite in estuaries with steep terrain. The frequency at which the berm is overtopped and an estuary is opened also depends on both the estuary’s hypsometric characteristic, as well as its relation to the height of its *supratidal* barrier (Perissinotto, et al., 2010).

The surface area of the estuary has an effect on the amount of water lost from an estuary due to evaporation. This becomes important during closed-mouth conditions, as it allows for the increase of salinity levels in the estuary when there is little fresh water input.

In shallow estuaries, mixing of the water columns can occur due to two mechanisms. The first mechanism is the higher ‘frictional resistance to flow’ experienced due to larger proportion of surface bed area to volume of water (Perissinotto, et al., 2010); and the second is due to wind across the water surface which encourages mixing in shallow systems (Chuwen, et al., 2009). In deeper estuaries, stratification occurs, i.e. the deeper one goes, the higher the salinity and the lower the dissolved oxygen that is prevalent in the water. High salinity and low dissolved oxygen levels do not provide a conducive environment for the general ecology of the estuaries.

The height of the *supratidal* barrier, besides determining the frequency of breaching events, also determines the maximum water level in a river mouth’s floodplain, as well as the scouring potential and removal of deposited fluvial sediment during breaching events. Due to human settlement along river mouths, the maximum level of water stored behind a closed sea berm (*supratidal* barrier) becomes crucial and has led to artificial breaching in many instances. A lower sea berm decreases the ability of a breaching event to scour fluvial sediment that has been deposited in the estuary during a closed-inlet period (Perissinotto, et al., 2010). Over a long period of time, the sediment accumulation can lead to the infilling of the estuary.

2.2.4. MOUTH DYNAMICS

The dynamics of the opening and closing of estuary mouths is essential to the modelling of an estuarine system. Pierce (1970, as referenced in Kraus, 2008) identifies two mechanisms for the natural breaching of these *supratidal* barriers. The first involves seepage through the berm, driven by a hydraulic head difference between the impounded water and the sea, liquefying portions of the berm and thereby undermining it – causing it to breach. This form of breaching does not require the water in the estuary to reach the height of the sea berm and generally occurs on beaches where the barrier is narrow.

The second breaching mechanism, more applicable to this study considering the wide beaches along the north eastern shores of South Africa, is that where 'running surface water or overflow scours a trough between the sea and the body of water' (Kraus, 2008). As indicated in Figure 2-2, this can occur either by the water level in an estuary increasing, or by the berm being breached by high waves such as that caused by surges during a storm. An example of such occurred in 2007 when Cyclone Gamede caused the berm at the St Lucia estuary to be breached (Whitfield & Taylor, 2009).

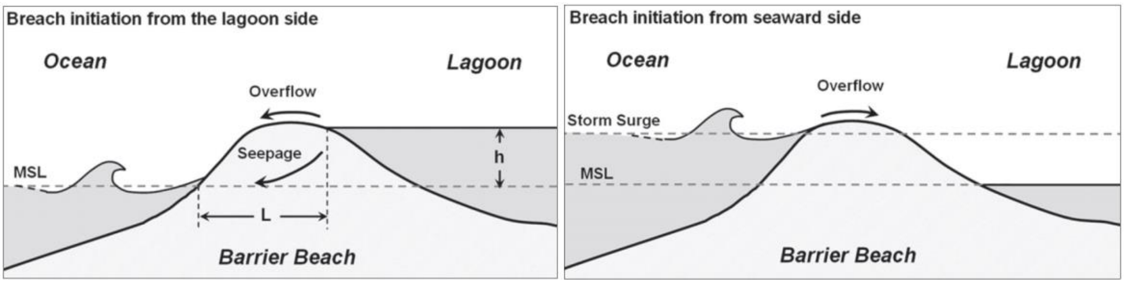


Figure 2-2: Breaching of supratidal barrier can be a result of overflow from either high estuarine water levels or high sea levels caused by a storm (Kraus, 2008)

At this point the sea berm will be overtopped and scoured away. This also results in sediment, accumulated in the estuary, to be scoured and flushed out to sea as well and water levels in the estuary will resume back to fluctuating around the *Estuarine Mean Water Level* (EMWL) – the mean water level in the estuary during open mouth conditions.

Two methods of mouth closure have been detailed by Ranasinghe & Pattiaratchi (2003). Both mechanisms are characteristic of microtidal, high wave energy environments and involve inlet currents. The first method involves the interaction of the inlet currents with sediments transported by *long-shore* drifts. An *up drift* shoal is formed, resulting in a spit blocking the inlet of the estuary when flow through the mouth is low enough.

The second closure process is a combination of inlet currents and sediment transported by *cross-shore* drifts. As a result, sediment is deposited on the beach. If the flow through the inlet (either due to river discharge or tidal prism) is low enough, sediment can also be deposited at the mouth and will eventually accumulate to form a sand berm. Figure 2-3 illustrates a comparison between the two processes. Note that in the context of the South African east coast, high stream flow occurs in summer, and low stream flow in winter.

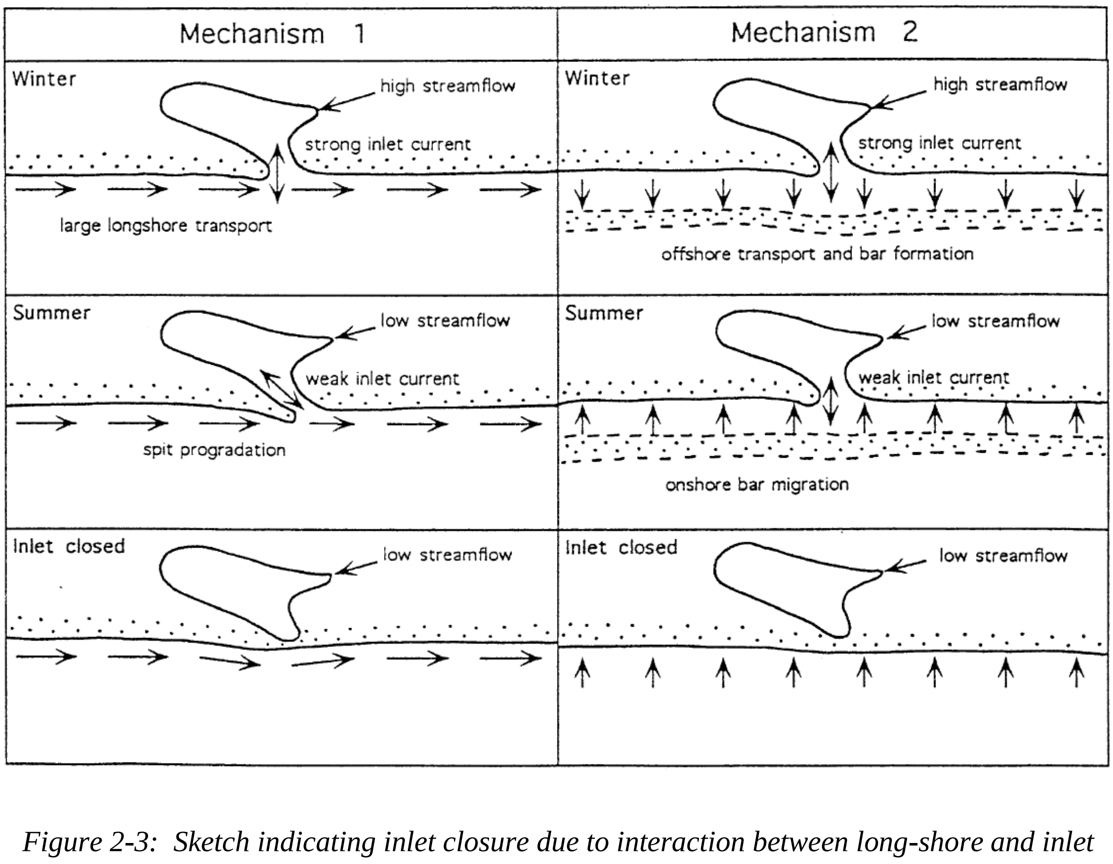


Figure 2-3: Sketch indicating inlet closure due to interaction between long-shore and inlet currents (Mechanism 1) and inlet closure due to interaction between cross-shore and inlet currents (Mechanism 2) - (Ranasinghe & Pattiaratchi, 2003)

Perissinotto, et al. (2010) suggest that the two methods do not work in isolation – rather that the sediment supplied by the *long-shore* drift is coerced into position by the *cross-shore* drift, leading to the closure of the estuary's inlet. In South Africa, the *long-shore* drift transports approximately 400 000 – 1 200 000 m^3 of sediment, parallel to the coastline in a northerly direction, per annum (Perissinotto, et al., 2010). Stretch & Zietsman (2004, as referenced in Perissinotto, et al., 2010) estimates an annual rate of 5 400 – 7 300 m^3 of sediment deposited by cross-shore drifts per meter of coastline. This rate becomes significant depending on the width of the inlet. Due to the estimated sediment flow rates, it can be implied that the closure of the inlets occur through a combination of *Mechanism 1* and *Mechanism 2* (as indicated in Figure 2-3) in varying degrees.

The height of the sand berms blocking the inlets of estuaries depends primarily on the type of marine sediment available. For example, Cooper (2001) states that due to fine sediments in the southern Cape coastline, the beaches and berms have gentle gradients as well as more off-shore bars. This is opposed to the coastline along the coast of Kwa Zulu Natal, where due to sediment of a coarser nature the beaches are much steeper resulting in higher berms.

2.2.5. SALINITY LEVELS

Salinity is a dimensionless indicator which is measured as the mass of dissolved solids, in grams, found in one kilogram of sea water (Stewart, 2007). In 1978, the *Joint Panel on Oceanographic Tables and Standards* decided that conductivity tests would be used as a standard method to measure salinity. The conductivity of sea water is measured against the conductivity of a standard potassium chloride solution. This test is referred to as the *Practical Salinity Scale of 1978* (Stewart, 2007).

Saline water is introduced into the estuaries from the seawater that enters through the inlet or through overtopping the sea berm which separates the estuary from the sea. The seawater mixes and is diluted with the freshwater from the river. When freshwater inputs into an estuary are low and evaporation rates are high, the salinity in estuaries can increase.

Salinity can also be introduced into the estuary via salt loads in the river. Removing vegetation from the catchment area for any number of anthropogenic activities can cause the water table to rise. The rising water table flushes up salts that are stored underground, to surface. When it rains, these salts are washed into the rivers that feed estuaries (Chuwen, et al., 2009).

Exceedingly high salinities can result in the death of certain species. Whitfield & Taylor (2009) describe 'extreme hypersalinity' as being saline concentrations that are greater than 60. This value can be compared to the average salinity of seawater which ranges between 32 and 38 (Gulf of Maine Ocean Observing System, 2010). This is prevalent in the Coorang Estuary, in Australia. The freshwater inflow into the southern compartment of the Coorang is less than the rate of evaporation; as a result salinities in excess of 100psu have been recorded. This has been detrimental to the invertebrates and polychaetes local to the estuary, which has in turn affected species higher in the food web, such as the birdlife (Webster, 2010).

Chuwen et al. (2009) conducted a study to compare the salinity, water temperature and dissolved oxygen of eight estuaries along the coast of south-western Australia. The estuaries ranged from being normally and permanently open to normally closed.

The study indicated that in *normally open* estuaries, the salinity experienced during open mouth conditions, was that close to sea water. When the mouth closed, the salinity began to decrease due to the incoming fluvial discharge reducing the concentration of salt. When the mouth breached, the incoming sea water would increase the salt concentration. The salinities experienced in these estuaries did not exceed that of seawater by a significant amount.

In a *normally closed* estuary however, the salinities increased dramatically during closed conditions. Normally closed estuaries are characterized by low fluvial discharge, therefore when the estuary mouth closed, the salt concentration of the estuary increases due to evaporation.

Bodies of water that have little mixing tend to have stratified layers, i.e. certain characteristics (namely the salinity and dissolved oxygen levels) of water columns vary with respect to depth. Chuwen, et al. (2009) describe the estuaries along the southern Australia and African coasts to have two parts: a shallow basin and a deeper, narrow 'riverine region'. It is a general norm that the salinity at the bottom of the column is to be higher than that of the top. This is due to the increase in fluid density as the salinity increases. In the estuarine basins, Chuwen, et al. (2009) indicate that the difference between the measurements taken at either end of the water column is minimal. This is in direct contrast to the data collected in the river inlet into the estuary. Chuwen et al. (2009) attribute this to the fact that in shallow basins, wind allows for mixing and therefore dissuades stratification.

Thill, et al. (2001) note that during an open inlet, due to the higher density of seawater, a salt water wedge permeates through the inlet along the floor of the estuary - therefore as one moves up the estuary, away from the inlet, the saltwater occupies a decreasing amount of the water column. The distance the saltwater wedge permeates upstream is dependent on the tidal range as well as the strength of the river discharge, i.e. during low flows, the saline water can be found further upstream of the river than during a flood event. This saline intrusion affects the ecology that exists in the river and its banks. There is also the possibility that saline water can quicken the flocculation process of suspended sediment as the "increased ionic strength reduces the electrostatic repulsion between particles" (Thill, et al., 2001). The increased flocculation of silt and clay particles can lead to a higher settling velocity and hence will increase the amount of fluvial sediment deposited in an estuary. Laboratory testing, conducted by Thill, et al. (2001) using sediment samples from the Rhone River could not conclusively confirm this theory; however laboratory testing conducted by Maine (2011) indicated that "aggregates which formed in saline conditions were larger than those which formed in fresh conditions". It must be noted that in the above study, no conclusive relationship between salinity and the rate of flocculation has been determined.

2.2.6. SEDIMENTATION

As discussed above, sediments are transported into the estuary basins via fluvial discharge and consist of fine suspended particulate matter and bed load which comprises of sand and gravel sized particles. In general it is observed that as a greater discharge velocity has more energy, it is able to transport both a higher quantity of sediment as well as larger sized particles. However in South Africa, due to the higher variance in river discharge, Annandale (1987) states that the availability of eroded sediment is the "limiting factor in sediment transport in rivers" which lends credence to the proposal set by Grenfell & Ellery (2009), who states that the sediment load of a river is a function of both the river discharge as well as the season - for example at the start of the rainy period after a dry winter. This theory, as well as how it is applied to the model developed as part of this study is discussed further in Section 4.2.4.1.

Sediment loading in a river entering an estuary is also dependant on the geology and land usage of its catchment area. This affects the potential and extent of erosion that can occur and be washed into the drainage basin's river. For example, rocky terrains will produce a smaller sediment load when compared to dusty plains with scarce vegetation or a freshly ploughed field. In general, deforestation, overgrazing and other anthropogenic activities lead to a greater sediment yield into rivers (Gonzalez-Ortegon, et al., 2010).

Sediment deposited into an estuarine basin accumulates until a breaching event occurs and leads to the scouring of the inlet sand berm as well as of a portion of the accumulated deposition in the basin. There are various factors that affect the scouring potential of a breaching event, such as the height of the *supratidal* barrier, the morphology and shape of the mouth and inlet channel, the sediment characteristics, the strength of the river discharge or the tidal current and length of time the open inlet is maintained.

An excess of sediment in an estuary can be problematic for mainly three reasons. The first reason is that if excessive sediment is able to enter and settle into an estuarine basin, and a breaching event is unable to scour away enough of the accumulated sediment, over time this will lead to an infilling process. The estuary's water levels will decrease and eventually become a marsh or swamp. In most cases, estuaries are "naturally net sediment sinks" and the infilling process is a natural and expected process (Duck & da Silva, 2012), however anthropogenic activities, such as the increased sediment loads or artificially reducing the sea berm's height can hasten it. The case study scenario of Ria de Aveiro, a Portuguese estuary discussed in Section 1.1, is indicative of an estuary that was naturally undergoing an infilling process. Although the infilling process was not expedited due to human concerns, the inlet of the estuary was artificially manipulated to remain open in the 1800s, as the estuary was a viable harbour. This action has led to the deepening of the estuary and high salinities which has resulted in the loss of plant species as well as large areas of both salt and freshwater swamps (Duck & da Silva, 2012).

Perissinotto, et al. (2010) state that estuarine sediment, unlike marine sediment, consists of a large portion of organic content. The sediment introduced into estuaries via rivers, is also a carrier of nutrients (Webster & Ford, 2010), often prevalent due to fertilizers used in crops alongside rivers or industrial and sewage waste discharges (Garnier, et al., 2010). These nutrients lead to eutrophication. Eutrophication is a process whereby there is an outburst of algal growth which can suffocate indigenous animal and plant species subsisting in the estuary by reducing dissolved oxygen and decreasing the amount of sunlight able to penetrate into the water. Perissinotto, et al. (2010) indicate that nutrients released to sea during a scouring event may be beneficial in terms of introducing nutrients to an otherwise oligotrophic environment. It is interesting to note that this is not always the case, as seen in the Seine estuary where coastal eutrophication regularly occurs in the plumes exiting the estuary, which negatively affects the local fisheries (Garnier, et al., 2010). Fabricius and De'ath (2004, as referenced in Webster & Ford, 2010) indicate that a decrease in the biodiversity and health of coral populations located on the Great Barrier Reef in Australia is also due to ‘increased riverine inputs of nutrients, sediments, and pesticides’ that are related to human settlement.

The third problem associated with high sediment loads is the correspondingly high turbidity that is prevalent in the water. This turbidity is detrimental to certain species, whilst to others it is favourable as seen with fish species in the St Lucia Lake. Turbidity has negative effects on the primary and secondary producers in an estuarine system: it ‘increases the attenuation and back-scattering of light’ thereby decreasing the productivity of phytoplankton, and it makes it difficult for zooplankton to locate its prey (Carrasco, et al., 2007). The mortality of marine juvenile recruits is also increased at high turbidity regions (Gonzalez-Ortegon, et al., 2010). Cyrus & Blaber (1987) note that there were five turbidity ranges in which different fish species would thrive and that as a result, the turbidity of the water influenced the occurrence and distribution of ‘juvenile marine fish’ species.

3. THE ST LUCIA LAKE & THE MFOLOZI RIVER FLOODPLAIN

3.1. GEOGRAPHY AND IMPORTANCE OF THE ST LUCIA LAKE

The St Lucia Lake complex is situated on the coastline of northern Kwa-Zulu Natal, South Africa. Its surface covers an area of approximately 350 km^2 (Whitfield & Taylor, 2009) and is fed by five rivers: the Mkhuze, Mzinene, Hluhluwe, Nyalazi and the Mpate Rivers (Lawrie & Stretch, 2011a). The Mkuze Swamp, lying to the north of the St Lucia Lake, is South Africa's largest swamp. To the south of the St Lucia Lake, is the Mfolozi Swamps and floodplain. Figure 3-1 illustrates the rivers that feed the St Lucia Lake directly and Figure 3-2 is a locality plan of the estuary.

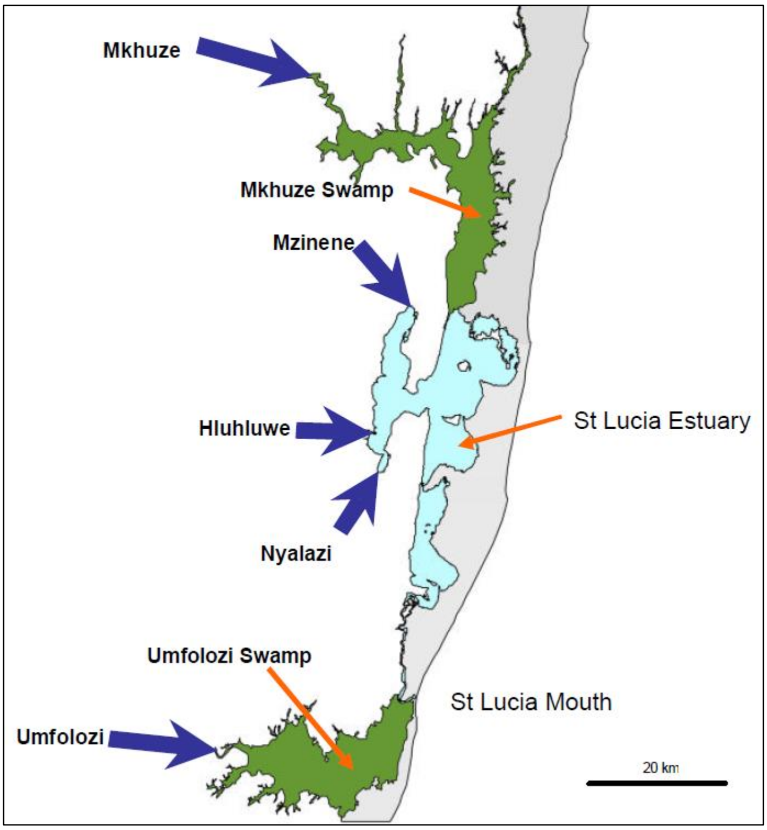


Figure 3-1: Surrounding areas and rivers of the St Lucia Lake estuary (Taylor 2006). The Mpate River (not indicated) enters the Lake in the northern part of the Narrows.

The lake complex comprises of five main parts: the North Lake, False Bay, Tewate Bay, South Lake and the Narrows (leading to the estuary's mouth). North Lake and False Bay are, in most cases, the first parts of the lake to experience hypersaline and extreme low water level conditions during times of drought (Whitfield & Taylor, 2009).

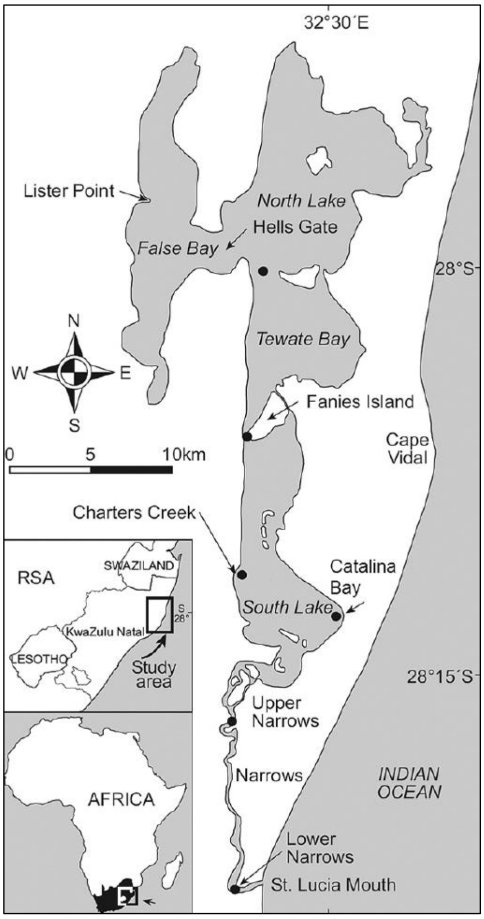


Figure 3-2: Locality plan of the St Lucia Lake estuary (Cyrus, et al., 2010)

The St Lucia Lake complex forms one of largest estuaries in this continent and is a crucial nursery ground for juvenile aquatic species which restock the fish and prawn populations found off shore (Cyrus, et al., 2010) for many species of fish and invertebrates. It is also one of the largest protected environments for birdlife and larger animals, such as crocodiles and hippos (Whitfield & Taylor 2009).

Due to its size, biodiversity and its status as both a *World Heritage Site* and *Ramsar Wetland of International Importance* (Whitfield & Taylor, 2009), the estuary attracts large numbers of international and local tourists. The lake and its sustained ecological functioning therefore forms a crucial part of the locality's economy.

3.2. GEOGRAPHY OF THE MFOLOZI RIVER FLOODPLAIN

The Mfolozi River has a large catchment area of approximately 11 068 km^2, comprising of mainly natural vegetation (Grenfell & Ellery, 2009) and steep terrain (Grenfell, et al., 2009). The Black and White Mfolozi Rivers join approximately 50km to the west of the Mfolozi River mouth to form the Mfolozi River (Grenfell, et al., 2009).

Grenfell et al (2009) state that the Mfolozi River discharge is extremely inconsistent and has a *coefficient of variability* of 79%. A *coefficient of variability* is a dimensionless statistical term which indicates the ratio between the standard deviation and mean of the same data set (Zady, 1999). A high *coefficient of variability* implies that the river discharge has a high standard deviation and is therefore, as suggested by Grenfell et al (2009), comprised of 'infrequent large floods and frequent below average flows'.

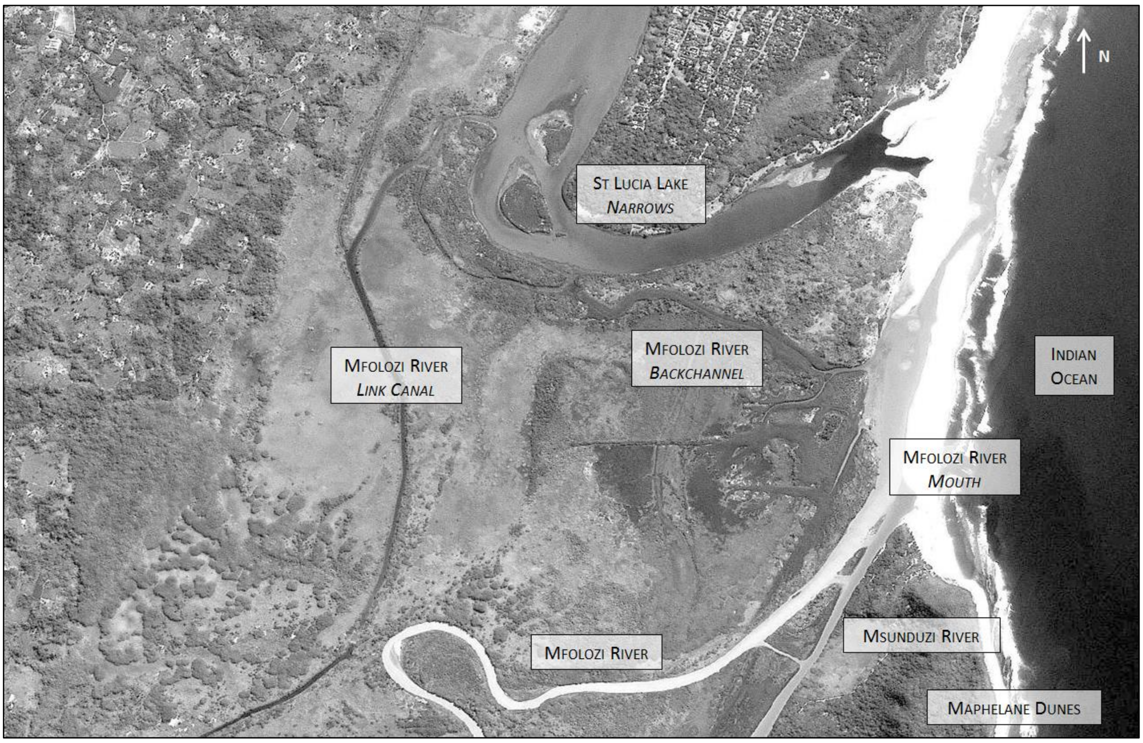


Figure 3-3: Aerial view of Mfolozi River Mouth and surrounding watercourses (2012)

The Mfolozi River floodplain is bounded by the Lebombo Mountains in the west, and the Maphelane Dunes and the Indian Ocean in the east (Grenfell, et al., 2009). It is a relatively large floodplain, approximately 200 km^2, and stretches approximately 30 km westward of the mouth. The elevation of the floodplain ranges from approximately 0.8m GMSL near the mouth of the estuary to 19.8m GMSL upstream of the floodplain (Umfolozi Sugar Planters Ltd., 2010).

There are three lakes that surround the floodplain, namely Lake Teza (south-west of the floodplain), Lake Futululu (in the north) and the St Lucia Lake (north-east of the floodplain). A second river, the Msunduzi River drains water from a catchment area that is localised in the floodplain (Grenfell, et al., 2009). As indicated in Figure 3-3, the Msunduzi joins the Mfolozi River close to the mouth.

According to Grenfell et al (2009), two-thirds of the floodplain is used for commercial sugar cane plantations. The remaining third is owned by the iSimangaliso Wetland Park. Part of this land is used by subsistence farmers. Figure 3-4 illustrates a sugar cane plantation in the Mfolozi River floodplain with a drainage canal. Canalisation of the floodplain began in the early 1930s to prevent the inundation of the farms. There is currently 94.4 km of main drainage canals that have been constructed in the floodplain (Umfolozi Sugar Planters Ltd., 2010).

Figure 3-4: The Mfolozi River floodplain was canalised to prevent the inundation of the low lying farms (van Vuuren 2009)

Prior to 1952, the Mfolozi River shared a combined mouth with the St Lucia Lake estuary. The mouth of the Mfolozi was then separated and dredged 1.5 km south of its original position. The Mfolozi River mouth currently travels northward at a rate of 60m/month towards its original position. Its general position near the Maphelane dunes is maintained by artificial breaching (Whitfield & Taylor, 2009).

3.3. CONSEQUENCES OF ANTHROPOGENIC ACTIVITIES EFFECTING THE ST LUCIA LAKE AND THE MITIGATING MANAGEMENT STRATEGIES IMPLEMENTED

The current sea levels were reached approximately 6000 years ago. At this point, the St Lucia Lake estuary was up to 40m deep in some areas and covered a surface area of about 1165 km^2. Through the natural and continuous process of sediment deposition, as discussed in Section 2.2.6, portions of the lake (including the Mkhuze and Mfolozi swamps) were filled with sediment transported by the rivers, resulting in the lake becoming shallower and the surface area reducing dramatically (Whitfield & Taylor, 2009).

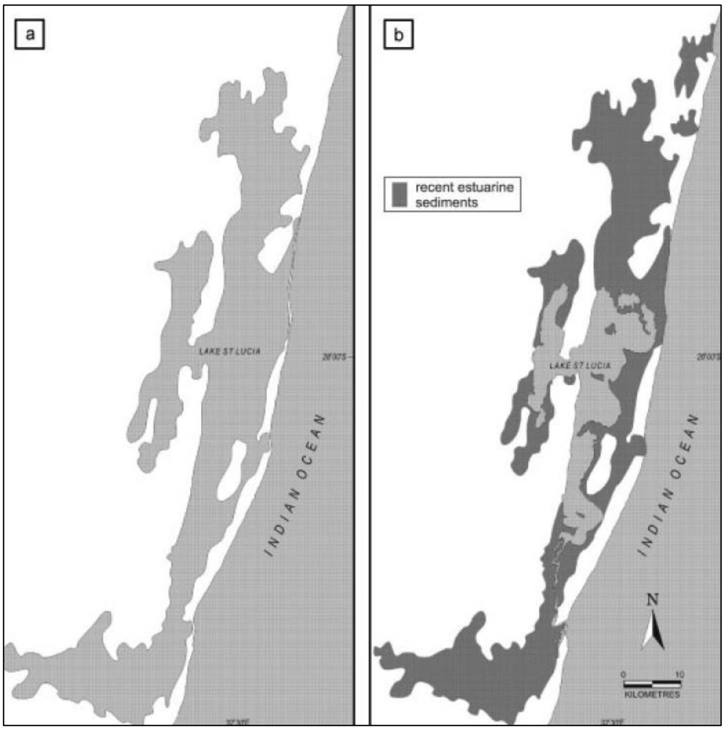


Figure 3-5: Surface area covered by the St Lucia Estuary Lake estuary (a) 6000 years ago as compared to that of (b) present day – area shaded in dark grey represents the "recent estuarine sediments" (Whitfield & Taylor 2009)

Figure 3-5 illustrates the surface area covered by estuary 6000 years ago compared to that of present day. It is important to note that although a large portion of the problem facing the St Lucia Lake estuary is due to anthropogenic activity, the lake is also undergoing a natural process of accumulating sediment to become shallower, eventually resulting in dry land. This natural process, however, is being hastened by human interference.

Prior to any human intervention, the Mfolozi River would flow through the Mfolozi swamp where a large amount of sediment in the fluvial discharge would be filtered before entering the St Lucia Bay. The St Lucia Bay (refer to Figure 3-6 below) was a point where both the mouths of the Mfolozi River and St Lucia Lake were combined. During the rainy season, when the combined flow of the St Lucia Lake estuary and the Mfolozi River was strong enough to maintain an open inlet, the Mfolozi River's discharge would flow out to sea during the ebb tide. During the dry seasons, when the combined mouth would close due to low discharge, water from the river would flow up through the Narrows to provide a fresh water supply to the lake. This would prevent a dramatic water level loss as well as high salinity levels from occurring during periods of high evaporation. When the water level reached the height of the sand berm, the mouth would be breached and the sediment deposited in the St Lucia bay would be scoured and flushed out to sea (Whitfield & Taylor, 2009).

Figure 3-6: Illustration of the St Lucia Bay (Taylor, 2006)

However, by the 1920s, farming of the Mfolozi floodplain had commenced. To prevent the Mfolozi River from flooding the farms, the river was canalised. The Warner's Drain (the main canal) was constructed during the 1930's (Whitfield & Taylor, 2009). The canalisation of the

Mfolozi River retarded the ability of the floodplain to filter out the sediment naturally, and therefore high sediment loads were introduced into the St Lucia Bay.

Due to concern that a high sediment loading from the Mfolozi River was being introduced and accumulated in the combined mouth, a new mouth (approximately 1.5 km south of the original combined mouth) was dredged for the Mfolozi River in the 1951 (Whitfield & Taylor, 2009).

Another motivation for separating the two mouths was that the local farmers did not wish for their farms to be inundated when the water levels in the Mfolozi River floodplain rose due to the combined mouth being closed – which occurred less frequently when the Mfolozi River mouth was separated from the lake. Figure 3-7 indicates the transition from a single combined mouth with the St Lucia Bay, to the separated mouths.

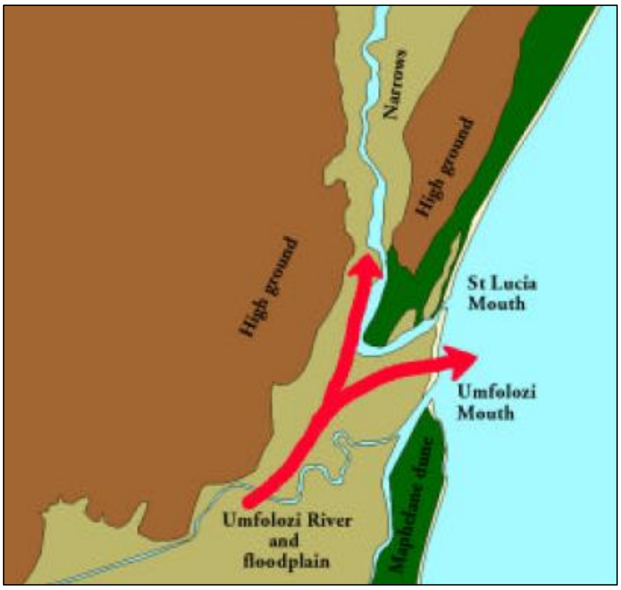


Figure 3-7: Illustration indicating the separate inlets of the Mfolozi River and St Lucia Lake estuary's (Taylor, 2006)

The Mfolozi River discharge is greater than the sum of the fresh water inputs from the other feeder rivers as well as the direct precipitation and ground water flow into the estuary (Whitfield & Taylor, 2009), and became significant to the St Lucia Lake's functioning during periods when both mouths were closed. The St Lucia Lake estuary was now deprived of its biggest fresh water source. As a result, the discharge through the St Lucia mouth was not large enough to maintain an open inlet.

Low water levels in the St Lucia Lake estuary result in long closed-mouth periods since the discharge is too small to keep the mouth open for necessary lengths of time. Most of the fish species in the estuary require access to the sea to facilitate the breeding process. Lack of access to sea discourages the breeding of the fish species. This also would affect the survival of the predators which feed on the fish – such as pelicans or crocodiles.

Whitfield & Taylor (2009) states that it took five years to create a *stable* artificially breached inlet at the St Lucia Lake mouth and a further 8 years to remove the excess sediment that had accumulated in the estuary. An open mouth was then maintained by method of dredging as it was believed that a surface water connection to the sea was crucial for the propagation of the fish and invertebrate species that used the estuary as a nursery ground (Whitfield & Taylor 2009). After the above thirteen years of dredging, the *Narrows* of the St Lucia Lake was deepened in an effort to encourage the circulation of water in the shallower compartments of the lake. An engineered inlet was also constructed at the St Lucia mouth in order to assist with maintenance of a permanently open mouth (Taylor, 2011a).

This management plan proved to be both detrimental and costly. During the drought of 1967 – 1972, the St Lucia Lake mouth was still open. The inflow of sea water, high evaporation rates and low fresh water input resulted in extremely high salinity levels at the *Estuarine Mean Water Level* (due to open-mouth condition). Both the plant and animal species suffered– the harsh salinity of the water destroyed shoreline vegetation and certain fish species which were intolerant to the high salinities. As a result, animals such as hippopotami, crocodiles and bird species faced both dehydration and starvation (Taylor, 2006).

In response, a link to bypass fresh water from the Mkhuze River around the swamp into the estuary was attempted in order to relieve the hypersalinity experienced in the lake. This action failed as the amount of fresh water provided was not enough to effectively reduce the salinity levels in the St Lucia Lake estuary. The bypass canal, besides being costly, also resulted in portions of the Mkhuze swamp drying up (Whitfield & Taylor, 2009).

Another development in the early 1970s was the construction of the Backchannel (refer to Figure 3-3) in order to transfer freshwater from the Mfolozi River into the St Lucia Lake. This concept was developed further in the late 1970s with the construction of the Link Canal. The Link Canal served the same purpose, however it abstracted water further up the Mfolozi floodplain and had a mechanism that would only allow water to flow through during 'average rainfall periods' when the sediment loading was assumed to be low. As indicated in Figure 3-3, the Link Canal deposits the water further upstream the Narrows as compared to the

Backchannel. Both linkages were expected to be used in conjunction with the artificially-maintained, permanent open St Lucia Lake mouth. The construction of the Link Canal was nearing completion in 1984, when it was damaged by Cyclone *Domoina*. The damage caused by this flood also resulted in the destruction of the engineered works at the lake's inlet (Taylor, 2011a).

It is only in the drought period that began in 2002 that the St Lucia Lake mouth was allowed to close naturally (Whitfield & Taylor, 2009). The absence of a reliable and sufficient freshwater source, namely the Mfolozi River discharge, could be clearly seen. When the mouth closed, a dramatic decrease in the estuary's water level occurred due to evaporation. After two and a half years, following the closure of the estuary's mouth, 40% of 'commonly occurring fish species' had vanished and by July 2006, 90% of the lake's surface had dried up. This had a disastrous effect on other species, such as pelicans, which depended on the fish as a food sources (Whitfield & Taylor, 2009).

In 2007, Cyclone Gamede breached the sand berm blocking the St Lucia Lake inlet, and allowed the mouth to remain open for 175 days before closing. As water from the lake began to evaporate, this scenario could have resulted in extremely high salinities similar to the 1967-1972 drought (Whitfield & Taylor 2009). The problem was prevented by allowing water from the Mfolozi River to flow into the St Lucia Estuary for a period of 6 months during the dry season. This allowed for the water being diverted into the St Lucia Lake to contain minimal amounts of sediment (van Vuuren 2009). This successful attempt at introducing fresh water into the St Lucia Lake estuary shall be discussed further in Section 3.4.

Figure 3-8: Pier uncovered due to dramatic decrease in water levels experienced in the St Lucia Lake estuary (Taylor, as referenced in van Vuuren 2009)

The policy to maintain separate mouths for the Mfolozi River and the St Lucia Lake, whilst still allowing the inlets to close and open naturally continued until 2012. In July 2012 the decision to re-combine the mouths of the two estuarine systems was implemented (iSimangaliso Wetland Park, 2012a). It is approximated that between July and November 2012, a water level rise of approximately 1m was experienced in the lake (iSimangaliso Wetland Park, 2012b).

Although the immediate results, as well as simulations completed by (Lawrie & Stretch, 2011b) indicate that this management strategy will prove to be successful; there still remains a certain amount of uncertainty. In an effort to consolidate the research that has been completed over the past fifty years regarding successful management and conservation of the St Lucia Lake, as well as to recommend the most viable management strategy, a private consultancy was employed at the end of 2012 under *GEF Tender No. 2011/01 for Consultancy Services*. The expected outcomes of project include to examine and compare the merits and potential problems of the following three main options: an option where the two mouths are allowed to combine naturally, an option where a deliberate path is taken to engineer the two mouths to combine, and lastly an option whereby water is transferred from the Mfolozi River into the St Lucia Lake whilst still maintaining separate inlets.

3.4. MFOLOZI RIVER ESTUARY – POSSIBLE SOLUTION TO ST LUCIA LAKE PROBLEM

Mercer (1973) states that sufficient fresh water from the Mfolozi River estuary could be diverted into the St Lucia Lake solving the problem of high salinity levels. Many studies have been completed in order to explore methods of accomplishing this, and the construction of the Backchannel and the Link Canal, as discussed in Section 3.3, attest to attempts to implement this concept.

The focus of this study is to determine the feasibility of re-using the Backchannel, as well as to identify the optimum design parameters. The transfer rate of fresh water, allowed through Backchannel, is limited by the following two considerations:

- The first is the high sediment loading of the Mfolozi River during flood events (see Figure 3-9 below) which should not be allowed to enter the St Lucia Lake estuary for reasons discussed in Section 2.2.6.

- Water from the Mfolozi River estuary will only be able to be delivered into the St Lucia Lake estuary during closed-mouth conditions when the water has backed up against the sand berm blocking the inlet. There are low lying farms in the Mfolozi River floodplain which could be inundated when the basin starts to fill up.

Figure 3-9: High sediment loading in Mfolozi River during flood events (Taylor, as referenced in van Vuuren 2009)

In a study performed by Mercer (1973), it is stated that it was a recommendation of the *St Lucia Lake Commission of Inquiry* (1964 – 1966) that methods be explored to introduce water from the Mfolozi River estuary into the St Lucia Lake. The primary objectives of Mercer's (1973) study was to prevent the silting and closing up of the St Lucia Lake estuary (thereby losing the surface water connection to the sea by which fish and invertebrate species had to move through) as well as to prevent high salinities developing in the northern parts of the lake. His key aims were to determine whether sufficient water was available to be diverted, a reasonable position in the St Lucia Lake estuary at which to divert the water into, and to determine whether the benefit of the exercise would outweigh the cost.

According to his report, there is sufficient water that can be transported into the St Lucia Lake estuary. Mercer (1973) stated that if the mouth of the Mfolozi River estuary is blocked (allowing the water levels behind the berm to rise), a certain portion of the water can be drawn through a canal to enter the St Lucia Lake estuary at the 'First Shallows upstream of the road bridge'. This would ensure that no diverted fresh water would be lost to sea during the ebb tide. With regards to the limitation detailed above, Mercer (1973) detailed that maximum level of water in the Mfolozi River estuary before the berm was to be breached would 'not affect the sugar cane fields' and that the water from the Mfolozi River was not to enter the diversion canal directly. It must be noted that this study was carried out in 1974 and that since then, more of the lower lying areas of the floodplain has been farmed.

Another study performed by Hutchison (1973) also explored remedial methods to improve the high salinities and low water levels prevalent in the St Lucia Lake Estuary. Hutchison (1973) modelled the lake and its compartments, and compared its reaction to different remedial methods. Hutchison (1973) concluded that a relatively small amount of additional fresh water (60×10^6 m^3/annum) diverted into the St Lucia either at the Narrows or the Nyalazi River feed, would be very effective in improving the problems faced by St Lucia Estuary. It is interesting to note that the study indicated a feed of additional fresh water into False Bay, via the Nyalazi River feed (refer to Figure 3-1), had the most positive effect on the salinity of the St Lucia Lake as a whole when compared to the other options investigated. As a result of the recommendations above, the construction of the Link Canal to transport water from the Mfolozi River estuary to the St Lucia Lake, as described in Section 3.3, commenced in the 1980s. It was never completed due to its destruction during Cyclone Domoina in 1984.

A study, performed by Kelbe & Taylor (2005), identified Catalina Bay (refer to Figure 3-1) as being a critical point to focus on. Catalina Bay is the deepest part of the St Lucia Lake and has the largest ratio of volume to surface area. During a period of drought and high evaporation, this compartment of the lake would require the least amount of fresh water input to prevent hypersalinity. Animals and aquatic species could seek ‘refuge’ in this area until conditions of the lake begin to improve. Kelbe & Taylor (2005) modelled the system, for the period January 2002 to December 2004, as a series of spillways, i.e. water from the Mfolozi River, transferred via the Link Canal into the Narrows would spill into the Makakatana and then finally overflow into Catalina Bay – refer to Figure 3-10.

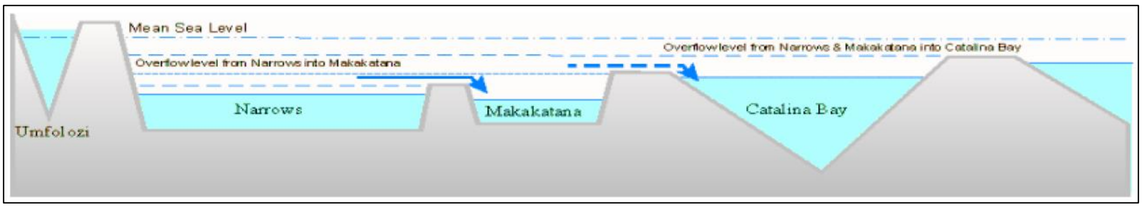


Figure 3-10: Schematic of fresh water flowing from the Mfolozi River into Catalina Bay using the existing Link Canal (Kelbe & Taylor 2005)

Their model concluded that a transfer flow rate of 20 000 m^3/day (7,32 x 10^6 m^3/annum) was required through the Link Canal in order to prevent the extreme hypersaline conditions that occurred in the St Lucia Lake during January 2004 (Kelbe & Taylor, 2005).

In 2007 during a drought, the berm was breached by Cyclone Gamede and the mouth was open for 175 days. The salinities in the St Lucia Lake, once the mouth closed, were expected to be extremely high. As a method to reduce the expected high salinity level, the Backchannel that had been excavated in the 1970s (refer to Figure 3-3 and Figure 3-11), was effectively used to divert approximately 15 x 10^6 m^3 of fresh water from the Mfolozi River estuary into the Narrows during the period of 31 May 2008 to 5 December 2008. The fresh water entering the canal was devoid of excess sedimentation as it was during the winter months and the discharge of Mfolozi River was relatively low. The sediment trapping efficiency of the floodplain was therefore higher, allowing the overflow through the canal to contain minimal sediment (Whitfield & Taylor 2009).

In order for the above activity to occur, three minor constructions, indicated in Figure 3-12, were completed. The first construction (refer to label c) involved strengthening the berm at the Mfolozi River mouth to ensure that the berm could not be readily breached by sea water. A small channel (label a) was excavated at a specified level near the Maphelane Dunes to ensure that if a flood event did occur, the Mfolozi River would breach at this point and not inundate the farms in the floodplain. The last construction was to ensure that the Backchannel (label b) could be closed in the case of a flood event – this would prevent excess sediment from entering the St Lucia estuary.

Figure 3-11: Mangrove lined canal used to transport fresh water from the Mfolozi River estuary into the St Lucia Lake estuary in 2007 ((Kelbe & Taylor, 2011))

Figure 3-12: Illustration of construction completed in order to transfer water from the Mfolozi River estuary into the St Lucia Lake in 2007. a: Excavation of small channel at a specified overflow level. b: Construction to ensure that the Backchannel could be closed in the case of a flood event level. c: Strengthening the berm at the Mfolozi River mouth to ensure that the berm could not be readily breached by sea water. (Whitfield & Taylor, 2009)

A model of the St Lucia Lake estuary (simulating salinity, water levels and mouth states) was created by Lawrie & Stretch (2011a). Three scenarios were performed in order to determine an effective method of management for the St Lucia Lake estuary. One of these scenarios included the use of fresh water from the Mfolozi River estuary added to the St Lucia Lake. A constant amount of 5×10^6 m^3 / month was assumed for the fresh water input throughout the year. It was concluded that although the freshwater input prevented high salinities from developing, the water levels remained erratic and the mouth state of the St Lucia Lake estuary remained mainly closed (Lawrie & Stretch, 2011a).

The value of 5×10^6 m^3 / month for the fresh water input was an assumption, and taking into consideration the dramatic seasonal variations, cannot be constant throughout the year. It is therefore the aim of this study to simulate a water balance of the Mfolozi River estuary so that a more accurate figure of fresh water inputs can be used to determine the effects that the diverted freshwater has on the St Lucia Lake, using the model developed by Lawrie & Stretch (2011a).

A study, with an aim similar in nature to this particular one, was completed by Kelbe & Taylor (2011) – however the mechanism, hypsometric curve and time period used to simulate conditions of the Mfolozi River floodplain are very different. The model simulated events from January 2008 to 2010 and indicated that an average freshwater flow rate of 1×10^6 m^3 / day could be transferred through the existing Backchannel during the winter months.

van Alphen, et al. (2012) attempted to simulate the discharge through the river using a 1D flow model, applying the results to determine the ideal Backchannel dimensions that would be required to divert the 60×10^6 m^3 of freshwater / year – the amount recommended by Lawrie & Stretch (2011a). The suggested dimensions include widening of the Backchannel, dropping the weir crest to 0.9m GMSL and increasing the general berm height to 1.8m GMSL. However the model uses a time interval of 12 minutes and a data set of river discharge data from June 2011 to October 2011 – thereby focusing on the response of the floodplain and Backchannel to isolated rainfall events, rather than a combination thereof. In order to determine an average transfer flow rate via the Backchannel, whilst taking into consideration the climatic oscillations on decadal time scales that the St Lucia system experiences, a long-term simulation with longer time intervals are required.

4. METHODOLOGY

4.1. INTRODUCTION TO THE MODEL

A model is a recreation of a system in order to simulate its behaviour. It is generally a simplification of reality in order to determine a relatively accurate solution to a specific problem (James 2005).

As stated in the introduction, the aim of this model is to be used as a tool so that decisions regarding the management of the estuary, as well as the adjacent St Lucia Lake, can be made on sound reasoning making use of all relevant research conducted to date in the study area. Turpie, et al. (2009) aptly state that:

> *"...management decisions, such as if and when to breach an estuary artificially, are also largely based on gut feel, which is in turn based on the experience of managers and the information available to them. Invariably, management decisions must rely on certain assumptions which are generally not made explicit.*
>
> *Modelling the interactions between different estuary components forces scientists to be explicit about the relationships that are assumed in predicting the consequences of different water flow or management scenarios."*

There are two main components of this model. The first part is to simulate the floodplain hydrology which includes modelling the amount of water that enters the floodplain every month and compare it to water removed. This will give us a resultant flow into the floodplain.

Modelling the estuarine mechanics is the second part of the model. This includes mouth dynamics, a hypsometric relationship, sediment trapping efficiency, etc.

The model has to then be evaluated and calibrated to allow one to use it to extract accurate outputs. The level of accuracy of the model must also be investigated and compared to the level required.

4.2. SIMULATION OF FLOODPLAIN HYDROLOGY

4.2.1. GENERAL WATER BALANCE EQUATION

As the storage of water in the estuary under closed mouth conditions can be likened to an ephemeral reservoir, the general water balance equation proposed by Ferguson & Znamensky (1981), and indicated in Figure 4-1, applies:

“ $I_S + I_{SS} + P - E - O_S - O_{SS} - \Delta S = 0$

Equation 4-1

Where: I_S = surface inflow into the lake or reservoir

I_{SS} = groundwater inflow

P = precipitation on the surface of the lake or reservoir

E = evaporation from the lake or reservoir

O_S = surface outflow from the lake or reservoir

O_{SS} = underground outflow (including percolation through a dam)

ΔS = change in the water storage in the lake or reservoir for the balance period ”

The surface inflow in this scenario would comprise of simulated monthly river inflow values as well as the run-off from the floodplain area not submerged, but that is still at a lower elevation than the flow gauge W2H032. Due to the groundwater flow not having a significant effect to balance as compared to the surface inflow and outflow, as well as the lack of reliable data required to quantify it, the groundwater inflow and outflow are not accounted for in this study’s summation of water flows.

Due to the *flatness* of the lower regions of the floodplain, the surface area inundated during closed mouth periods is significant for relatively small increases in water level. As closed mouth conditions generally occur during the dryer months when the river inflow is relatively low, the net effect between evaporation and precipitation on the floodplain becomes significant. Quantification of precipitation and evaporation on water surface is therefore required.

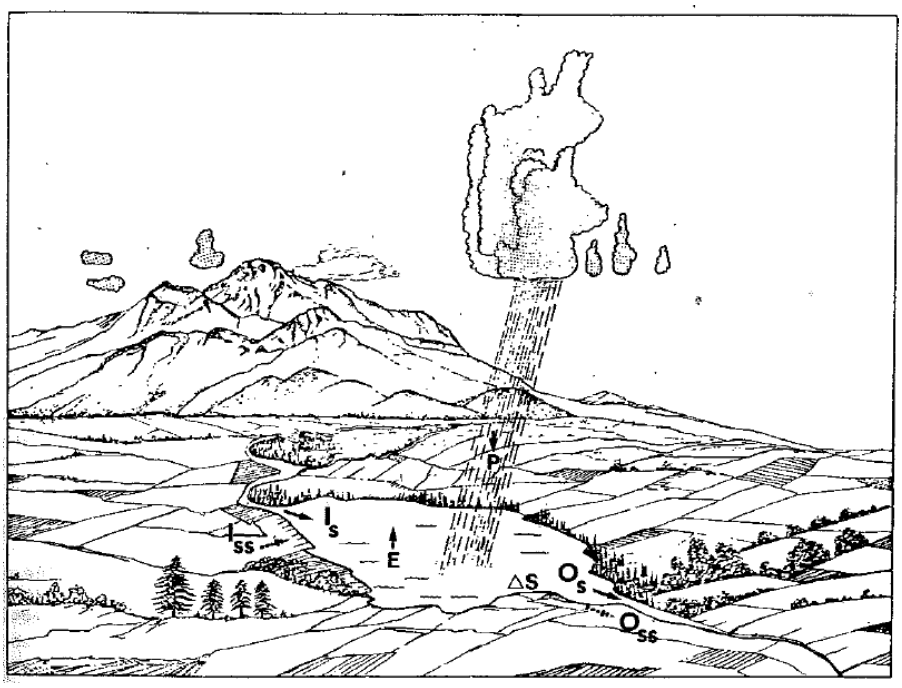


Figure 4-1: Pictorial depiction of General Water Balance Equation (Ferguson & Znamensky, 1981)

The surface outflow (represented by O_S in Equation 4-1) of the Mfolozi floodplain, being a *temporarily open/closed estuary*, comprises of three parts: the first is the flow that enters the sea during open mouth conditions, the second is the flow that can be diverted into the St Lucia Lake estuary during closed mouth conditions, and the third is any abstractions that occur on the river downstream of flow gauge W2H032. At any point in time, at least one component will be equal to zero. The aim of this study is to estimate the change in water storage and evaluate if it can be of any benefit in channelling a sufficient amount of much needed fresh water into adjoining estuarine lake, during closed mouth conditions.

In the calculation of the resultant monthly inflow rate into the floodplains, certain factors such as groundwater seepage (into and out of estuary) and abstractions, were not able to be quantified as there was a lack of measured data regarding them. It was also assumed, that compared to the effect of river inflow, evaporation and run-off, that these values would be negligible. As a result, the effects of these factors have been omitted in this current study. However, provision has been made in the model for the User to input these values if the information is available.

4.2.2. MONTHLY INFLOW DATA OF THE MFOLOZI RIVER

The model that is created as part of this study is to be used to determine various estuarine management strategies over a long term period. River inflow data spanning decades is therefore required. However, flow data has only been captured via a weir at Station W2H032 from approximately October 1993 (Department: Water Affairs, 2010).

The monthly river data used in this model, spanning a period of 92 years (1918 - 2010), has been garnered from a study conducted by Lawrie & Stretch (2011b) in the development of a water balance model for the St Lucia Lake complex. The river inflow data is a combination of simulation results performed by Hutchison & Pitman (1973, as referenced by Lawrie & Stretch 2011a), as well as those modelled by Lawrie & Stretch (2011a) using a method proposed by Smakhtin & Masse (2000, as referenced by Lawrie & Stretch 2011a). The method uses a 'non-linear spatial interpolation technique' whereby a *Current Precipitation Index* (CPI) is calculated and the probability of it being exceeded is matched to its corresponding river inflow probabilities, determined from the measured results of Station W2H032. The CPI value is an indication of the 'catchment wetness' as it is the sum of current precipitation as well as the previous CPI value multiplied by a coefficient that is used to represent the drying of the catchment (Smakhtin 2004). A coefficient of 0.6 was used in order to simulate the Mfolozi River inflows (Lawrie & Stretch 2011a).

An attempt to guage the ability of the simulated results to mimic the Mfolozi River flows measured by flow guage W2H032 was made by plotting various comparative graphs. Unfortunately there proved to be little agreement between the two sets of data. The Pitman model has been previously calibrated against various weir gauged data from upstream sites. As flow guage W2H032 has not been re-calibrated for many years, as well as the fact that at high flows there is an upstream diversion (so that this gauging site does not measure flows > 783m^3/s), it is therefore reasonable to assume that data from it is unreliable (van Alphen, et al., 2012).

4.2.3. PRECIPITATION, EVAPORATION, RUN-OFF & ABSTRACTIONS

As discussed in 4.2.1 the water balance model requires quantification for the precipitation (P) and evaporation (E) over the surface of the water in the Mfolozi, abstractions (portion of O_S), as well as the run-off (portion of I_S) from the floodplain at a lower elevation than that of where flow gauge W2H032 is located. Hydrological data for the Mfolozi River floodplain was acquired from using the maps and data compiled by Midgley, et al. (1994). The floodplain is situated within the W23D & W23C *quaternary sub-catchments*.

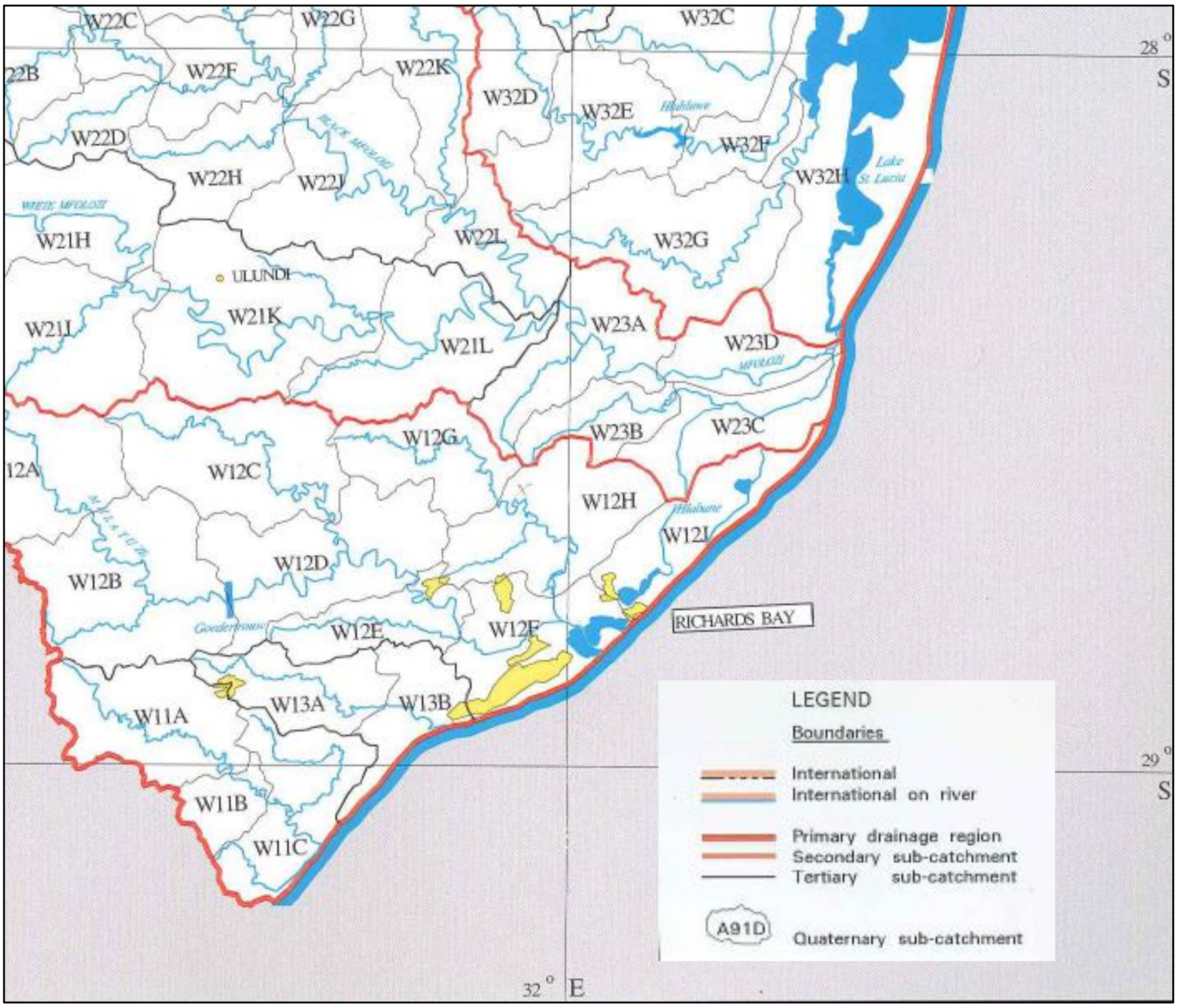


Figure 4-2: Indication of constituent quaternary sub-catchments (W23C & W23D) of the Mfolozi River floodplain (Midgley, et al., 1994)

[Note: Middleton & Bailey (2008), which is a 2005 update of the hydrological data provided in Midgley, et al. (1994), was reviewed. However, as the change in hydrological conditions between the two editions was minimal (tertiary sub-catchment W23 only had a 2.10% change in MAR), and the data and monthly factors in (Midgley, et al., 1994) were more precise and methodological in its layout, the decision to use the hydrological data provided by Midgley, et al. (1994) over Middleton & Bailey (2008) was taken.]

4.2.3.1. PRECIPITATION

Average monthly values for precipitation were calculated in mm/m^2. The mean annual precipitation (MAP) for four rainfall stations in the floodplain locality, and cumulatively spanning a period of 1919 to 1989, were averaged. The average MAP is then distributed between the months by factors stated in Appendix 2.2 Volume VI of Midgley, et al. (1994). These factors were determined using measurements from seven gauges situated in the W23 *tertiary sub-catchment*. Numerical data applied can be viewed in the *Hydrology Tab* in the model.

4.2.3.2. EVAPORATION

The mean annual evaporation (MAP) was calculated using the measurements of two evaporation stations: A-pan W2E002 situated at River's View along the Mfolozi River, and S-pan W3E001 located at Charter's Creek by the St Lucia Lake.

Kriel (unkwn) indicates the fundamental differences of the two pans in his report: the *American A-type* pan is circular and is slightly raised off the ground. It has a diameter and depth of approximately 1.2m and 25cm respectively. The *Symons* pan, on the other hand, is a square, partially sunken tank. Its sides and depth have the approximate dimensions of 1.8m and 61cm (of which only 8cm is exposed to the surface) respectively. Due to the S-pan having a greater depth and being less exposed to the sun (therefore less radiation), the extent of evaporation in the A-pan is generally higher. The following relationship is suggested by Midgley, et al. (1994) to convert between pans (units in mm):

$$\text{MAE (S-pan)} = 130 + 0.726 \times \text{MAE (A-pan)}$$

Equation 4-2

The MAE (A-pan) value of W3E001 is converted to a S-pan reading and is then averaged with W2E002.

Factors given for evaporation zone 22A (in which the floodplain is located) in Appendix 3.2 Volume VI of Midgley, et al. (1994) is used to distribute the average MAE between the months. To this, further monthly "pan factors for open water evaporation", stated in Appendix 3.3 Volume VI, and are applied to the monthly S-pan evaporation readings. Numerical data applied can be viewed in the *Hydrology Tab* in the model.

4.2.3.3. RUN-OFF

The mean annual run-off (MAR) refers to net amount of water that drains from a catchment to a drainage point (which in this case would be the Mfolozi River) and takes into consideration the precipitation, evapotranspiration, plant usage and drainage characteristics of the catchment area. As flow from the main catchment has been accounted for through the W2H032 river gauge, the run-off from the catchment downstream of the gauge is calculated from the data provided from simulations completed by Midgley, et al. (1994).

The catchment area upstream of flow gauge W2H032 has been quantified as 9882 km^2 by Maro (2012); therefore, assuming the total Mfolozi River catchment area to be 10 008km^2 (Midgley, et al., 1994), the area to which the estimated MAR shall be applied to shall be the difference of 126 km^2 and the area inundated by the Mfolozi River.

MAR results for *quaternary sub-catchments* W23C & W23D are averaged and divided by the area covered. The MAR (mm/m^2) is then distributed over the twelve months using the simulation results of the *tertiary sub-catchment* W23 in Appendix 7.2 Volume VI. Numerical data applied can be viewed in the *Hydrology Tab* in the model.

4.2.3.4. ABSTRACTIONS

Richards Bay Minerals (RBM), a sand mining company situated south of the floodplain, has the rights to abstract water from the Mfolozi River – downstream of flow gauge W2H032. According to Kelbe & Taylor (2011), theoretically RBM may only pump water from the river when the flow rate of the river is greater than 5m^3/s. There is very little information regarding the actual flows, if any, that are currently being abstracted. Taking into consideration the lack of information regarding the RBM abstractions as well as other small farming abstraction schemes, as well as the low impact the small flows would have on the water balance over a long period of time, this information has not be included as part of this study. However, provision has been made in the model for the *User* to input an abstraction value.

4.2.4. SEDIMENT LOADS

4.2.4.1. MONTHLY SEDIMENT CONCENTRATIONS

The model must evaluate the ability of the Mfolozi floodplain's storage capacity, during closed mouth conditions, to act as a sediment-trap in order to divert water with low TSS concentrations into the St Lucia lake mouth. In order to do so, data regarding the sediment loading transported with the river inflow must be garnered, examined and used as an input in the water balance model.

Measurement of the Mfolozi River's turbidity is taken by the Mtubatuba Water Treatment Works which is situated 'at the head of the floodplain' (Grenfell & Ellery, 2009). Readings were noted at two, and then more recently, four hour intervals. Data has been acquired from Grenfell & Ellery (2009) and Maro (2012) for periods 2000-2006 and 2008-2011 respectively.

The unit of measurement taken by the works is a *nephelometric turbidity unit* (NTU). In order to convert the turbidity results to a measurement of the *total suspended solids* (TSS) content in the water, with a unit of g/ℓ, samples with measured NTU readings are dried in an oven to remove water content, and the total solids that remain on sample filter paper are measured. This testing and calibration process was performed by both (Grenfell & Ellery (2009) and Maro (2012), who proposed the following relationships (Equation 4-3and Equation 4-4 respectively) to convert the measured turbidity readings in NTUs to TSS (g/ℓ):

$$\text{TSS} = 0.0093 \times \text{Turbidity}^{0.674}$$

Equation 4-3

$$\text{TSS} = 0.0007 \times \text{Turbidity}$$

Equation 4-4

Figure 4-3 indicates the data collected and processed by Grenfell & Ellery (2009) and Maro (2012) in order to create a relationship to convert the turbidity readings taken into TSS measurements. The relationships described by Equation 4-3 and Equation 4-4 above are also depicted. As one can see, the samples collected by Grenfell & Ellery (2009) were taken during flow with low turbidity values. The relationship (Equation 4-3) determined from these measurements severely underestimates the high turbidity measurements taken by Maro (2012). Equation 4-4 however, aptly predicts the relationship between the combined data set with a very high *coefficient of determination* (R^2 value) of 0.985.

For the purposes of this model, the calibration relationship between turbidity and TSS of the Mfolozi River will therefore be as per Equation 4-4.

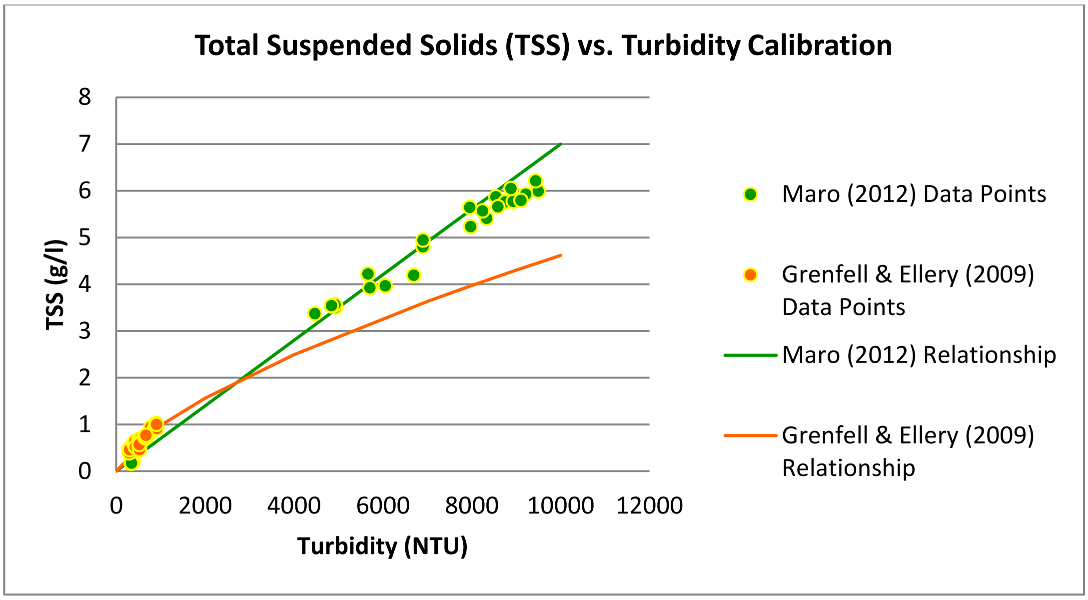


Figure 4-3:Graph indicating data collected for TSS-Turbidity calibrations, as well as a comparison of relationships proposed by Equation 4-3 and Equation 4-4

The sedimentation data collected and converted, as detailed above, is evaluated in order to determine the most accurate way of inputting the sediment concentrations transported by the Mfolozi River into the model. One would assume that a higher river flow would be due to a large rainfall event, and therefore the energy potential of the river to carry sediment, as well as the amount of sediment introduced into the river to be transported would be correspondingly high. Grenfell & Ellery (2009) suggest that the sediment concentration is not only dependant on the river flow, but also due to the seasonal variation.

This argument is centred on the availability of eroded sediment being the “limiting factor in sediment transport in rivers” (Annandale, 1987). The dry winter months experienced by the eastern coast of southern Africa result in relatively large amounts of sediment to be eroded and available for fluvial transportation during the start of the rainy summer season. Near the end of the rainy season, although flow may still be high, the amount of sediment carried by the river decreases as the store of eroded sediment is depleted. This results in turbidity of the river being higher than expected at the start of the rainy season (November and December) as opposed to the end (January and February) – even though a similar scale of rainfall and river flows may occur throughout (Grenfell & Ellery, 2009). Figure 4-4 below is illustrative of the *hysteresis loop*, caused by seasonal variation, described by Grenfell & Ellery (2009). It also indicates how a linear relationship between the discharge and sediment concentrations may compare.

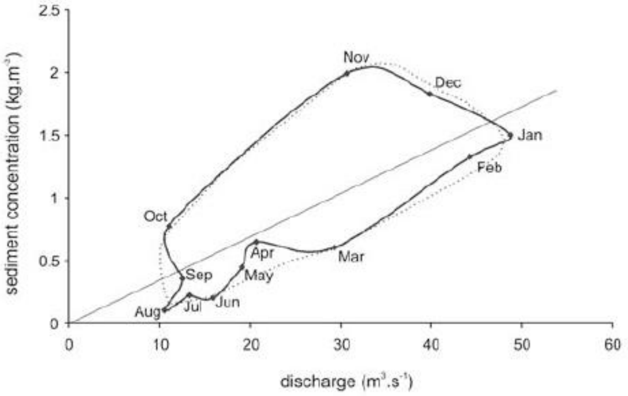


Figure 4-4: Comparison of hysteresis loop and linear trend line representation of average monthly values of sediment concentrations plotted with corresponding river flow (Grenfell & Ellery, 2009)

A method of estimating sediment concentration in the Mfolozi River is required. The choice of methods is as follows: (a) a flow vs. TSS concentration relationship is determined, or (b) an average value per month that takes into consideration of seasonal implications is used as a model input.

Daily TSS data from the Mtubatuba Water Treatment Works, acquired and converted as described above, were plotted against daily river flow data acquired from the W2H032 gauge (Department: Water Affairs, 2010). Due to the large range experienced by the two variables, a log-log scale was used to achieve an evenly distributed graph.

The use of a log-log scale graph between the two variables is one of the two methods proposed by Annandale (1987) to estimate sediment yield values – however, this method is discouraged due to the high variance in data. The second method proposed by (Annandale, 1987) shall be discussed in 4.2.4.2 below.

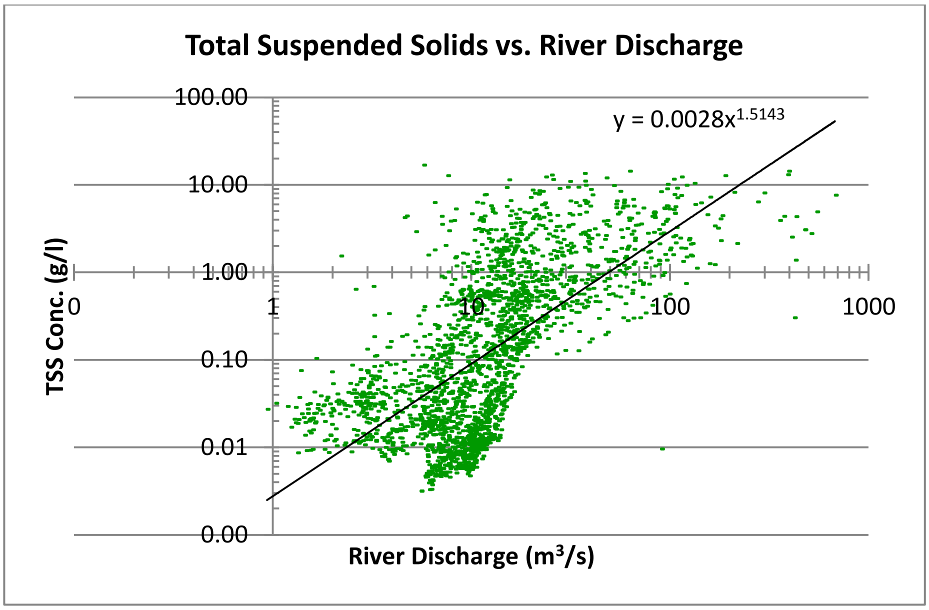


Figure 4-5: Graph on a log-log scale indicating Total Suspended Solids concentration against corresponding river flow for data spanning 2000 to 2011

Figure 4-5 was evaluated in conjunction with both the *Spearman Rank* and *Pearson Product Moment* correlation coefficients in order to determine whether the option of inputting a TSS-River Inflow relationship into the model was feasible. From the above log-log graph, it is obvious that the relationship between the two variables is not linear, but rather exponential. The *Pearson Correlation* coefficient is therefore not used as a statistical test as it requires the assumption that there is a linear relationship between the two variables in question. The *Spearman Rank Correlation* tests the "strength of associations of two variables" (Hauke & Kossowski, 2011), and requires the assumption that data is in fact monotonic. The following equation (Laerd Statistics, 2012) is followed in order to determine the correlation coefficient:

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$$

$$, where\ d_i = x_i - y_i\ \&\ n = no. of\ values\ sample$$

Equation 4-5

The above test was performed and a value of ρ = 0.67 was calculated. This suggests a positive association of ranks, i.e. a relationship (not necessarily linear) exists between the two variables

– and that as one variable increases, so does the other. It is therefore reasonable to use a TSS-river flow relationship.

Using the data indicated in Figure 4-5, a linear trend-line is plotted in *Microsoft Excel* for both a normal scale and a log-log scale graph, which would relate to a linear and an exponential function respectively. *Microsoft Excel,* using a *Least Squares Regression* method, was also used in order to determine the equation of the functions, as well as the *coefficient of determination* (R^2 value). Through the comparison of *coefficients of determination* for both trend-lines, it was evident that the exponential function below provided a better fit of $R^2 = 0.43$ as compared to the $R^2 = 0.14$ for the linear trend line:

$$\text{TSS} = 0.0028 \times \text{River Flow}^{1.5143}$$

, where the unit for TSS is g/ℓ and River Flow is m^3/s

Equation 4-6

The effect of seasonal changes on the sediment load was examined by plotting monthly sediment load against the corresponding monthly river flow values for years in which enough data was available for the whole hydrological year. An attempt to produce a *hysteresis loop* graph, such as that in Figure 4-4 by Grenfell & Ellery (2009), was made. Although the individual yearly results did not show a conventional hysteresis relationship, it did show a loop that occurred due to seasonal changes. The average of the monthly river flow and sediment data indicated a similar relationship as that proposed by Grenfell & Ellery (2009) – refer to Figure 4-6. The suspended solids concentration is indeed higher during the start of the rainy season (November-December), even though the river discharge peaks in January and February.

It is therefore reasonable to agree that the TSS concentrations in the Mfolozi River are heavily dependent on two variables: the extent of river discharge, and the time in the year that the flow occurs - therefore an empirical relationship to determine TSS concentrations based solely on river discharge shall not be used in this study.

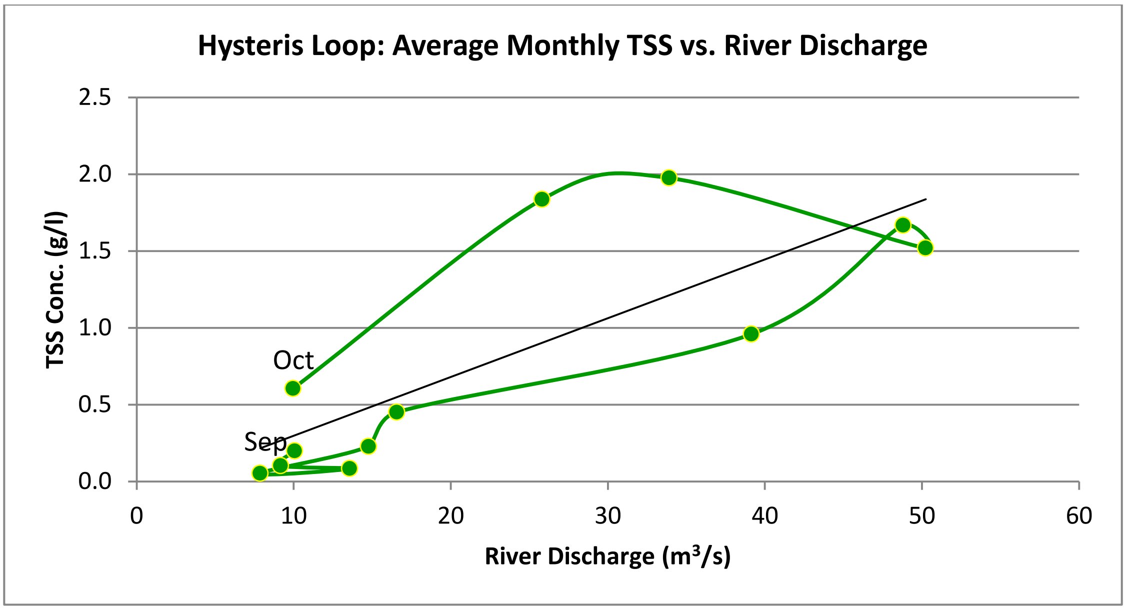


Figure 4-6: Attempt to reproduce hysteresis loop relationship between TSS concentrations and river discharge due to seasonal variance – as proposed by (Grenfell & Ellery, 2009)

Figure 4-7 compares the various monthly sediment concentrations from different sources. The first set is of the monthly average and median values of both the TSS concentrations and the river discharge – readings of which was taken (as described above) from the Mtubatuba Water Treatment Work's and the W2H032 gauge respectively. It is evident from the graph that the peak for the sediment concentrations is offset to that of river discharge flow, occurring first during the November-December period. This concurs with the relationship proposed by Grenfell & Ellery (2009). As one can see, in general the variation between the median and average values is small and therefore one can infer that the average values are a good indication of frequent conditions.

The TSS concentrations, using the relationship described by Equation 4-6 above, are plotted from the average monthly river discharge values. The results indicate that it severely underestimates the TSS concentrations at the start of the rainy season (November & December), and overestimates the TSS concentrations during the winter months (June – August) when there is little rain to transport eroded material into rivers. It is also deemed to be lacking as it does not account for significant climate and hydrological changes due to seasonal differences.

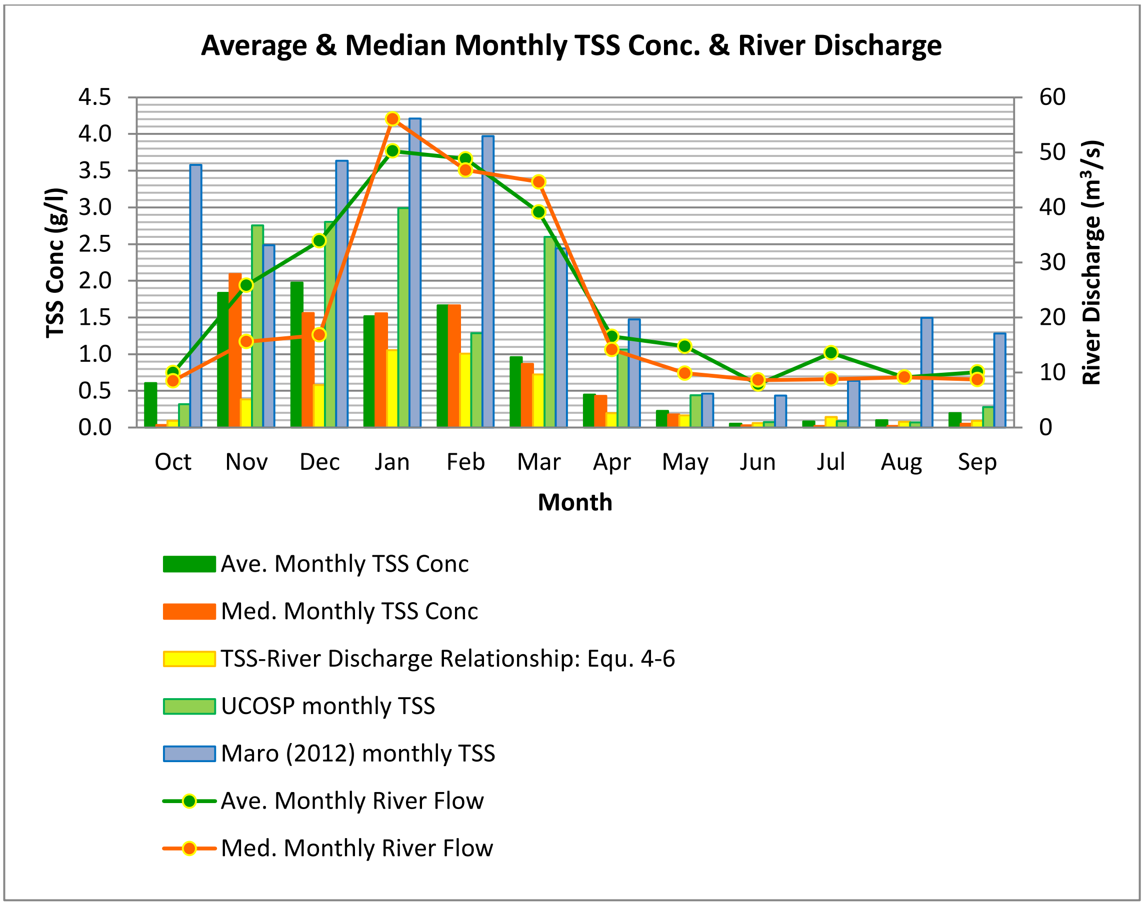


Figure 4-7: Comparison of monthly TSS concentrations

Figure 4-7 also indicates monthly TSS values as taken by the Mfolozi Sugar Planters Ltd (UCOSP) as referenced by van Niekerk & Huizinga (2012). The values are considerably higher than that of the Mtubatuba Waterworks monthly values. This is accounted to the data being collected during the period of 1973-1975, which according to Lawrie & Stretch (2011), as referenced in Maro (2012), was a “relatively wet year”. The data measured, besides covering a short period of time, is also biased to higher monthly sediment loads due to higher river discharge values and will not be used in this study.

Maro (2012) created an *ACRU* model in order to “simulate water and sediment yields incorporating land use changes” over a relatively long period of time, i.e. 1950 to 2010. The monthly sediment values are averaged and represented in Figure 4-7. As one can see, the values indicated by the study far exceed those measurements taken by UCOSP during a wet period. The monthly concentrations are therefore not used in the model, as it may lead to be an underestimation of the floodplain’s efficiency in trapping sediment.

In the rainfall index for the St Lucia Lake catchment area, created by Lawrie & Stretch (2011), as referenced in Maro (2012), the period for which the Mtubatuba turbidity readings were collected, fall under a "dry period". As stated above, the reading taken by UCOSP occurred during a wet period. Using either alone would result in either overestimating or underestimating the trapping efficiency of the floodplain. It is must also be noted that both sets of measurements agree with seasonal influence on the sediment availability and therefore concentrations, as proposed by Grenfell & Ellery (2009). **The average of both sets of measured monthly data will therefore be adopted into the water balance model.** Numerical data applied can be viewed in the *Hydrology Tab* in the model.

4.2.4.2. ANNUAL SEDIMENT YIELD

In order to validate the usage of the chosen set of monthly sediment concentration values, the annual sediment yield computed from the values chosen above are compared to other values from literature. The comparison is graphed in Figure 4-8.

The sediment yield estimated by Rooseboom (1975), as referenced in Grenfell & Ellery (2009), as well as that proposed by Grenfell & Ellery (2009) are relatively too high and too low respectively, when compared to other estimates. The estimate derived from Rooseboom (1975) is derived from a sediment yield map that indicates areas of "equal erosion potential" - the extent to which is then quantified by calibrating the map with other sediment yield data (Annandale, 1987). Annandale (1987) infers that as maps such as these are used for design purposes, they are generally very conservative – this observation is confirmed by the sediment map created by Rooseboom (1975) indicating that the Mfolozi River catchment has a yield of approximately 150 – 400 ton/km^2/annum. The sediment yield model by Maro (2012) also indicates a relatively high yield of 156 ton/km^2/annum.

Although the yield estimation by Grenfell & Ellery (2009) and that described by the "average annual yield for period 2000-2010" in Figure 4-8 share the same source for the turbidity data (namely the Mtubatuba Waterworks), there is a disparity in their values. This is caused by the different relationships used to convert the turbidity reading into TSS concentrations – refer to Equation 4-3 and Equation 4-4 respectively. As discussed before, the relationship calibrated by Grenfell & Ellery (2009) under-estimates the TSS concentrations at higher turbidity values.

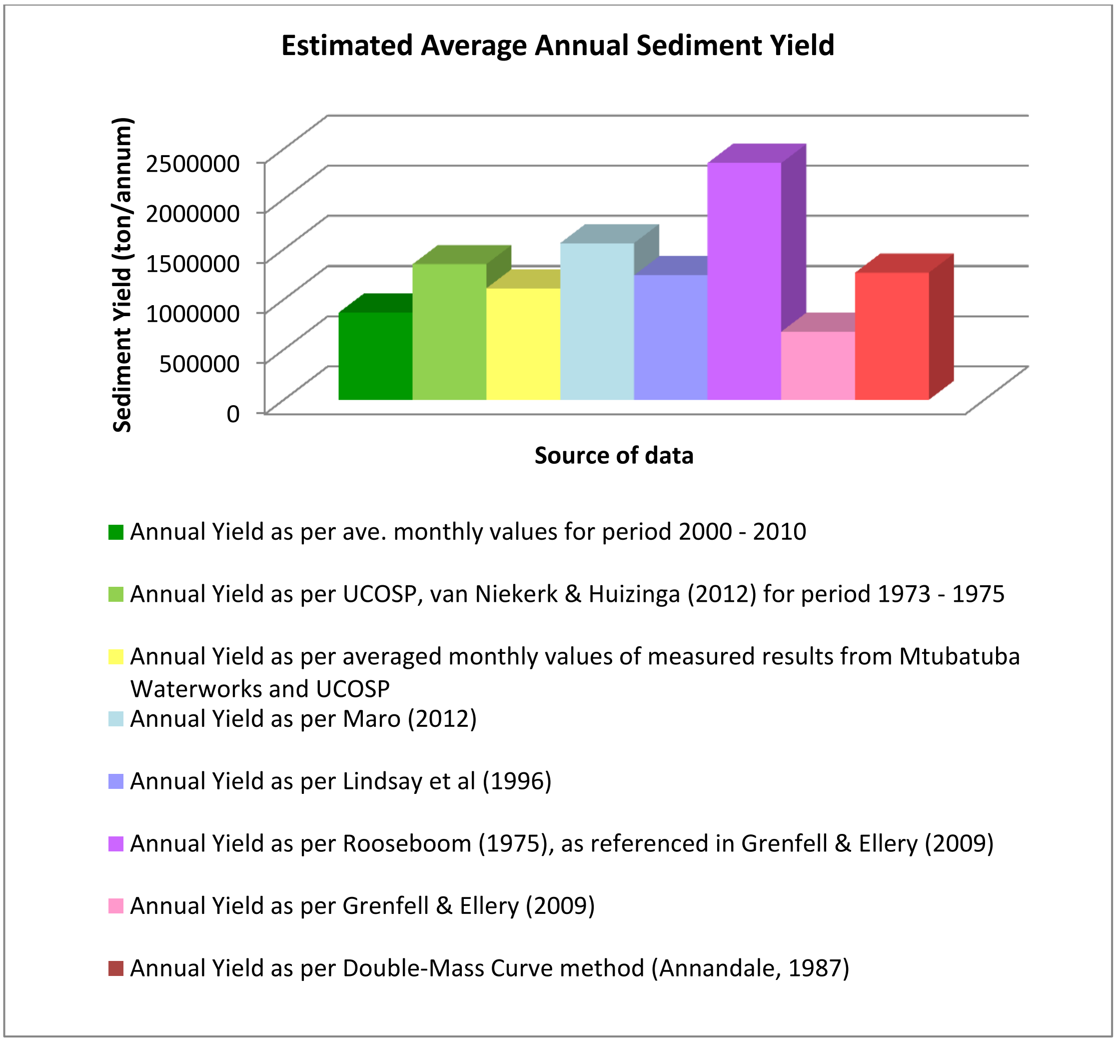


Figure 4-8: Comparison of estimated Annual Sediment Yield values

As mentioned in 4.2.4.1, Annandale (1987) recommends two methods to estimating sediment yield. The first, explored above, is the use of log-log scale graphs. The second is the creation of a double mass curve: “a cumulative plot of sediment discharge against water discharge”. Dahmen & Hall (1990) explains further, that the slope of a line used to join the start (at the origin) and the end of the curve, is indicative of the “true mean of the proportionality factors”, i.e. an average quantification of how the river discharge influences the TSS concentrations. This method is applied to derive an annual sediment yield and therefore requires data representative of all seasonal changes within a year. Daily TSS concentration data and its corresponding river discharges were sifted in order to find a set that spanned an entire year, without any significant missing portions. Five years in total were found to be applicable. However, only one of these years can be described by the catchment wetness index created by

Lawrie & Stretch (2011), as referenced by Maro (2012), to be representative of the mean annual rainfall. To compute an annual sediment yield estimate, the cumulative plot of this period (duration of a year) was plotted and the slope gradient multiplied with the average annual discharge. This sediment yield value is approximately only 14% greater than the average monthly values of the Mtubatuba Waterworks and UCOSP data.

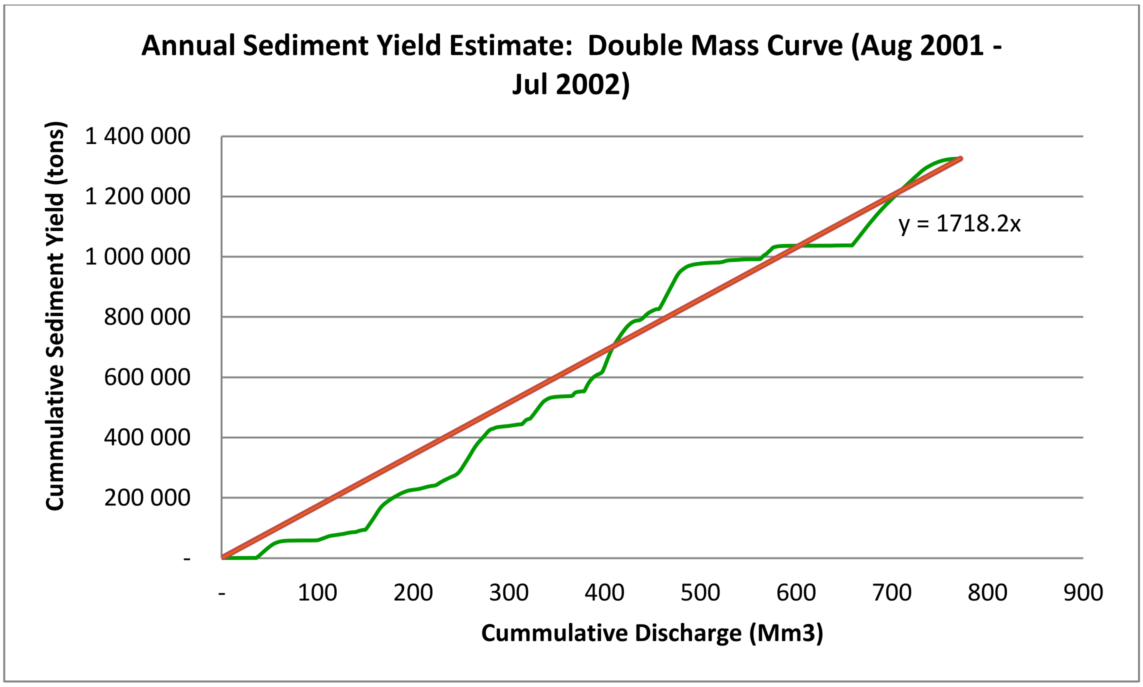


Figure 4-9: Double mass curve for year representative of mean annual rainfall in order to estimate an annual sediment yield for the river discharge entering the Mfolozi floodplain

Taking into account the above explanations, the usage of the average monthly values of the Mtubatuba Waterworks and UCOSP data takes into consideration TSS concentrations during both dry and wet periods, and the yield estimated by using its monthly values is comparable to estimations documented by Maro (2012) and Lindsay, et al. (1996), as well as the estimate computed using the double-mass curve method.

4.3. SIMULATION OF ESTURINE MECHANISM

In order to model an estuary, one must be aware of various unique estuarine mechanisms that exist. The first is the temporary condition of the estuarine mouth. This influences the storage of water within the floodplain during closed mouth periods and the emptying of it once the berm, closing the mouth, is breached. Another characteristic of an estuary is that the amount of water stored in an estuary behind a berm during a closed mouth period can vary quite drastically depending on the topography of the floodplain. The chapter below details the relationships used to replicate the Mfolozi River estuary in a simple 0-D (zero dimensional) water balance.

4.3.1. DERIVATION OF A HYPSOMETRIC CURVE

In this water balance model, the flows in and out of the Mfolozi floodplain are calculated in terms of Mm^3 (a million m^3) of water per month. However, the breaching level of the mouth and the height of the weir flowing into the Lake St Lucia, are both measured in a unit of length (GMSL). In order to determine the inundation, the mouth state and the amount of outflow that can be channelled into the Lake St Lucia at varying monthly flow rates, **a relationship between the volumes stored in the floodplain and the resulting water levels is essential.**

The *Edit Hyps. Curve* tab in this model allows the user to interchange between four different volume–water level relationships. These relationships have been created using different methods – a summary of which is to follow:

The first volume–water level relationship was based on a contour map (refer to Figure 4-10) found in a journal article written by Grenfell, et al. (2009). The contour map was copied into AutoCAD and scaled. Polylines were then used to trace each 5m contour line so as to determine the area bound by the contour lines. The areas bounded by each of the contour lines were determined, and a scatter graph was plotted. The integral of the trend line (function of area in terms of elevation) was then calculated to provide a volume – water level relationship.

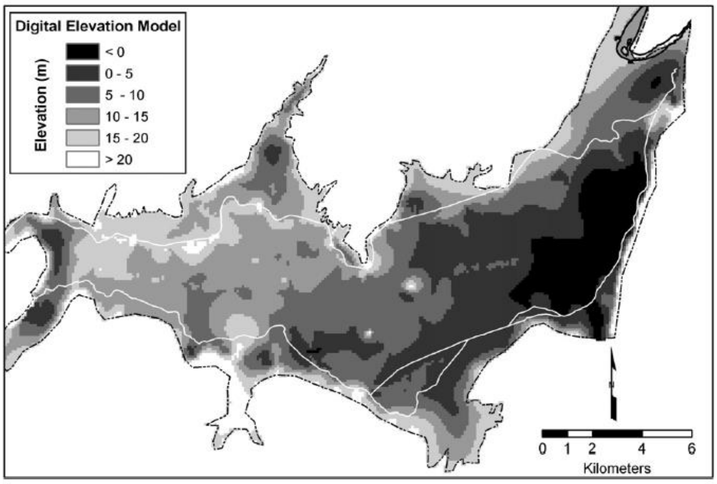


Figure 4-10: 5m Contour map of the Mfolozi floodplain as constructed by (Grenfell, et al., 2009)

The contour map was formulated by use of various methods, such as ortho-photographs, 5m contour intervals from the Surveyor General of South Africa, and Trimble GPS (Grenfell et al 2009).

The second hypsometric relationship that can be used is based on an equation propositioned by Kelbe & Taylor (2011). The *digital terrain model* (DTM) used to create the model was developed from a collation of *Shuttle Radar Topography Mission* (STRM) data supplied by NASA, *Light Detection & Ranging* (LiDAR) data procured from Richards Bay Minerals (RBM) and elevations manually picked up from *Google Earth*. It must be noted that the LiDAR data covered the ‘southern high dunes and part of the floodplain’ and was therefore mainly used for the ‘evaluation of the accuracy of the resultant DEM’ created from the other two sets of data. Kelbe & Taylor (2011) also state that this relationship is only accurate up to a water level of 4m GMSL, and therefore a model using this data should have the maximum berm height limited to 4m GMSL.

Attempts to create a DTM using *Google Earth* was also made as part of this study. A study completed by Hoffman & Winde (2009) detailed the usage of data points from *Google Earth*. In their study it was concluded that the *Google Earth* elevation data was more refined than its base STRM data as it included ‘other technologies and alternative data sources’, and that it allowed for detailed elevation changes as compared to the 5m and 20m contour maps available in South Africa from the *Chief Directorate: Surveys and Mapping* (CDSM). This is required in areas with a relatively flat relief. It is interesting to note that a vertical offset of 5m was found when their *Google Earth* DTM of the Gerhard Minnebron wetland (area of study) was compared to that of a 0.5m survey (Hoffman & Winde, 2009).

A hundred and sixty-three data points were spread out over the Mfolozi floodplain in such a way as to cover most of the topographical changes in elevation. The longitude, latitude and elevation of each point was recorded and converted into a Gaus Conform x-y co-ordinate system using a Central Meridian (Lo) of 31°. A text file containing these points was then fed into *Model Maker*, a bulk-earthworks design program, in order to triangulate and create contour lines. Figure 4-11 indicates the contours of the DTM created.

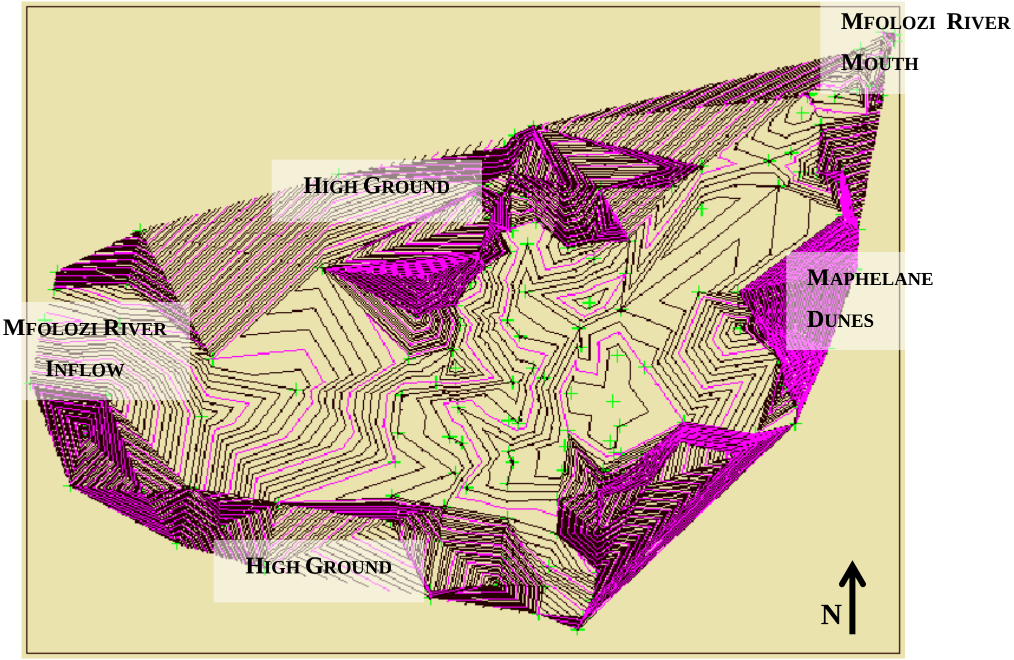


Figure 4-11: DTM created using points garnered off Google Earth

As depicted from Figure 4-11, the morphology of the DTM model seemed to reflect the current terrain conditions, however the elevations abstracted from the contour lines were much higher than that expected – for example, the area closet to the mouth was seen to be 5m GMSL, instead of being closer to mean sea level. Known elevations of surrounding trig-beacons were compared to their corresponding *Google Earth* elevations in order to create the correction factor. However, no conclusive relationship could be found. The DTM model was therefore dropped by 5m, which was estimated by using the known elevations near the mouth area. The third volume-water level relationship is based on the hypsometric curve derived from the DTM created above.

A DTM was created by Chrystal (2012) using differential GPS field measurements. The area-water level and volume-water level relationships proposed by Chrystal (2012) are used as the fourth option in the model created for this study. **To date, this DTM is the most current surveyed data of the floodplain.** That being said, a detailed LIDAR survey is currently being undertaken as part of the GEF tender mentioned in Section 3.3.

4.3.2. ESTUARINE BASIC FLOW-MECHANISM

The flow diagram below indicates the basic sequence of the model. A monthly time step is used, with the month's starting conditions (water level, volume, area and mouth state) of the floodplain being equivalent to the values derived at the end of the previous time-step.

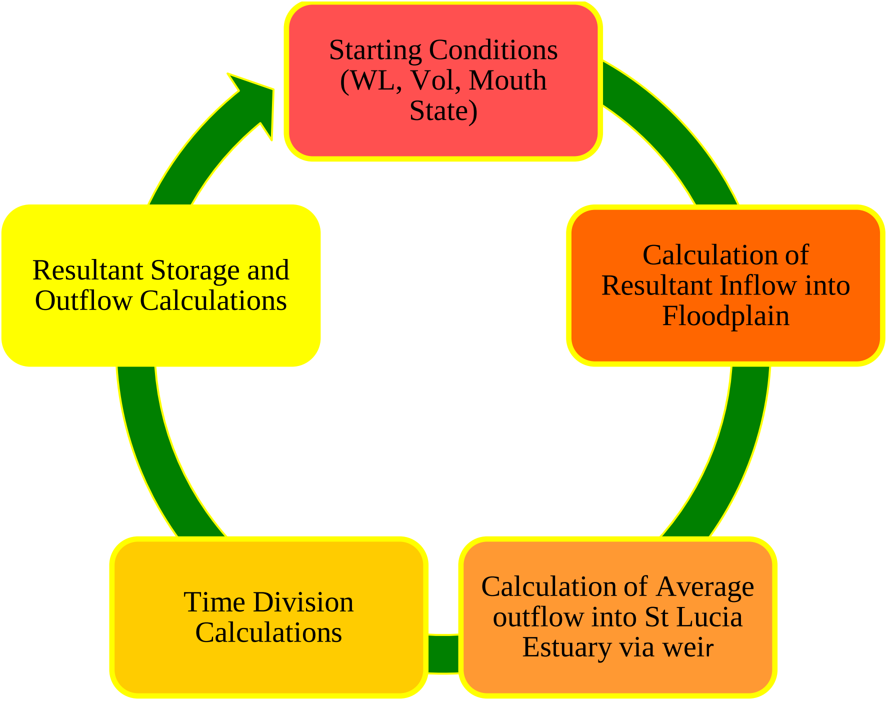


Figure 4-12: Basic flow mechanism of model

The resultant inflow into the floodplain per time step is then calculated as per Equation 4-1 in section 4.2.1. The monthly hydrological information regarding the precipitation, evaporation, runoff and sediment loading is calculated and then fed into the *Editor* tab in the model.

After which an average flow rate of water into the St Lucia Lake is calculated (refer to 4.3.5) and then multiplied by the time that flow over the back channel weir is possible. These time divisions are discussed further in 4.3.4. Once the difference between the monthly resultant inflow into the floodplain and the outflow (via the Backchannel) is taken into consideration, the subsequent condition of the estuary is determined. The time divisions play a crucial role in determining how much water can be channelled into the lake before the mouth is breached.

4.3.3. ESTUARINE MOUTH MECHANISM

The functioning of the mouth is one of the defining characteristics of a *temporarily open/closed* estuary.

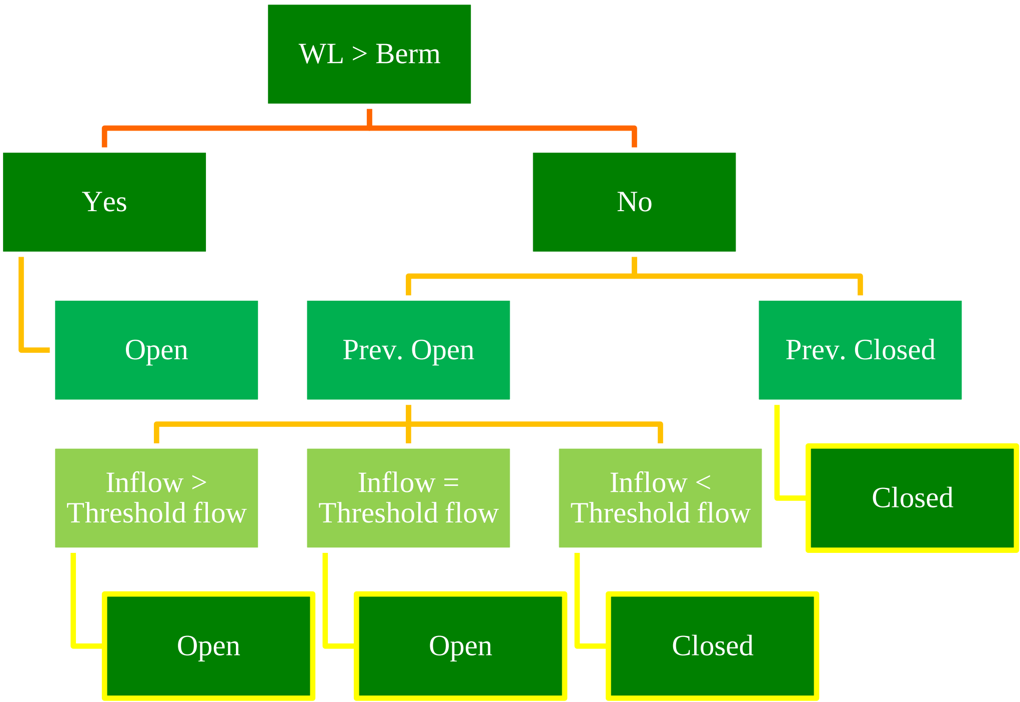


Figure 4-13: Mechanism used to simulate estuarine mouth

A closed mouth is breached (opened) when the water level stored in the estuary exceeds the sand berm height. The berm is then washed away and the mouth is kept opened until such time that that the flow through the sea inlet decreases enough such that a new berm can be built up to once again close the mouth. This process is discussed in greater detail in 2.2.4.

The flow at which a berm can begin to be built up is referred to as a *threshold flow* and the simplified mouth mechanism used in this model in depicted in Figure 4-13 above.

4.3.4. <u>TIME DIVISIONS</u>

A problem identified during the initial stages of the model development was that a monthly time step, although applicable to view long-term trends, was too large in terms of deriving a reasonable indication of the amount of water transferred into the St Lucia Lake. During a month of high inflow, the mouth was only allowed to breach at the end of the month when it should have been opened much earlier. As a result of the unrealistically high water levels reached by the end of the month, the amount of water transferred was drastically overestimated. To rectify this, each month (as depicted in Figure 4-14) is divided into three periods of activity.

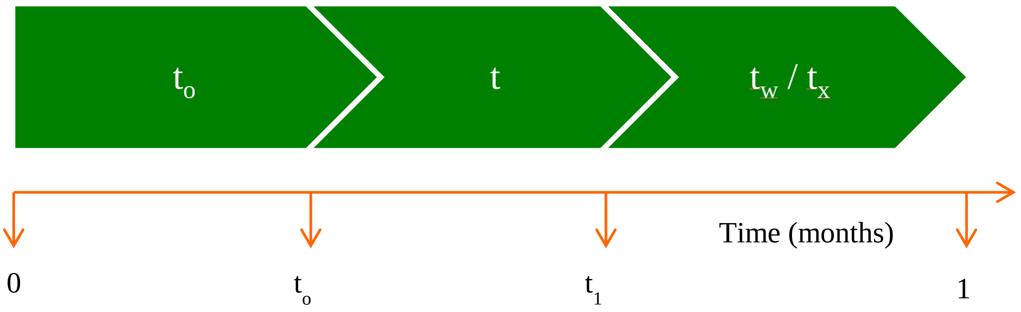


Figure 4-14: Schematic of monthly time divisions

Sequentially, the first period to occur in the month is termed t_o. During this period, the water level in the floodplain is below the Backchannel weir height, i.e. no water can enter the St Lucia Lake. The value of t_o can therefore range between zero (if at the start of the month, the water level is adequate to allow for the transfer of water) or one (if the flow of water is limited to either flowing through an open mouth, or accumulating in the floodplain behind a closed one).

Time period t (equivalent to the difference between t_1 and t_o), exists when the water level during the month is in between the height of the Backchannel weir and the berm height – by implication this occurs only during closed-mouth conditions. Once again, the value of t, measured in months, can range between zero (as in the case when t_o is equivalent to one) and one (where there is a continual transfer of water from the Mfolozi River into the Lake St Lucia).

The final period is denoted either t_x or t_w. Both occur during months where there is a certain amount of water transfer that occurs. If the water level is greater than the Backchannel weir height, but the resultant flow rate into the floodplain is less than the estimated transfer rate into the St Lucia Lake, it is assumed that the transfer outflow during time t_x is equivalent to the resultant inflow. If during a month, the resultant inflow is high enough to fill the floodplain up to breaching height, whilst still transferring water into the St Lucia Lake, then during time period t_w, the mouth will open releasing all stored water to sea and water transfer to the lake will cease.

It is important to note that the sum of t_o, t and either t_x or t_w is equivalent to one month.

4.3.5. CALCULATION OF OUTFLOW INTO ST LUCIA LAKE THROUGH WEIR

The formula used to determine flow over a broad crested rectangular weir is as follows:

$$Q = C_d \times \sqrt{2 \times g} \times B \times h^{3/2}$$

Equation 4-7

Where: Q = flow rate of water over weir (m^3/s),

C_d = broad crested weir coefficient

= coefficient of 0.385 used as in (Lawrie & Stretch, 2011a),

g = gravitational acceleration (m/s^2),

B = breadth of weir (m),

h = height of water above weir (m)

= water level (m GMSL) – height of weir (m)

The flow rate through the Backchannel is therefore a function of the water level, which in turn is based on the difference between the inflow into the floodplain and the rate of outflow through the Backchannel. It is clear that the calculation to determine the transfer rate of water into the St Lucia Lake via the Backchannel is an iterative one.

In order to solve it accurately, one would have to find the solution to an integral such as the one attached in the Appendix A below. As this model is meant to be a simplified storage model, that has limited base-data and a relatively large time-step, it is not appropriate that such a complicated method be used. Rather, the model determines the minimum and maximum possible transfer rates that occur and then uses the average as a constant flow rate through the month.

As discussed above, the minimum and maximum flow rates are dependent on the minimum and maximum water levels, able to feed water through the Backchannel, experienced in the floodplain during the month. These water levels can therefore range between the height of the weir and the height of the berm that is to be breached.

It also has to take into consideration whether the resultant inflow is greater than or less than zero. A negative resultant inflow can potentially occur when river flow is very low, but the water surface area is high due to water accumulating behind a closed mouth. The evaporation on the water’s surface can therefore become significant in comparison to the water entering the floodplain. In an instance such as this, the maximum transfer rate would occur at the start of the month, rather than at the end.

For greater detail regarding how the maximum and minimum transfer rates are calculated in order to estimate an average transfer flow rate for each month, the reader is directed to the model write-up that is included in the Appendix B.

4.4. DETERMINATION OF SEDIMENT TRAPPING EFFICIENCY

As discussed in 2.2.6, the input of excess sedimentation can be detrimental to the ecological functioning within an estuary. This is of particular import with regards to the option of introducing water from the Mfolozi River (with possible high sediment loading – refer to Figure 3-9) into the St Lucia Lake. In order to prevent excess sediment being transferred through the Backchannel, it is proposed that the stored water, behind a closed mouth, can act as a sediment trap.

Unfortunately due to the following reasons, it is not feasible to create a sediment balance of the floodplain – as the deposition and scouring of sediment during a breaching event cannot be reasonably simulated:

- the lack of sufficient field data: a detailed land and bathymetric survey of the floodplain, a larger sample of turbidity data which includes both wet and dry periods, as well as more sediment sample analyses of both the suspended sediment and bed-load
- the capabilities of the current model being a storage based model rather than a more complex 2D or 3D model.

However, as one of the objectives of this study is to determine how much of the Mfolozi sediment can be detained during the transfer of water to the lake, the sediment trapping efficiency of the floodplain during each month will be examined in a simplistic plug-flow model – detailed in 4.4.1 below. The method used to determine the sediment trapping efficiency will then be compared to other methods found in relevant literature.

4.4.1. PROPOSED METHOD USED IN MODEL

Horizontal plug-flow (as indicated in Figure 4-15) was assumed for the estuary. As indicated in van Alphen, et al. (2012), if the floodplain is modelled using plug flow to determine the settling of sediment in the estuary, the depth of water is the crucial factor, and therefore there is no difference whether it is modelled at horizontal or vertical flow. Modelling the settlement of sediment as a plug-flow model has numerous limitations, such as it doesn’t account for re-suspension, turbulence, or short-circuiting of flow through the estuary – however, it is fitting to the level of data available as well as the relatively large time-steps.

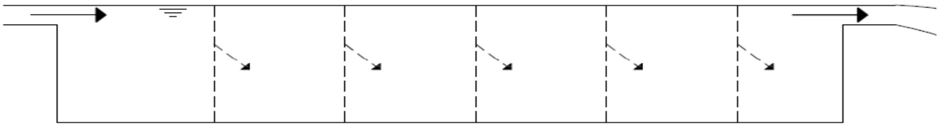


Figure 4-15: Illustration of horizontal plug flow (van Alphen, et al., 2012)

A value for a representative residence time is calculated by dividing the average stored water volume for the month by the river inflow for the month. The residence time is defined as the time required for a pocket of water to travel through the estuary into the Backchannel - inlet to outlet of floodplain (Rueda, et al., 2006). As one can see from Figure 4-16, the larger monthly river inflows are characterised by very disparate peak flows. Therefore if the residence time for each month is calculated using the average monthly river discharge, the residence time for the larger flood events (in which the sediment loading is generally high) is grossly overestimated.

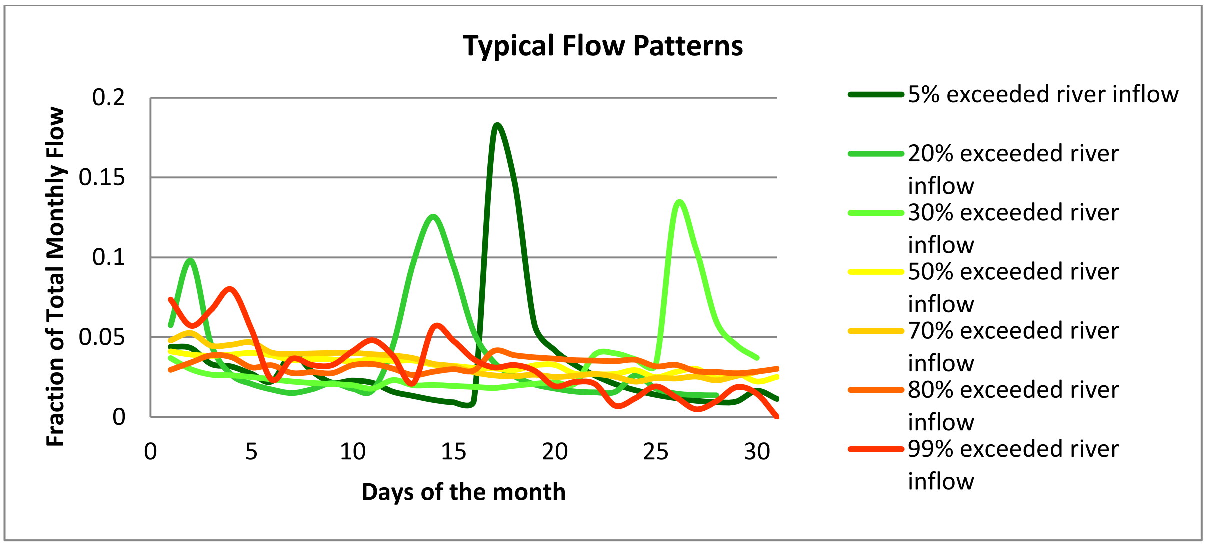


Figure 4-16: Flow patterns for typical river inflows

To combat this overestimation of the sediment trapping efficiency of the floodplain, a peak river inflow rate is required to compute the monthly residence time. An attempt to determine a relationship between the totally monthly inflow and the maximum five-day-average flow for a set of typical river discharge values (5%, 20%, 30%, 50%, 70%, 80% and 99% probability exceeded monthly river discharge) was made. The result is depicted in Figure 4-17 The correlation between the two parameters is high and therefore the relationship between the peak and total monthly Mfolozi River discharge was used in the model to determine the residence time.

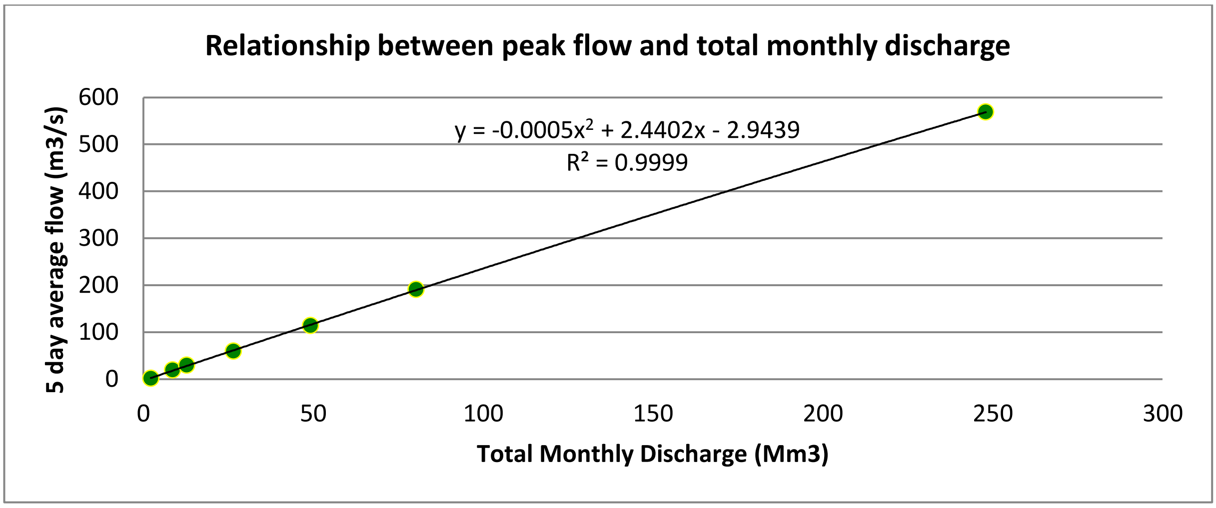


Figure 4-17: Relationship between peak and total monthly Mfolozi River discharge

The total amount of sediment suspended in the water is calculated by multiplying the monthly river discharge with the monthly sediment concentrations, as previously discussed in 4.2.4.1 above. To this, the amount of sediment that did not settle from the previous time-step is added.

The residence time is multiplied by the settling velocity of the median sized sediment particle in order to derive the potential depth in which settlement can occur during the month. This depth is compared to the actual average water level in the floodplain for the month. If the potential depth is greater than the average water level, then the floodplain achieved a 100% sediment trapping – however, if not, the amount of sediment not settled is added to the next month's total amount of suspended sediment.

If the sediment trapping efficiency is less than 100% and the transfer rate via the Backchannel is greater than zero, then the amount of Mfolozi sediment introduced into the lake is calculated by multiplying the monthly sediment concentration, the transfer rate and percentage of sediment that did not settle.

4.4.2. METHODS FROM LITERATURE

The determination of sediment trapping efficiency is generally used for planning and monitoring the life cycle of dams. Although a wealth of literature exists regarding this topic, one must remember that dams differ from a *temporarily open/closed* estuary in the sense that the water level is relatively constant. The sediment trapping efficiency of dams (otherwise referred to as reservoirs in international literature) is also generally calculated used average yearly data – the methods would therefore have to be modified for a monthly time step so that it can be applied to this study's model.

There are three main empirical relationships that were developed using measured data from certain reservoirs. The first one is the usage of the *Brown's Curve*, as referenced by the US Army Corps of Engineers (1995). This curve relates the sediment trapping efficiency to the ratio of the volume of the stored water to the contributing drainage area. The curve can be represented by the following equation:

$$E = 100 \times \left(1 - \frac{1}{1+\frac{K \times C}{w}} \right)$$

Equation 4-8

Where E = Sediment trapping efficiency (%),

K = Coefficient ranging from 0.046 to 1 – a higher K results in a greater trapping efficiency,

C = Volume of stored water (acre.ft),

W = Contributing drainage area (mile^2).

This method is rejected for this study as it does not take into consideration the impact on the residence time, and therefore the trapping efficiency, that a significant variation in river discharge which would have. As discussed above, this method is also used to estimate the average yearly sediment trapping efficiency and is therefore not applicable to this model's requirements.

The second empirical method, indicated by the US Army Corps of Engineers (1995) to evaluate the sediment trapping efficiency of a reservoir, is the usage of the curves first proposed by

Brune (1953), and then modified later by Dendy (1974) who added more data and defined Brune's median curve by the following equation:

$$E = 100 \times \ 0.97^{0.19^{\log(\frac{C}{I})}}$$

Equation 4-9

Where: E = Sediment trapping efficiency (%),

C = Volume of reservoir,

I = Mean Annual Runoff into reservoir.

Brune (1953) used a total of forty normally ponded reservoirs ("as distinguished from desilting basins and dry reservoirs") in order to develop the curve he proposed. Unfortunately, his empirical relationship is only valid if the capacity of reservoir is divided by the mean annual runoff – which in the case of this model is unsuitable as an estimate of the sediment trapping efficiency per month is required. This method is therefore also rejected.

The third empirical relationship is the sediment trapping curve developed by Churchill (1948, as referenced by the US Army Corps of Engineers, 1995). Churchill (1948) used measured results to propose a relationship between the amount of sediment passing through a reservoir and a *Sedimentation Index*. The relationships are as follows:

$$SI = R \ \div V = \ldots . = \frac{C \times A}{I^2}$$

Equation 4-10

$$(100 - E) = (\ 800 \ \times \ SI^{-0.2} \ ) - 12$$

Equation 4-11

Where: SI = Sedimentation Index – refer to Equation 4-10,

R = Residence time (s),

V = Mean velocity (ft/s),

C = Volume of reservoir (ft^3),

A = Average cross-sectional area (ft^2),

I = Inflow rate (ft^3/s),

E = Sediment trapping efficiency (%).

According to Verstraeten & Poesen (2000), the equation used to define the Churchill (1948) empirical relationship is more accurate than the Brune (1953) ones as ‘the scatter of data points around the proposed curve is also less pronounced’. The problem encountered with the usage of the Brune (1953) curve for this model is not experienced with the relationship described by Equation 4-11, as it allows for periods where the ratio of storage capacity to river discharge is greater than one. This is compared to Brune (1953) where the trapping efficiency reaches a plateau once the storage-discharge ratio exceeds one. Borland (1971, as referenced in Verstraeten & Poesen, 2000) also notes that the trapping efficiency curve derived by Churchill (1948) has a wider range than that of Brune (1953). The Churchill (1948) sediment trapping efficiency curves is therefore an acceptable method to compare the trapping efficiency values calculated in the model, as per the method described in 4.4.1 above.

The average cross section used in Equation 4-10 has been estimated from the cross-sections of the floodplain measured and reported in Grenfell, et al. (2009). Note that only the relevant cross-sections of the lower floodplain were considered.

Verstraeten & Poesen (2000) also made reference to simple theoretical models very similar to that proposed in 4.4.1 above. However these suggested models contained the following provisions:

- The deduction of dead storage from the reservoir capacity,
- As well as a constant in order to adjust the determination of the trapping efficiency to allow for the occurrence of re-suspension, turbulence, short-circuiting, etc.

Unfortunately due to the lack of field measurements, the amount of dead storage in the floodplain is unknown. There is also very little sediment concentration data of water through Backchannel in order to calibrate the trapping efficiency model and to quantify the constants allowed for.

4.4.3. DETERMINATION OF TYPICAL SETTLING VELOCITY

A characteristic settling velocity is required in order to determine the trapping efficiency of the floodplain in the theoretical plug-flow model (described in 4.4.1 above). Settling velocity of a sediment particle is strongly dependant on both the particle size and its density.

There are three sets of data in literature regarding the particle sizes of the Mfolozi river silt. Grenfell & Ellery (2009) took a set of ten samples using an *Eijelkamp Water Trap* Sampler, whilst Maine (2010) obtained a set of two samples from the Mfolozi River bed using a grab. Both sets of samples taken were measured using a *Malvern Mastersizer*. There was a distinct difference between the average median-sized-particles (D_{50}) recorded in each study: 0.0052mm and 0.309mm in the studies conducted by Grenfell & Ellery (2009) and Maine (2010) respectively. According to the *American Geophysical Union Sediment Classification System* as tabled by the US Army Corps of Engineers (1995), the particle sizes measured by Grenfell & Ellery (2009) and Maine (2010) can be termed a *very fine silt* and as a *medium sand* respectively.

As one can see, the particle size determined by Maine (2010) would not be a problem with regards to suspended sediment as a typical settling velocity would be 0.096m/s (using *Stoke's Law* for settling velocities and a particle density of 2650kg/m^3 as particle would be considered a sand). As samples were taken using a grab on the river bed floor, it is quite possible that a certain amount of bed load could influence the readings. The D_{50} particle size of the bed load that was recorded by Grenfell & Ellery (2009) as 0.350mm lends credence to this assumption.

However, with cohesive sediment (silt and clay particles), there is a 'tendency to aggregate into larger particles known as flocs' (Maine, 2011). The third set of field data collected was recorded by Maine (2011). The average D_{50} particle diameter found suspended in the Mfolozi River discharge was 0.004mm, with the sample as a whole having a clay-silt-sand proportion ratio of 25-72-3%. Through extensive experimentation conducted by Maine (2011), an approximate value for the D_{50} floc diameter of 0.030mm is found.

van Rijn (1984) indicates that *Stoke's Law* can be used in order to determine the settling velocity of 'a solitary sand particle smaller than about 100µm'. In order to estimate a settling velocity for the above particle diameters (all below 0.100mm), *Stoke's Law* is applied using the following equation (Pafko 1995, as referenced in Maine, 2010):

$$v = \frac{D_p^2 \times (\rho_p - \rho) \times a_c}{18 \times \mu}$$

Equation 4-12

Where: v = Settling velocity (m/s),

D_p = Diameter of particle (m),

ρ_p = Density of particle (kg/m^3),

ρ = Density of fluid (kg/m^3),

a_c = Gravitational acceleration (m/s^2),

μ = Dynamic viscosity (N s/m^2).

As this method, like most conventional settling velocity calculation methods, accounts for a solitary particle, van Alphen, et al. (2012) suggests using a particle density of 1200kg/m^3 (instead of the 2650kg/m^3 for sand) when determining the settling velocity of a floc.

Maine (2011) indicates that the settling velocity of the Mfolozi River micro-flocs (diameter of less than 0.100mm) settle at a rate that exists between 0.1 to 0.5mm/s. Using graphical results, one can estimate that the settling velocity of a 0.030mm floc in slightly saline conditions settle at approximately 0.2mm/s. It is important to note that Maine (2011) relates the settling velocity to the size of floc that is allowed to aggregate, and that the study shows that at salinities above 1 ppt can promote the growth of flocs.

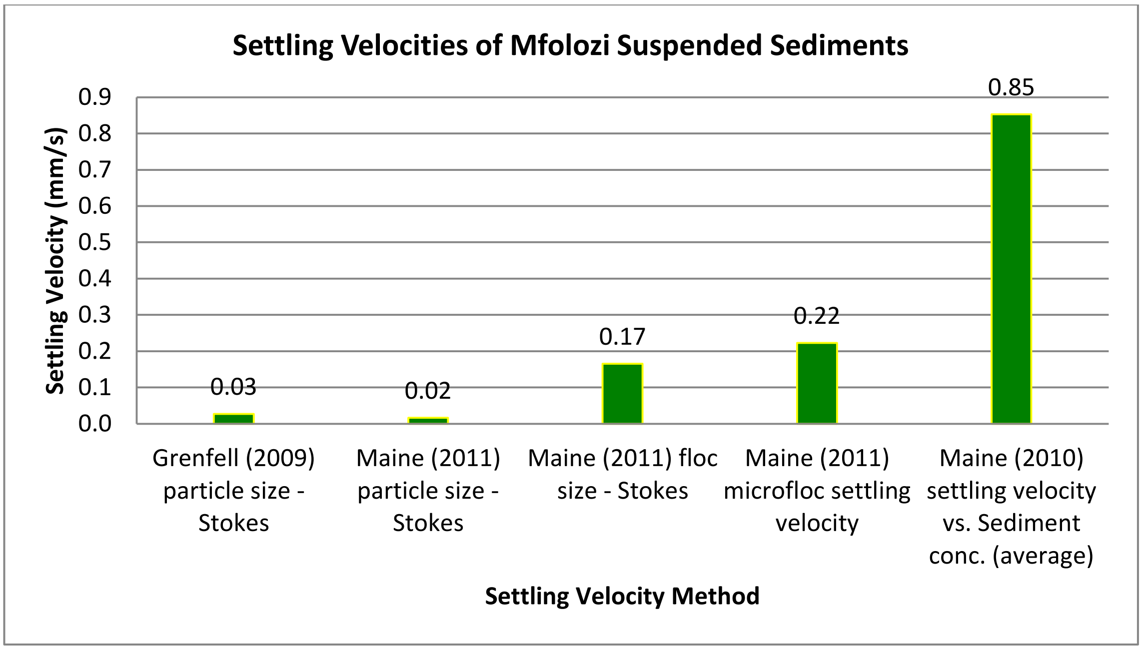


Figure 4-18: Comparison of settling velocities of Mfolozi River suspended sediments

Krone (1962) and Coles & Miles (1983), both as referenced by the U.S. Department of the Interior (2006), propose that the settling velocity is dependent on the concentration of the suspended solids in the fluid. Through experimental procedure, Maine (2010) developed the following relation between the settling velocity of Mfolozi silt and the suspended sediments concentration:

$$v_s = (3 \times 10^{-13} \times C^3) - (2 \times 10^{-10} \times C^2) + (2 \times 10^{-8} \times C) + (4 \times 10^{-5})$$

Equation 4-13

Where: v_s = Settling velocity (m/s),

C = Suspended sediment concentration (mg/ℓ).

In the *Editor* tab of the model, the user is given the choice between five methods of determining the settling velocity of the suspended solids – the merits and its effect on the sediment trap efficiency of the floodplain will be discussed further in 5.1.2 below. The magnitudes of each method are compared against each other in Figure 4-18 above.

4.5. LAYOUT OF MODEL

The model has been developed using a *Microsoft Excel* workbook as an instrument to record and calculate data. Snapshots of the workbook, as well as a full algorithm write-up and *Excel* file are appended to this report (refer to Appendices B and C below).

Table 4-1: Components of workbook used to simulate the water balance model

No.	**Sheet Title:**	**Description:**
1.	Introduction	
2.	Contents Page	
3.	Parameters Editor	User Interface – various parameters of models can be modified in this tab, such as weir and berm heights, threshold flow, etc.
3.1	Hydrology Calculations	Calculations of monthly precipitation, evaporation, runoff and sediment load figures – data is fed into the Sheet No.3
4.	Hypsometric Curve Editor	User Interface – choice of volume-water level relationships can be made from the four DTMs listed below.
4.1	DTM – 1st Option	Relationship derived by (Grenfell, et al., 2009)
4.2	DTM – 2nd Option	Relationship derived by (Kelbe, 2010)
4.3	DTM – 3rd Option	Relationship derived as part of this study
4.4	DTM – 4th Option	Relationship derived by (Chrystal, 2012)
5.	Model	Simulates results using data from Sheet No. 3, 4 & 5.1
5.1	Sediment Trapping Efficiency	Supporting calculations for Sheet No. 5 above.
5.2	Sensitivity Analysis	Sheet enabled with *macros* in order to calculate the sensitivity to change of certain parameters (listed in Sheet No. 3 above) in the model (Sheet No. 5).
5.3	Probability Exceedance Curves	Based on flows calculated in Sheet No. 5.
6.	Output	Graphs & figures relating to simulated results from Sheet No. 5.

5. RESULTS AND ANALYSIS

5.1. REVIEW OF MODEL'S SIMULATION ABILITY

5.1.1. SENSITIVITY ANALYSIS

In order to evaluate and calibrate a model, the sensitivity of the model to changes in parameters must be studied for four main purposes (James, 2005). The reasons are as follows:

- To serve as a check to ensure that the model functions as it is meant to. For example that if the threshold flow is equal to zero, the mouth should not be able to close. If it does, then one must realize that there is a problem with the model and must try to rectify it.
- To determine if there are limits to which each parameter can be changed. For example if one allows the sea berm to increase to 10m GMSL and no outflow to St Lucia Lake is allowed, the model will indicate the enormous area that would be inundated.
- To calibrate the model to a certain degree of accuracy, one needs to determine to which of the parameters the model is very sensitive. If the outcome of the model alters drastically when a certain parameter is changed, then it stands to reason that more effort should be taken to calibrate that specific parameter.
- The last purpose of a parametric study is to determine when a parameter will give an optimal solution. This shall be further discussed in 5.1.2 and 5.2 below.

A sensitivity analysis on a certain parameter is performed by holding all other variables constant whilst varying the parameter in question. The rate of change in an output is then compared to the incremental change of the parameter. If the rate of change is significantly high, then calibration of the parameter is required.

The following parameters and control values have been tested, and used respectively in order to conduct a parametric study on the model derived as part of this study:

- The height of the berm closing the estuary mouth off from the sea - default value of 2m GMSL,
- The threshold flow, which is the maximum resultant river discharge through the inlet at which the sea berm can start to build up again after a breaching event - default value of 4 Mm^3/month,

- The height and breadth of Backchannel weir used to transfer water between estuaries - default values of 0.9m GMSL and 20m respectively,
- The hypsometric curve used to relate the volumes of stored water in the floodplain to water levels - default DTM used was that derived by (Chrystal, 2012),
- The sediment loading of the Mfolozi River - default data set was the average of the measured results from the Mtubatuba WWTW and UCOSP – as discussed in 4.2.4.1 above.
- The method of calculating the sediment settling velocity - default method derived by (Maine, 2010) regarding a settling velocity-sediment concentration was adopted.

Results of sensitivity analysis are indicated in Appendix D.

5.1.1.1. HEIGHT OF THE SEA BERM

The sea berm is the barrier of sand that closes the river mouth from the sea. This is discussed in greater detail in Section 2.2.4. The sensitivity analysis of this parameter (refer to Figure 8-1 A) indicates that as the berm increases, so does the transfer rate of water via the Backchannel into the St Lucia Lake. This is due to an extension of time required to breach the higher berm, as well as a higher head of water over the Backchannel weir.

However it is noted that there is a *limit* after which there is no significant increase in out flow which occurs for berm heights greater than approximately 3.5m GMSL. At this point, the transfer rate is approximately 256 Mm^3/year (roughly 30% of the Mfolozi’s MAR) and the estuary mouth is closed approximately 57% of the time.

As the berm height increases, the sediment trapping efficiency (refer to Figure 8-1 B) decreases slightly. This is contrary to initial expectations of a longer residence time due to an increase into the storage capacity in the floodplain behind the berm. However, the significant increase in the transfer rate out of the floodplain into the St Lucia Lake due to the higher sea berm, results in a shorter residence time. It is noted that the decrease in sediment trapping efficiency is not significant and if all default values are kept as indicated in Section 5.1.1 above, the trapping efficiency does not decrease past 90% - which is desirable.

Therefore an increase in berm height is restricted not by its effect on the decrease in the floodplain's sediment trapping ability, but rather by the level inundation caused by stored water and damage it can cause to the surrounding sugar cane farms as discussed in Section 3.4.

The sensitivity analysis indicates that between berm heights 1.5m GMSL and 3.5m GMSL (reasonable range of values), there is an approximate increase in water transfer rate of 52 Mm^3/year for a 0.5m increase in the sea berm height. **The berm height is therefore a sensitive and important design parameter that will be carefully considered in 5.2 below.**

As a design check, with regards to the functioning of the model, when the berm height is less than the weir height, it must be ensured that no flow is allowed through the Backchannel.

5.1.1.2. THRESHOLD FLOW

The value of the threshold flow determines when flow through the river mouth will decrease sufficiently to allow a sand berm to build and close the estuary inlet – until such time that it is breached again. The influence that the threshold flow has on the mouth mechanism is detailed in Sections 2.2.4 and 4.3.3. In general, an increase in the threshold flow results in the mouth being able to close more often, and therefore when sufficient water is accumulated in the floodplain, more water can be transferred to St Lucia Lake via the Backchannel.

Results from the sensitivity analysis (refer to Figure 8-1 C) indicates that at low threshold flows (approximately 0 – 10Mm^3/month), there is a 13Mm^3/year increase in the transfer rate per 1Mm^3/month increase in threshold flow. After which the rate of increase in the water transfer rate decreases – becoming constant at a threshold flow of approximately 50Mm^3/month. To place the threshold flows above into perspective – a flow of 3 and 10Mm^3/month through the Mfolozi River is exceeded approximately 99% and 75% of the time respectively.

As the threshold flow is a difficult measurement to accurately estimate on site (as it is a process that occurs over a period of time and is affected by changing mouth cross-section), it is fortunate that **the rate of change is not as significant as that seen in some of the other parameters**. However a good estimate, such as that made by Stretch (2010) of 4Mm^3/month – a flow that is exceeded 90% of the time, is required. This estimate was made by comparing the statistics of recorded open/closed mouth conditions to the Mfolozi flow duration curves.

A change in the threshold flow has little influence on the trapping efficiency of the floodplain (refer to Figure 8-1 D), as it only has an effect on how often the mouth closes. However, the greater time the mouth is closed, the more sediment is allowed to enter the St Lucia estuary via the Backchannel in proportion to the transfer flow rate.

As a design check, with regards to the functioning of the model, when the threshold flow equals zero, it must be ensured that the mouth of the river estuary is continuously opened.

5.1.1.3. HEIGHT OF WEIR INTO THE ST LUCIA ESTUARY

Equation 4-7 indicates that the transfer flow rate via the Backchannel is dependent on the height difference between the estuary’s water level and the height of the Backchannel weir. As the height of the weir increases, the flow rate into the St Lucia Lake decreases at a rate of approximately 7.5Mm^3/year (if other parameters are as their control values) per 10cm rise in height (refer to Figure 8-2 A).

Due to the transfer rate decreasing, breaching levels are reached more often and therefore the proportion of time that the estuary mouth is open increases. The decreasing outflow to the St Lucia Lake also results in higher residence times and therefore an increase in sediment trapping (refer to Figure 8-2B).

The weir height is a sensitive and important design parameter that will be carefully considered in Section 5.2.

As a design check, with regards to the functioning of the model, when the weir height is equal to the height of the sea berm, it must be ensured that no flow is allowed through the Backchannel.

5.1.1.4. BREADTH OF THE BACKCHANNEL WEIR

Equation 4-7 indicates that the transfer flow rate via the Backchannel is directly proportional to the crest breadth of the Backchannel weir. In contrast to the effect of raising the height of the weir (refer to Section 5.1.1.3), the increase in the breadth results in an increase in the transfer flow rate. As a result, the mouth is able to close for a longer proportion of time due to it taking longer for breaching water levels to accumulate in the floodplain. The residence time, and therefore the settling trap efficiency also decreases.

A realistic value of the Backchannel width would be between 20-50m. If it is too small, the transfer rate would be insignificant and would be ineffective in solving the problem of the St Lucia Lake's lack of freshwater supply. However, the weir breadth must be manageable and controllable – a crest width greater than 50m, would not fulfil this criteria. Using the control values for all other parameters, it is seen that the following could be proposed: as the width of the Backchannel increase by a 1m, the transfer rate also increases by 2.3Mm^3/year (refer to Figure 8-2Figure 8-1 C). **This, like the weir height, is a sensitive and important design parameter that will be carefully considered in Section 5.2.**

Using control conditions, it is noted that a *limit* is reached during the sensitivity analysis is conducted and the weir breadth becomes very wide (approximately 400m). If the weir height is dropped so that there is no height or width control, it can be assumed that the conditions are similar to that of a St Lucia-Mfolozi combined mouth scenario. The sediment trapping efficiency (refer to Figure 8-2Figure 8-1 D) at this stage is approximately 85%. This is an acceptable limit and therefore lends credibility to the school of thought that even during a combined mouth condition; the floodplain is sufficiently large to provide the required trapping of sediment.

As a design check, with regards to the functioning of the model, when the weir breadth is equal to zero, it must be ensured that no flow is allowed through the Backchannel.

5.1.1.5. HYPSOMETRIC CURVE

As discussed in Section 4.3.1, for the model to function, a relationship between the water levels and the corresponding volume of stored in the floodplain is required. The option to choose between the four relationships, displayed in Figure 5-1, is given.

As indicated in Figure 5-1, the volume to water level relationship proposed by Kelbe & Taylor (2011) is much greater than that surveyed by (Chrystal, 2012). The DTM (digital terrain model) created by (Chrystal, 2012), from which the hypsometric curves are developed, indicates the riverine channel that holds storage below 1.5m GMSL, after which it spills onto the floodplain. This is indicative of the existing floodplain morphology.

When compared to the three other hypsometric relationships (refer to Figure 8-3), the DTM developed by (Chrystal, 2012) stores less water behind closed mouth conditions. The breaching water levels are reached quicker and therefore the mouth is closed less often. This results in a significantly smaller transfer rate through the Backchannel – the DTM proposed by (Kelbe, 2010) produces a transfer rate that is 125% greater than that of (Chrystal, 2012). The smaller storage volume also results in a lower sediment trap efficiency. The derivations of these DTMs are explained in greater detail in Section 4.3.1.

Due to the relatively large difference in the estimated transfer rate via the Backchannel, caused by using different hypsometric curves is great, **the need to choose an accurate DTM and corresponding hypsometric curve is crucial.**

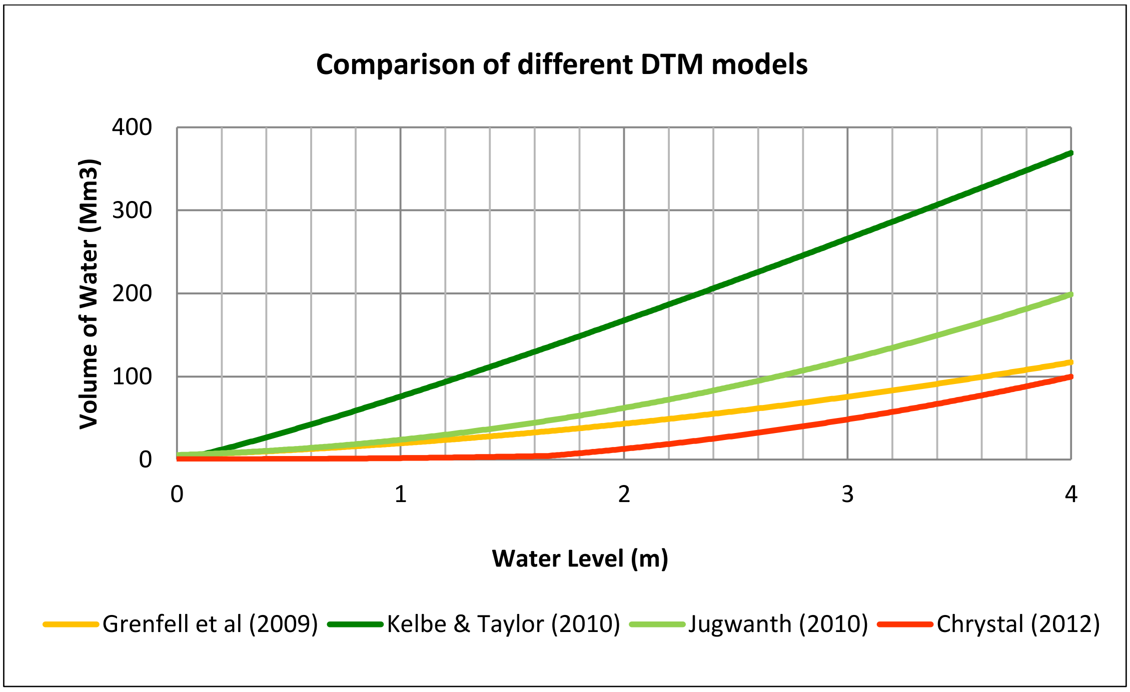


Figure 5-1: Comparison of volume to water level relationships used in model

5.1.1.6. SUSPENDED SEDIMENT LOADING & SETTLING VELOCITY

The evaluation of literature in order to extract plausible data sets for the suspended sediment concentration that is prevalent in the Mfolozi River throughout the year, as well as a characteristic study in order to estimate settling velocity for a representative particle size is discussed in great detail in Sections 4.2.4 and 4.4.3 respectively.

As a result of the evaluation process, in the model, the user is given the option to choose between two data sets regarding the sediment concentration in the river. The first is an average of measured data from the Mtubatuba Water Treatment Works (procured during a dry period) and from UCOSP (procured during a wet period). The second set was the monthly average of approximately one hundred years of simulated and calibrated data, developed by Maro (2012) using an ACRU model.

As discussed in Section 4.2.4.1, the concentration values proposed by Maro (2012) are significantly higher in relation to the measured data, and this results in the estimated sediment mass entering the St Lucia Lake via the Backchannel being 70% higher than the estimates based upon the measured data (refer to Figure 8-4 C). However, given the high sediment trapping efficiency of the floodplain, the amount of sediment entering the lake regardless of which data set is used, is relatively insignificant in relation to the large area of the St Lucia Lake and the natural scouring and other sedimentation process that occur within it during the period of a year.

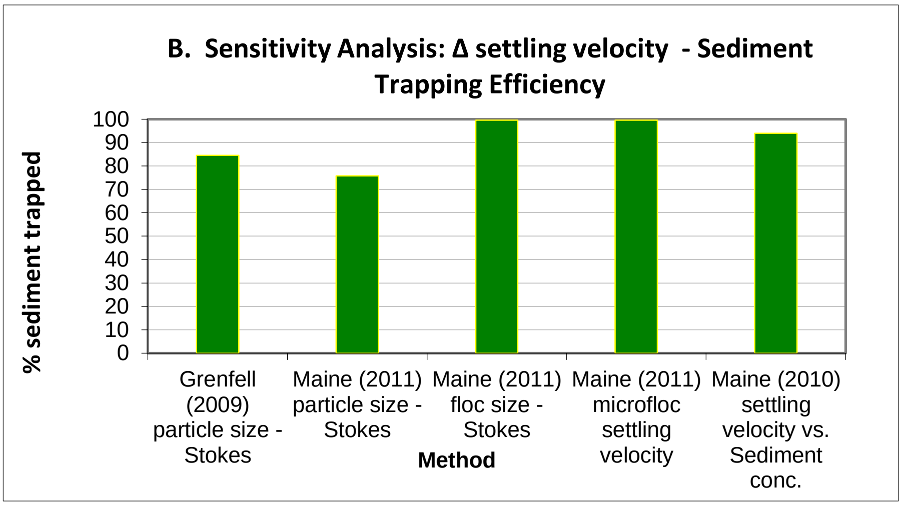


Figure 5-2: Comparison of effect of settling velocity on sediment trapping efficiency

One of the most influential parameters affecting the sediment trapping efficiency is the settling velocity of the median sediment particle size. The model gives the user the ability to switch between five settling velocities. The effect of the five settling velocity on the sediment trapping efficiency of the floodplain is indicated in Figure 5-2.

As one can see the usage of *Stokes Law* on sediment particles, results in a sediment trapping efficiency that is less than when using the other methods. This is due to the fact that it does not account for flocculation, which occurs in cohesive material – such as the Mfolozi silts. Using *Stokes Law* on the floc sizes, as well as using a floc density, leads to results that are similar to the settling velocities observed during experimentation recorded in Maine (2010) and Maine, (2011).

The sediment trapping efficiency simulated when using the settling velocity-sediment concentration relationship proposed by Maine (2010) produces interesting results. In Figure 4-18, the settling velocity calculated using the average monthly sediment concentration is far greater than any of the other methods. However, in Figure 5-2, the sediment trapping efficiency is less than that produced by the other two floc-settling velocity estimates. This is due to the fact that the settling velocity-sediment concentration relationship increases the settling velocity during periods of high sediment load, which generally corresponds to larger river discharges. At those times the mouth is more likely to be open and therefore sediment trapping is not required. During lower flows, when the mouth is more likely to be closed while water is diverted into St Lucia via the Backchannel, the sediment concentrations are lower – decreasing the rate of flocs, and hence the settling velocity.

The disparities in the available literature concerning the sediment loads, characteristics, particle diameters, settling velocities, etc. indicate that further research (including field measurements) are required - however **the current available information is reasonable enough to evaluate whether or not the Mfolozi River floodplain in applicable as a sediment trap** in order to prevent excess sediment entering the St Lucia Lake via water transfer through the Backchannel. This is indicated by the worst case scenario, when under default conditions the slowest settling velocity is used, resulting in a minimum trapping efficiency of approximately 76% which still a high proportion of the sediment load.

5.1.2. VALIDATION OF MODEL UNDER CURRENT CONDITIONS

5.1.2.1. VALUES OF MODEL PARAMETERS

In order to examine the ability of the model to simulate the estuarine mechanism, the model output is examined under existing conditions. The DTM used, for the volume-water level relationship, was that surveyed and recorded by Chrystal (2012). **To date, this is the most current and extensive field survey conducted in the floodplain**.

Although historical records indicate that the berm closing the Mfolozi River mouth inlet may have reached 4.5m GMSL (Taylor, 2011a), in recent times it has been common practise to artificially breach the estuary's berm when the water levels are approximately 1.5m GMSL (van Alphen, et al., 2012).

By the comparison of river discharge flow duration curves against records regarding the Mfolozi River's mouth condition, Stretch (2010) estimated that the threshold flow rate which allowed for the sand berm to build up is 4Mm^3/month (a 95% probability of being exceeded). Another study, conducted by van Niekerk & Huizinga (2012), estimated that the inlet would be able to close when the river discharge was less than 8Mm^3/month (an 80% probability of being exceeded). As described in Section 5.1.1.2, the threshold flow is a sensitive parameter – and therefore (as indicated in Figure 8-1 C) there is a significant change in the transfer rate through the Backchannel depending on which value of the threshold flow rate is used. It also must be noted that a threshold flow of 4Mm^3/month was stringent and only allowed the mouth to generally close in August, at end of the winter period. From past records, it is evident that this is not the case – such as in July 2008 to January 2009 when a closed mouth resulted in a transfer of water into the St Lucia Lake (Taylor, 2011a). On the other hand, a threshold flow of 8Mm^3/month resulted in the mouth being closed on average for a longer time than is expected of a normally open estuary of the eastern coast of South Africa.

An average between the two estimates was used for this model. The threshold value of 6.38Mm^3, equivalent to an 87.5% exceeded resultant river flow was used.

As the Backchannel runs through mangroves and has been shaped in recent times via the movement of animals such as hippopotami through it, the dimensions vary. The average width of the Backchannel has been estimated by Stretch (2010) as 20m and the crest of the weir leading into the St Lucia has been surveyed as being at 0.9m GMSL (Chrystal, 2012).

In terms of the sediment characteristics and loading selected for the model: the average of the two measured turbidity data sets (from UCOSP and the Mtubatuba WTW) are used, as well as the settling velocity-sediment concentration relationship proposed by Maine (2010).

5.1.2.2. MODEL OUTPUT UNDER CURRENT CONDITIONS

The results of above input data fed into the model are detailed in Figure 5-3. The mouth of the Mfolozi River is seen to be closed 22% of the time tested (a period of approximately 90 years) allowing for a yearly average transfer rate of 22Mm^3/annum from the Mfolozi River to the St Lucia Lake. It is also useful to note that the average value, for months when there is flow through the back channel is 8Mm^3/month. The average trapping efficiency is 99%.

As discussed in Lawrie, et al. (2011), the system will go through ‘decadal cycles of wet and dry periods. These climatic cycles account for the fact that the *coefficient of variance* for the average decade transfer flow rate (205 Mm^3/decade) is 36% as compared to the 119% for the average yearly flow rate. The greater confidence in the estimation of the transfer flow rate per decade is due to the greater chance that each decade contains a portion of both wet and dry years. The large time-step of the model is therefore applicable in that context, as it allows the user to examine the behaviour of the estuary under different conditions for many decades, encompassing a combination of both dry and wet periods.

Examining Figure 5-3 C, it is evident that the threshold flow is generally met in July – mid winter. The inlet is then closed by a sand berm allowing the river discharge to accumulate in the floodplain. Once the water levels are sufficiently high, a transfer of fresh water from the river into St Lucia commences. It seems a trend that water levels - high enough to breach the berm - occur at the beginning of summer during December and January due to the higher river discharges. The peak river discharge (as seen in Figure 5-3 B) is seen to be during February and April when the chance that the mouth is closed in minimal.

If Figure 5-3 C and Figure 5-3 A are compared, it is evident that the transfer rate during August and September is much smaller than that of October and November, even though they seem to have the same likelihood of having a closed river mouth. The explanation is that the transfer rate through the Backchannel is proportional to the height of water, which is higher at the end of spring due to the more rapid accumulation of water in the river floodplain area.

As mentioned above, the sediment trapping efficiency of the floodplain has been calculated as approximately 99%, with the exception of February. Referring to Figure 5-3 B it is evident that the river discharge peaks in February and March. This would generally breach a closed mouth – it would also be the typical high flow that would cause a shorter residence time in the floodplain for sediment to settle. In this scenario, the average sediment trapping efficiency during this period (February) is 81% - which is acceptable.

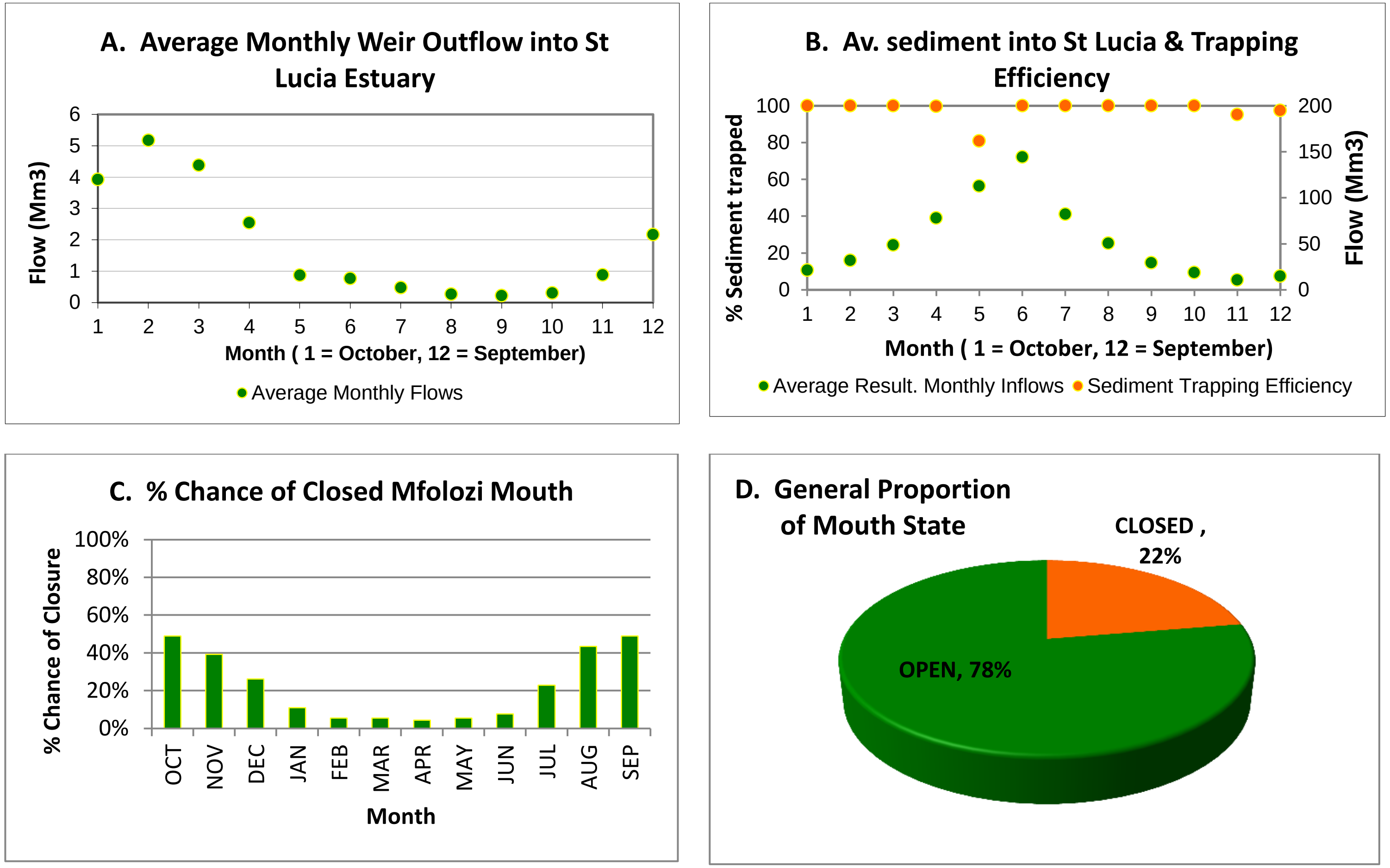


Figure 5-3: Model output simulating operation of old Backchannel

Taylor (2011b) states that there is a perception ‘that the Mfolozi mouth has closed more frequently in recent years’. This is due to the severe drought that has been experienced by the study area since 2002 (Maro, 2012). It is pleasing to note that the model (using the simulated river discharge values and the input parameters detailed above) also indicates this trend.

One must remember that the product of this study is a simple storage model with a relatively large time increment – it is a management tool that can be used to estimate an amount of water that can be transferred into the St Lucia Lake and the effect that such a scheme would have on the floodplain. After an examination of the sensitivity analysis, as well as the output (transfer rate of water via the Backchannel and percentage time mouth is closed) and the resultant trending - for its intent and purpose - it is evident that the model is valid under current conditions.

5.1.2.3. COMPARISON AGAINST VARIOUS MEASURED & SIMULATED DATA

There are two relevant sets of field measurements that can be used to compare against the results of the model.

The first is the turbidity readings reported by van Alphen, et al. (2012) in order to validate the sediment trapping efficiency that was proposed in their study. Measurements were taken at the start of the floodplain, at the old Backchannel and the Mfolozi mouth. The measured data is indicated in *Worksheet 5.1* of the model (refer to Appendix E), and yielded an average value of 84%. There is no corresponding data available regarding the water levels and the river discharge into the floodplain at that time, and so the results of methods proposed in this study and by van Alphen, et al. (2012) cannot be checked against the actual trapping efficiency measured at that point in time. The monthly simulated trapping efficiencies (at current conditions over a 90 year period) ranges from 25% - 100%, with the median and average values being 100% and 99% respectively.

The field measurement is beneficial as it indicates the relative magnitude of sediment trapping that can be expected in the floodplain. The average sediment trapping efficiency as derived from the plug-flow model is an overestimate of the natural conditions as it does not allow for mixing, re-suspension, varying floodplain dimensions, short-circuiting and takes into consideration the settling of the median sediment particle size. The measured sediment trapping efficiency indicates that the model potentially overestimates the trapping efficiency by approximately 15% between the average simulated value and field measurement. This is not a very significant overestimation; however it must be still taken into consideration in deriving the optimum solution. It therefore also indicates that the model can be used to derive a useful estimate as well as to gain understanding of how the trapping efficiency of the floodplain is affected by changes in the Backchannel dimensions and the berm height – as done in Section 5.1.1.

In a study conducted by van Alphen, et al. (2012), it is estimated that for the average Mfolozi River floc sizes investigated by Maine (2011), a 100% sediment trap efficiency would occur for flows 0 - 100m^3/s. Although the concept of a plug-flow model was also used by van Alphen, et al. (2012), the model derived in this study calculates the average residence time of each time increment as a function of average stored volume of water, the river discharge and the outflow through the Backchannel. At low water levels, a high river discharge may be stored for period of time, before a significant transfer rate through the Backchannel can commence, and therefore a high residence time would be realised. This scenario is compared to one where the high river discharge enters a floodplain in which water levels are significantly higher than the weir height. The high transfer rate through the Backchannel could significantly reduce the storage volume of the floodplain in relation to the high incoming and outgoing flow. As a result, the residence time could be potentially much shorter, even though they both result from the same river discharge. The sediment trapping efficiency method used by van Alphen, et al. (2012) and conducted for much smaller time-increments (12min intervals) and over a shorter duration, can therefore not be compared to that derived in this model, as they serve different purposes.

The second set of field data from June to July 2010, recorded by representatives of UCOSP and the iSimangaliso Wetland Park, and referenced in van Alphen, et al. (2012), consisted of water levels (taken from the *Cotcane* gauge on the Msunduzi River) and corresponding flow rates of the Mfolozi River and transfer rate through the Backchannel. Kelbe & Taylor (2011) state that the gauge was replaced and calibrated in 2010 due to ‘instrument errors and failures’ – however, van Alphen, et al. (2012) note that the *Cotcane* gauge may be ‘poorly calibrated or malfunctioning’. During 11-20th October 2011 a river discharge of 7m^3/s was measured (at the W2H032 Mfolozi flow gauge station) entering the Mfolozi floodplain behind a closed mouth, whilst a transfer rate through the Backchannel was estimated at 2m^3/s. According to van Alphen et al. (2012), the *Cotcane* gauge indicated ‘fairly stable’ water levels during this time, when it should have noted an increase.

The recorded transfer rates through the Backchannel, used in the data set discussed above, are also rough field estimates (van Alphen, et al., 2012) which are garnered by multiplying approximate dimensions of a portion of the channel against an estimated velocity. The velocity is estimated by measuring the time it takes for a floating stick to flow past a known distance. Besides the fact that the known distance is short causing the error in taking the time using a normal watch to become significant; it is difficult to estimate the flow through natural channels, such as the Backchannel, complete with uncompacted mud, debris, and mangrove roots, as well as inconstant dimensions. These obstructions cause the friction and change the flow rate measured at different areas of the cross-section in question. The stick-method of estimating flow can therefore be only used as an estimate and could potentially result in substantial errors if the flow rate of one portion is applied to the entire cross section of the Backchannel.

The measured data was compared to that simulated using the model developed as part of this study in two ways. The water levels measured (and corrected to convert data to GMSL) was plotted against the water accumulation in the basin in an attempt to create a hypsometric curve – this did not relate well to any of the DTM models, being a complete over-estimate of the surveyed DTM provided by Chrystal (2012). And though it was during a closed mouth period, some measurements indicated a decrease in water level even though there was substantial river discharge into the floodplain. The attempt to validate the hypsometric curve chosen in the model using the field readings above was discarded.

The second use for the field data was to investigate the relationship between the water levels and the transfer rate through the Backchannel. This was then compared to the flow rate that was calculated as per the model using Equation 4-7 under current conditions (refer to Section 5.1.2.1). Figure 5-4 indicates that the model simulation of the transfer rate through the Backchannel is on average about three times greater than the measured flow.

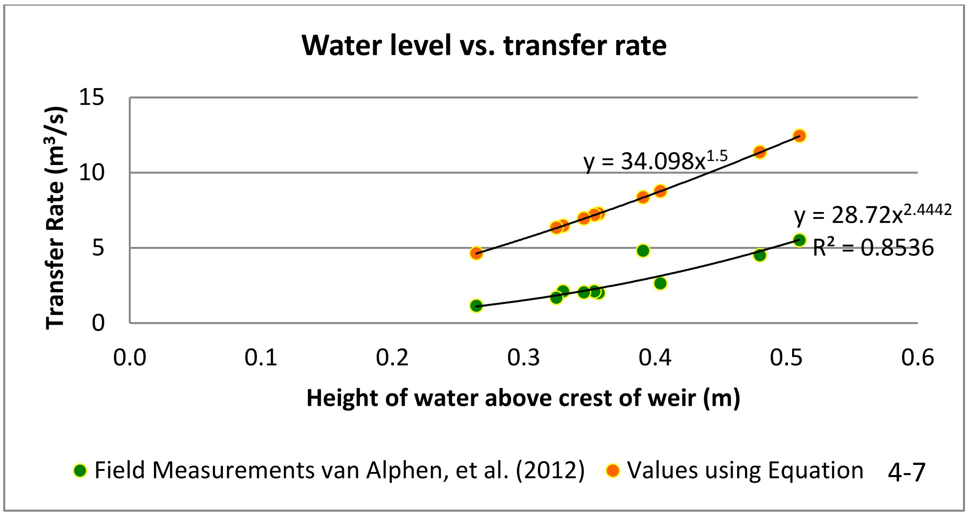


Figure 5-4: Comparison of simulated and measured flow through Backchannel

It is interesting to note that Kelbe & Taylor (2011), using the measured data to calculate the transfer rate via the Backchannel, estimated that a flow of approximate 1Mm^3/day could be transferred. In the model created as part of this study, during closed months, the average daily flow rate through the channel is 0.27 Mm^3/day, even though the transfer flow rate relationship produces higher results (as indicated in Figure 5-4). The difference between the measured and calculated (using a flow over a broad crested weir equation) is significant, however, as the accuracy of the measurement may be questioned, the transfer rate used in the model shall remain as per Equation 4-7.

5.2. DETERMINATION OF OPTIMUM BACKCHANNEL DESIGN AND ITS PROBABLE EFFECT ON THE ST LUCIA LAKE ESTUARY

In order to determine the feasibility of using the Backchannel to divert freshwater from the Mfolozi River into the lake, as well as to select best design values for the berm height, width of the Backchannel and the height of the Backchannel weir crest; the average transfer rate through the Backchannel and the resultant sediment trapping efficiency must be compared between possible options. As the Mfolozi mouth is a normally open estuary, the proportion of time the mouth is open must not be changed dramatically so as to not interfere with its ecological functioning. Options must then be examined on their effect on the St Lucia Lake. Indicators of the lake's health would be the effect on the water and salinity levels of the lake, as well as the frequency and length of open mouth conditions of the lake.

In order to determine the effect on the indicators, the monthly transfer rates simulated in the model (developed as part of this study) for a period of 90 years, are fed into the model created by Lawrie & Stretch (2011b). The aim of the model is to 'to estimate the occurrence and persistence of water levels and salinities for different management scenarios' – which in two scenarios, was achieved with the diversion of freshwater from the Mfolozi through either the Backchannel or a combined mouth system (Lawrie & Stretch, 2011c). In order for the Backchannel option to be evaluated in the model created by Lawrie & Stretch (2011b), a single, constant monthly value for the transfer rate is estimated and fed into the system. Therefore by using the results from the model developed as part of this study, which calculates a transfer rate that is dependent on the Mfolozi river discharge, the water levels and mouth conditions of each month, a more accurate approximation and effect on the St Lucia Lake can be gauged.

Taylor (2006, as referenced in Lawrie & Stretch, 2011c), defines hypersaline conditions as being greater than 46ppt, and 0m above EMWL (*Estuarine Mean Water Level*) as being a medium water level at which no desiccation occurs.

Six viable options were examined and the results of which are reflected in Table 5-1.

According to van Alphen, et al. (2012), it is preferable to the sugarcane farmers on the lower Mfolozi floodplain that the berm height is 1.5m GMSL – at this point, damage to crops is minimal. Lawrie & Stretch (2011a) limits the berm height to 2.75m GMSL in order to create an acceptable balance between the inundation of crops and the transfer rate through the Backchannel. As a result, a berm of 2.0m GMSL would be acceptable, causing moderate damage to crops in the lower floodplain (van Alphen, et al., 2012).

Table 5-1: Effect of possible design options on the Mfolozi and St Lucia Lake estuaries

		Existing dim.	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Input	Height of berm (GMSL)	1.5	1.5	1.5	1.75	1.75	2	2
	Width of Backchannel (m)	20	30	30	20	30	20	30
	Height of Backchannel weir (GMSL)	0.9	0.9	0.7	0.9	0.9	0.9	0.9
Effect on Mfolozi River floodplain	Average transfer rate through Backchannel (Mm^3/year)	22	38	62	48	69	85	113
	Average sediment trapping efficiency of Mfolozi floodplain (%)	99	98	95	97	96	96	95
	Proportion of time Mfolozi mouth is open (%)	78	72	65	69	65	59	53
Effect on Mfolozi River floodplain	Proportion of time St Lucia Lake water levels > 0m above EMWL (%)	50	58	61	63	64	74	77
	Proportion of time St Lucia Lake salinity levels > 46ppt (%)	2	< 1	0	0	0	0	0
	Proportion of time the St Lucia Lake mouth is open (%)	12	14	16	14	15	16	19
	Average open mouth period (years)	1	2	2	2	2	2	2
	Average closed mouth period (years)	10	11	10	11	10	10	7

The average width of the current Backchannel is 20m. It would not be advisable to extend further than 30m as the channel would become unmanageable. The channel width also creates a flow control and needs to be narrow enough to control the amount of water transferred during a flood event, which occurs whilst water levels are below breach level. As per the sensitivity analysis results indicated in Figure 8-2C, as the breadth increases, the time the Mfolozi mouth is open decreases. The width is therefore limited to 30m.

The existing weir crest height is 0.9m GMSL and from the sensitivity analysis seems to be sufficient in creating an effective sediment trap. However, if the berm height is to be lowered, it is possible that the weir crest height would also have to be lowered in order to maintain an adequate transfer flow rate. This is not a preferred option for two reasons: the first is that it would decrease the sediment trapping efficiency as the buffer storage zone below the weir crest height would decreased, and secondly, as stated in Lawrie & Stretch (2011a), there needs to be a height difference between the Backchannel weir and the mean water level in the St Lucia Lake to prevent the lake from losing water through the channel.

From the review of Table 5-1 it is evident that the option to use the Backchannel for freshwater diversions to the lake is viable, with *Option 4* being the most practical solution.

Figure 5-5: Comparison of inundated area of floodplain when berm height is (from left to right) less than 1.5m GMSL, between 1.5m and 2.0m GMSL, and between 2.0m and 2.5m GMSL (van Alphen, et al., 2012)

A sea berm height of 1.75m GMSL has a dual purpose – it allows for a compromise between the level that is more acceptable to the sugarcane farmers (less than 1.5m GMSL) and prevents excessive inundation of the lower lying farms, and a level (greater than the 2.0m GMSL) which allows for a greater transfer rate of water through the Backchannel. The extent of inundation for the different berm heights is illustrated in Figure 5-5. It also allows for certain amount of flexibility: in Section 5.1.2.3 it was indicated that the transfer rate through the Backchannel used in the model may be an overestimation. For this reason, the relationship would need to be calibrated against more field measurements. If there is an overestimation, the berm height can be modified and increased slightly so as to allow for the required flow through the Backchannel, without causing unnecessary friction between all effected parties.

It is not recommended to lower the crest of the Backchannel height from its current position as per the reasons stated above, and therefore to maximise the amount of flow through, the width is set as the maximum of 30m.

Even though *Option 4* transfers less water than *Option 5 & 6*, the effect on the lake's water levels, salinity and mouth state is marginal – **it still maintains a larger proportion of time that the Mfolozi mouth is open as in its natural state**. A decent sediment trapping efficiency is also maintained.

6. RECOMMENDATIONS

As deduced in Section 5.2, the option of diverting freshwater from the Mfolozi, through the Backchannel, into the St Lucia Lake is viable and can have a remarked impact on the estuarine lake. Out of six proposed design parameter configurations, *Option 4* was selected as being a balance between increasing the water rate to make a significant impact on the lake, against factors such as the flooding of lower lying farmlands and not diminishing the floodplain's sediment trapping ability, amongst other discussed.

Section 3.3 & 3.4 list various options that were envisioned to possibly alleviating the devastating effect that the lack of freshwater has had on the lake system. Two of the most feasible and likely solutions consist of diverting water from the Mfolozi River, either through the Backchannel (as discussed and quantified in this study), or through a combined mouth system. In Table 6-1, the effects of these two solutions are compared to the simulated outcomes of the past two management strategies used by the authorities in order to protect the lake's ecology: both strategies encompass having separate mouths being artificially maintained, although the first option (applied from 1952 – 2002) has the St Lucia Lake inlet been kept artificially open, as compared to the second strategy (2002 – 2012) where the inlet is allowed to open and close sans human intervention (Lawrie & Stretch, 2011c).

From the comparison of results of this study and that conducted by Lawrie & Stretch (2011c) in Table 6-1, it is evident that the previous management strategies are not suitable: the first option of maintaining an open St Lucia inlet results in hypersaline conditions existing in the lake for a significant period of time, whereas by allowing the mouth to close and open naturally, the proportion of time that there is an direct sea connection to the decreases dramatically. For both scenarios, the water levels are also mainly below 0m above EMWL, a point at which below, desiccation occurs. As discussed previously, hypersaline conditions and low water levels are detrimental to the ecology of the system. A short direct sea connection also has dire effects to the estuary and to the local fisheries as it prevents the estuary being used as a breeding ground for certain marine species, which in turn effects the other species of the system which are dependent on them as a food source.

Diverting water into the St Lucia Lake via the Backchannel indicates a significant improvement on water levels and salinity – much greater than that of a combined mouth system – however it lacks the direct sea connection through which recruitment can occur. Kelbe & Taylor (2011) believe that the Mfolozi mouth can be used as an intermediary basin through which recruitment can occur during flow through the Backchannel. Kelbe & Taylor (2011) suggest the use of a V-notch as a cross-section of the weir, with the apex of the V being at *mean sea level* in order to facilitate recruitment but limit flow at low levels. As the channel is very wide and secluded, it would be difficult to maintain such a profile; however, the concept of using the channel for recruitment could be optimised by decreasing the weir crest height slightly. Another option is to construct a compound weir that has a narrow section at a lower level to facilitate recruitment. As *Option 4*, was chosen for its ability to maintain an open mouth for majority of the time, it stands to reason that this theory does indeed have its merits.

Table 6-1: Comparison of Option 4's effect of St Lucia as compared to other management options proposed by (Lawrie & Stretch, 2011c)

	Separate Mouths - St Lucia Lake maintained artificially opened **(Lawrie & Stretch, 2011c)**	Separate Mouths - St Lucia mouth allowed to open/close naturally **(Lawrie & Stretch, 2011c)**	Combined Mouths **(Lawrie & Stretch, 2011c)**	Separate Mouths - Freshwater Diversion through Backchannel (Option 4)
Proportion of time St Lucia Lake water levels > 0m below EMWL (%)	39	55	58	64
Proportion of time St Lucia Lake salinity levels > 46ppt (%)	32	8	9	0
Proportion of time the St Lucia Lake mouth is open (%)	100	11	65	15

As evident in the results indicated in Table 6-1, **the strategy of using a combined mouth system rather than diversion through the Backchannel is recommended**. Although the water levels and salinity is less favourable than that of using the Backchannel, it is a vast improvement from the previous two scenarios tried, and it does allow for recruitment as the mouth is open for longer periods. As stated in Lawrie & Stretch (2011c), the effect of a combined mouth (as discussed above) is crucial 'for the long-term sustainability of the system'. It must be noted that **if the St Lucia and Mfolozi inlets are to be kept separate, the usage of**

the Backchannel as discussed in this study, is a viable solution to maintaining the health of the system's ecology and biodiversity.

If this is the case, and the option of transferring water from the Mfolozi River to the St Lucia Lake via the Backchannel is to be used, the following field measurements are required in order to improve the accuracy of the model's results:

- A detailed survey of the Mfolozi flood plain and channels,
- Accurate and extensive field measurements of water levels in the floodplain and corresponding transfer flow rates through the Backchannel in order to calibrate the transfer flow rate relationship in the model,
- Turbidity readings over a year, taken at the start of the flood plain, near the Mfolozi mouth and in the Backchannel, as well as corresponding water levels, river discharge and transfer flow rates in order to calibrate the sediment trapping efficiency model to account for short-circuiting, mixing, re-suspension, etc.

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8. APPENDICES

A.

Equation to be integrated in order to determine transfer rate of water, through the Backchannel, from the Mfolozi River floodplain into the St Lucia Lake

B.

Algorithm of model developed as part of this study to simulate the water balance and estuarine mechanism of the Mfolozi River floodplain – a normally open barred estuary on the east coast of South Africa, as discussed in 4.2, 4.3, and 4.4 above.

C.

Snapshots of model interface from the *Microsoft Excel* workbook used – as discussed in 4.5 above.

D.

Results of Sensitivity Analysis as discussed in 5.1.1 above.

E.

Soft copy of model created as part of study

INTEGRAL TO DETERMINE TRANSFER FLOW RATE BETWEEN THE MFOLOZI RIVER FLOODPLAIN AND THE ST LUCIA LAKE VIA THE BACKCHANNEL

Let:

V = *Volume in the floodplain,*

A = *Volume of water in the floodplain at start of time increment,*

I = *Inflow rate of the Mfolozi River into the floodplain,*

Q = *Outflow into the St Lucia Estuary via the backchannel,*

t = *Time increment – in this study, a month,*

Then,

$$\partial V/_{\partial t} = I(t) - Q(t)$$

$$\therefore V = \int I(t) - \int Q(t) + A = I.t - \int Q(t) + A$$

To complete the water balance for each time step, it is required to solve for $\int Q(t)$*, after which the influence of the estuarine mouth dynamics must be included in order to calculate the resultant storage in the floodplain.*

Let:

C_d = *Coefficient of discharge over the Backchannel weir,*

g = *Acceleration due to gravity,*

B = *Breadth of weir,*

W = *Height of weir above set datum,*

H = *Height of water level in floodplain above set datum,*

F, m = *Characteristics of a typical hypsometric curve,*

Then,

$$Q = C_d \times \sqrt{g} \times B \times h^{3/2}, \quad where\ h = H - W$$

$$\therefore Q = C_d . \sqrt{g} . B . (H - W)^{3/2}$$

From a typical hypsometric curve, $V = F . H^m \quad \therefore \quad H = (V/_F)^{1/m}$

If $V = A + I.t$ *then* $H = (^{A + I.t}/_F)^{1/m}$

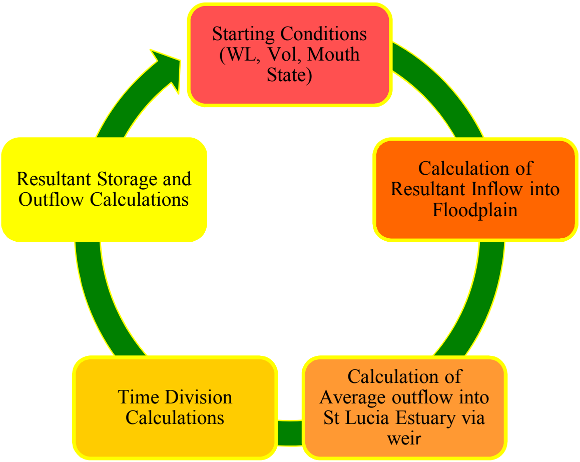
$$\therefore Q = C_d . \sqrt{g} . B . [(^{A + I.t}/_F)^{1/m} - W]^{3/2}$$

$$\longrightarrow$$

MODEL ALGORITHM

I. Abreviations

WL	[gmsl]	= Water level in floodplain
V	[Mm^3]	= Volume of water in floodplain
MS	[Open = 0 Closed = 1]	= Mouth state of estuary inlet from sea
Q	[Mm3/month]	= Transfer flow from Mfolozi floodplain to the St Lucia Lake
A	[m^2]	= Surface area inundated by floodplain
H	[gmsl]	= Height of water level of floodplain for weir calculation
M	[ton]	= Fluvial sediment inflow
start	[subscript]	= Value of parameter at start of interval, equal to value of parameter end of previous interval
res	[subscript]	= Value of parameter at the end of interval
open	[subscript]	= Value of parameter if the mouth is open
weir	[subscript]	= Value of parameter at the level of the backchannel weir
breach	[subscript]	= Value of parameter at the level of top of inlet sand berm



II. Calculation for Resultant Inflow

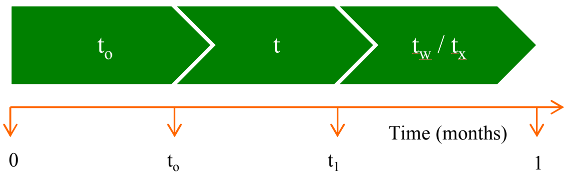
I	[Mm3/month]	= Resultant Inflow
		= + Simulated Mfolozi River Flow + Rainfall on inundated area of floodplain - Evaporation on inundated area of floodplain + Runoff from floodplain downstream of guage - Abstractions

III. Calculation of Average Rate of Outflow into St Lucia

V_o	[Mm^3]	= Volume of water at start of transfer	
		= V_{weir}	[if V_{start} </= V_{weir}]
		= V_{start}	[if $V_{start} > V_{weir}$]
V_{pot}	[Mm^3]	= Maximum potential vol of water in floodplain during interval	
		= V_{open}	[if previous MS = 0]
		= V_{breach}	[if previous MS=1 & $V_{start} + I > V_{breach}$]
		= $V_{start} + I$	[if previous MS=1 & $V_{start} + I$ </= V_{breach}]
H_{min}	[gmsl]	= Lowest water level in floodplain during interval	
		= WL_{start}	[if I >/= 0 & $V_{start} > V_{weir}$]
		= WL_{weir}	[if I >/= 0 & V_{start} </= V_{weir}]
		= WL_{pot} (WL corresp. to V_{pot})	[if I < 0 & $V_{poss} > V_{weir}$]
		= WL_{weir}	[if I < 0 & V_{poss} < / = V_{weir}]
H_{max}	[gmsl]	= Highest water level in floodplain during interval	
		= WL_{pot}	[if I > 0 & $V_{poss} > V_{weir}$]
		= V_{weir}	[if I > 0 & V_{poss} </= V_{weir}]
		= V_{start}	[if I </= 0 & $V_{start} > V_{weir}$]

		= V_{weir}	[if I </= 0 & V_{start} </= V_{weir}]
H_{check}	[m]	= H_{max} - H_{min}	[highlight in red if < 0]
Q_{min}	[Mm^3/month]	= Minimum transfer flow rate to St Lucia Lake during interval	
		= C_D*($g^{1/2}$)*B*($H_{min}{}^{3/2}$ - WL_{weir})*((3600*24*30.5)/1000000)	[if prev MS = 1]
		= 0	[if prev MS = 0]
Q_{max}	[Mm3/month]	= Maximum transfer flow rate to St Lucia Lake during interval	
		= C_D*($g^{1/2}$)*B*($H_{max}{}^{3/2}$ - WL_{weir})*((3600*24*30.5)/1000000)	[if prev MS = 1 & H_{max} > WL_{weir}]
		= 0	[if prev MS = 0 or H_{max} </= WL_{weir}]
Q_{ave}	[Mm^3]	= Average transfer into St Lucia during an interval for a duration of time = t	
		= (Q_{min} + Q_{max}) / 2	

IV. Calculation of time divisions



$t_{o\ prelim}$	[month]	= Prelim calc of duration of time where no flow is transferred to the St Lucia Lake	
		= 1	[if prev MS = 0]
		= 1	[if prev MS = 1 & V_{start} < V_{weir} & I </= 0]
		= (V_{weir} - V_{start}) / I	[if prev MS = 1 & V_{start} < V_{weir} & I > 0]
		= 1	[if prev MS = 1 & V_{start} = V_{weir} & I </= 0]
		= 0	[if prev MS = 1 & V_{start} = V_{weir} & I > 0]
		= 0	[if prev MS = 1 & V_{start} > V_{weir}]
t_o	[month]	= Duration of time where no flow is transferred to the St Lucia Lake	
		= 1	[if $t_{o\ prelim}$ > 1]
		= $t_{o\ prelim}$	[if $t_{o\ prelim}$ </= 1]
t_{prelim}	[month]	= Prelim calc of duration of time where flow is transferred to the St Lucia Lake	
		= 0	[if t_o = 1]
		= (V_{breach} - Vo) / (I-Q_{ave})	[if t_o < 1 & I - Q > 0]
		= 1 - t_o	[if t_o < 1 & I = Q]
		= (V_{start} - V_{weir}) / (Q - I)	[if t_o < 1 & I - Q < 0 & V_{start} > V_{weir}]
		= 0	[if t_o < 1 & I - Q < 0 & V_{start} </= V_{weir}]
t	[month]	= Duration of time where flow is transferred to the St Lucia Lake	
		= 1 - to	[if t_o + t_{prelim} >/= 1]
		= t_{prelim}	[if t_o + t_{prelim} < 1]
t_w / t_x?	["t_w" / "t_x"]	= Duration of time that a breach event (t_w) or spilling into channel (t_x) occurs	
		= "-"	[if t_o + t_{prelim} >/= 1]
		= t_w = 1 - t_o - t	[if t_o + t_{prelim} < 1 & I - Q > 0]
		= t_x = 1 - t_o - t	[if t_o + t_{prelim} < 1 & I - Q < 0]
t_{total}	[month]	= t_o + t + t_w / t_x	[highlight in red if≠ 1]

V. Calculation of resultant storage & monthly outflow & mouth state

V_{acc}	[Mm^3]	= Accumulation of water in floodplain discounting transfer	
		= V_{start} + (I * (t_o + t + t_x))	[if MS_{start} = 1]
		= V_{open}	[if MS_{start} = 0]
$Q_{weir\ outflow}$	[Mm^3]	= Volume of water transferred to St Lucia Lake during interval	
		= (Q_{ave} * t) + (I * t_x)	
MS_{res}	[Open = 0	= 0	[if t_w > 0]
	Closed = 1]	= 1	[if t_w = 0 & MS_{start} = 1]
		= 0	[if t_w = 0 & MS_{start} = 0 & I >/= Threshold flow]

		= 1	[if $t_w = 0$ & $MS_{start} = 0$ & $I <$ Threshold flow]
V_{res}	[Mm^3]	= Volume in floodplain at end of interval	
		$= V_{open}$	[$MS_{start} = 0$ & $MS_{res} = 0$]
		$= V_{open}$	[$MS_{start} = 0$ & $MS_{res} = 1$]
		$= V_{open}$	[$MS_{start} = 1$ & $MS_{res} = 0$]
		$= V_{acc} - Q_{weir\ outflow}$	[$MS_{start} = 1$ & $MS_{res} = 1$]
V_{ave}	[Mm^3]	$= (V_{start} + V_{res}) / 2$	

VI. Calculation of sediment trapping efficiency

$M_{s\ in}$	[ton]	= Fluvial sediment loading entering floodplain during interval	
		= I * Sediment concentration * 1000	
I_{peak}	[m^3/s]	= Peak flow averaged over a five day period	
		$= (-0.005 * I^2) + (2.4402 * I) - 2.9439$	[See tab 5.1 for derivation of relationship]
$t_{r\ inflow}$	[s]	= Residence time during peak 5-day resultant inflow	
		$= (V_{ave} * 10^6) / I_{peak}$	
$M_{s\ total}$	[ton]	= Total fluvial sediment entering the floodplain plus unsettled sediment from previous interval	
		$= ((prev.WL_{ave} - prev.d_s) * prev.C_d) + M_{s\ in}$	[if $prev.Wl_{ave} - prev.d_s > 0$]
		$= M_{s\ in}$	[if $prev.Wl_{ave} - prev.d_s$ </= 0]
C_d	[ton/m]	= Concentration of sediment per unit depth of water in floodplain	
		$= M_{s\ total} / WL_{ave}$	
v_s	[m/s]	= Settling velocity of fluvial sediment	[See tab 5.1 for diff methods]
		$= 3*10^{-13}*M_{s\ in}{}^3 - 2*10^{-10}*M_{s\ in}{}^2 + 2*10^{-8}*M_{s\ in} + 4*10^{-15}$	[Method by Maine (2010) used
d_s	[m]	= Potential settling depth available	
		$= v_s * t_{r\ inflow}$	
$M_{s\ st\ lucia}$	[ton]	= Fluvial sediment entering the St Lucia Lake via the backchannel	
		$= Q_{weir\ outflow} * (1 - (d_s/WL_{ave})) * 1000 *$ Sediment concentration	[if $MS_{start} = 1$ & d_s/WL_{ave} </= 1]
		= 0	[if $d_s/WL_{ave} > 1$]
$M_{s\ scour}$	[ton]	= Fluvial sediment flushed to sea	
		$= prev.M_{s\ balance} + M_{s\ total} - M_{s\ st\ lucia}$	[if $MS_{start} = 1$ & $MS_{res} = 0$]
		= 0	[if not a breaching event as indicated abov
$M_{s\ balance}$	[ton]	$= prev.M_{s\ balance} + M_{s\ total} - M_{s\ st\ lucia} - M_{s\ scour}$	
TE	[%]	= Fluvial sediment trapping efficiency of floodplain	
		= -	[if $MS_{start} = 0$]
		= 100	[if d_s/WL_{ave} >/= 1
		$= d_s / WL_{ave} * 100$	[if $d_s/WL_{ave} < 1$

Images: Lawrie & Stretch (2008) & Taylor (2010)

Water Balance of the Mfolozi River Flood Plain

UNIVERSITY OF
KWAZULU-NATAL
School of Civil Engineering, Surveying & Construction

The aim of this research project is to model the water balance of the Mfolozi River floodplain, over a long period of time, in order to feed resultant transfer rates into the water balance model of the St Lucia Lake complex that was developed by (Lawrie & Stretch, 2011b). The combined results can then be used to determine an effective and holistic management plan for the estuarine system. Good management of the system will result in the safeguarding of its ecology, its tourist opportunities and the resulting economic benefits to the local communities.

The objectives of the study are:

- To determine the water inputs, outputs and mouth dynamics of the Mfolozi River floodplain and relate it to the water levels experienced during the periods when the river mouth is closed.
- To use the above information to predict the volume of fresh water that can be diverted from the Mfolozi floodplain into the St Lucia estuary.
- To investigate optimum dimensions of the sea berm height, the connecting channel’s broad-crested-weir height and breadth that will allow the maximum amount of water to enter the St Lucia estuary without excessive sedimentation entering the estuary and unnecessary inundation of low lying existing farms.

The above objectives are evaluated using a long-term simulation of approximately 90 years – focussing not on flood and drought conditions (of which most water is wasted to sea) but rather to study a combination of wet and dry periods, sometimes spanning decades.

Samista Jugwanth
Supervisor: Prof. Derek Stretch

Images: Lawrie & Stretch (2008) & Taylor (2010)

Ima

Water Balance of the Mfolozi River Flood Plain

UNIVERSITY OF
KWAZULU-NATAL
School of Civil Engineering, Surveying & Construction

CONTENTS:

Parameter Editor

Berm (river to sea):	1.75	m
Threshold Flow:	6.38	Mm^3
Height of Weir (Back Channel into St Lucia estuary): [level at top of weir (gmsl)] [must be > 0 and < height of berm]	0.9	m
Width of Back Channel:	30	m
Flood line Contour:	2	m above gmsl
Flood Plain Water Level during Open Mouth Cond.: [must be > 0 and < height of weir]	0.45	m above gmsl
Coeffcient for weir equation	0.3849	m
Area downstream of gauge W2H032:	126	km^2
Settling Velocity Method	Maine (2010) settling velocity vs. Sediment conc.	
Selected Settling Velocity	see model	m/s
Sediment Concentration Data Set	Ave. of Mtubatuba WTW & UCOSP data	
Year - Start: (Note: Model to start on month: October)	1918	

Month	Rainfall (mm/m^2)	Evaporation (mm/m^2)	Run-off (mm/m^2)	Sediment Rates (g/l)
10 October	97	126	12	2.254
11 November	110	117	9	1.476
12 December	117	131	10	1.779
1 January	131	131	12	0.758
2 Ferbruary	139	114	19	0.334
3 March	143	113	24	0.063
4 April	81	86	16	0.086
5 May	65	77	13	0.086
6 June	51	64	11	0.239
7 July	43	68	12	0.462
8 August	43	94	8	2.294
9 September	75	109	14	2.389
Sum	1095 (MAP)	1230 (MAE)	161 (MAR)	

Hydrology Calculations:

PRECIPITATION

Appendix 2.2, Vol VI, Midgley et al 1994 - pg. 2.92 - 2.93

	Month	Monthly Rainfall Factors (%)	Rainfall Station	Period	MAP (mm/m^2)
1	October	8.83%	0 339 415	1919 - 1949 & 1953 - 1987	1010
2	November	10.00%	0 339 357	1926 - 1989	869
3	December	10.66%	0 339 538	1929 - 1989	1112
4	January	11.98%	0 305 308	1932 - 1989	1389
5	Ferbruary	12.70%		Average:	1095
6	March	13.03%			
7	April	7.41%			
8	May	5.91%			
9	June	4.68%			
10	July	3.94%			
11	August	3.97%			
12	September	6.88%			

EVAPORATION

Appendix 3.1, 3.2 & 3.3.1, Vol VI, Midgley et al 1994 - pg. 3.1 - 3.4

	Month	Monthly Evap Factors (%)	Pan Factor for lake evap (unitless)
1	October	10.66%	0.81
2	November	9.75%	0.82
3	December	10.78%	0.83
4	January	10.63%	0.84
5	Ferbruary	8.84%	0.88
6	March	8.76%	0.88
7	April	6.67%	0.88
8	May	6.03%	0.87
9	June	5.16%	0.85
10	July	5.63%	0.83
11	August	7.90%	0.81
12	September	9.19%	0.81

Evap. Station	Period	MAE (mm/m^2)
W2E002 (Evap Zone 22B)		
River View		
(A - pan)	1967 - 1978	1864
(S - pan)	(A-pan converted)	1483
W3E001 (Evap Zone 22C)		
Charter's Creek		
(A - pan)	1951 - 1980	1706
(S - pan)	(A-pan converted)	1369
(S - pan)	1951 - 1980	1446
	Average:	1465

MEAN ANNUAL RUN-OFF

Appendix 7.2 & 8, Vol VI, Midgley et al 1994 - pg. 7.28 & 8.5 respectively

	Month	Simul. MAR for W23 (Mm^3)	Monthly Factor for W23 MAR (%)
1	October	10.81	7.18%
2	November	8.58	5.70%
3	December	9.76	6.48%
4	January	11.23	7.46%
5	Ferbruary	18.13	12.04%
6	March	22.15	14.71%
7	April	14.70	9.76%
8	May	12.60	8.37%
9	June	10.46	6.95%
10	July	11.04	7.33%
11	August	7.78	5.17%
12	September	13.32	8.85%

Simulated MAR

W23C (tertiary sub-catchment)

MAR (mm)	179
Area (km^2)	313

W23D (tertiary sub-catchment)

MAR (mm)	139
Area (km^2)	248
Weighted Average (mm/m^2)	161

SEDIMENT LOADS

Reference to "Sediment Yield Analysis" spreadsheet

		(Jugwanth 2012)	(van Niekerk 2012)	(Maro 2012)
	Month	Av. Mtubatuba WTW	UCOSP	Simulated 1950-2010
		(g/l)	(g/l)	(g/l)
1	October	1.518	2.990	4.211
2	November	1.667	1.285	3.970
3	December	0.959	2.600	2.442
4	January	0.450	1.065	1.474
5	Ferbruary	0.228	0.440	0.464
6	March	0.052	0.075	0.438
7	April	0.083	0.090	0.636
8	May	0.103	0.070	1.494
9	June	0.199	0.280	1.280
10	July	0.604	0.320	3.578
11	August	1.836	2.753	2.484
12	September	1.975	2.803	3.636

Hypsometric Curve Editor:

Choose DTM Model 4

DTM Model Used: Crystal 2011

DTM Models:

1 Grenfell 2009

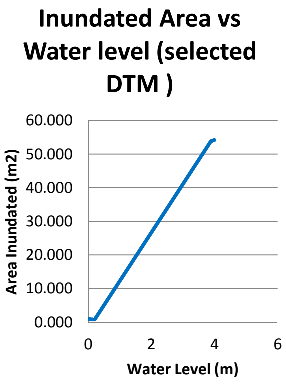
2 Kelbe 2010

3 Jugwanth 2010

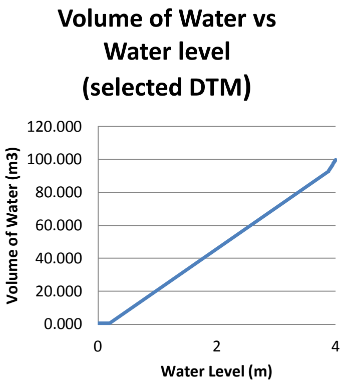
4 Crystal 2012

WATER - VOLUME RELATIONSHIP

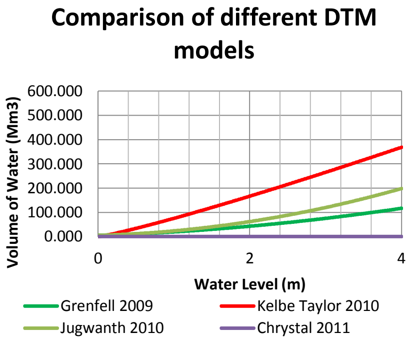
WL	Area (km^2)	Volume (m^3)	Volume (Mm^3)
0	0.982	598000.000	0.598
0.01	0.967	593101.300	0.593
0.02	0.953	588545.200	0.589
0.03	0.939	584331.700	0.584
0.04	0.926	580460.800	0.580
0.05	0.914	576932.500	0.577
0.06	0.902	573746.800	0.574
0.07	0.890	570903.700	0.571
0.08	0.880	568403.200	0.568
0.09	0.869	566245.300	0.566
0.1	0.860	564430.000	0.564
0.11	0.851	562957.300	0.563
0.12	0.843	561827.200	0.562
0.13	0.835	561039.700	0.561
0.14	0.828	560594.800	0.561
0.15	0.821	560492.500	0.560
0.16	0.815	560732.800	0.561
0.17	0.810	561315.700	0.561
0.18	0.805	562241.200	0.562
0.19	0.801	563509.300	0.564
0.2	0.797	565120.000	0.565
3.9	53.909	93870970.000	93.871
3.91	53.946	94447865.700	94.448
3.92	53.982	95026340.800	95.026
3.93	54.016	95606395.300	95.606
3.94	54.049	96188029.200	96.188
3.95	54.081	96771242.500	96.771
3.96	54.112	97356035.200	97.356
3.97	54.142	97942407.300	97.942
3.98	54.170	98530358.800	98.530
3.99	54.197	99119889.700	99.120
4.00	54.223	99711000.000	99.711



Inundated Area vs Water level (selected DTM)



Volume of Water vs Water level (selected DTM)



Comparison of different DTM models

TABLE TO FORMULATE HYPSOMETRIC CURVE

Contour (m)	UPPER LIMIT	AREA (km2)	AREA (m2)
< 0	0	15.45234898	15452348.98
0 - 5	5	49.67224611	49672246.11
5 - 10	10	106.1519646	106151964.6

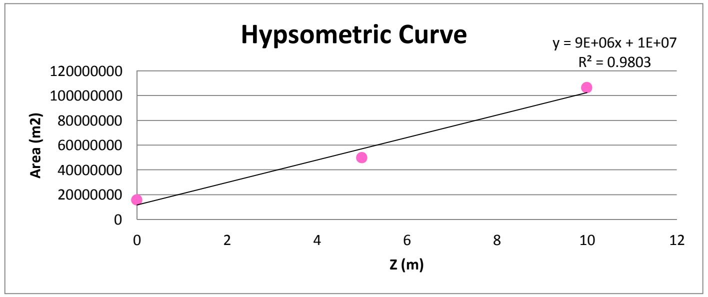
DETERMING WL _ VOL RELATIONSHIP

V = integral of A . Dz
= (9*10^6)z + 1*10^7 dz
= (4.5*10^6)z^2 + (1*10^7)z + A

A is the V when the WL is at z=0
therefore find a radius for area < 0
= (area < 0 / pi)^0.5
and assume lowest depth is at z = -1
Drew a cone with above dimensions -

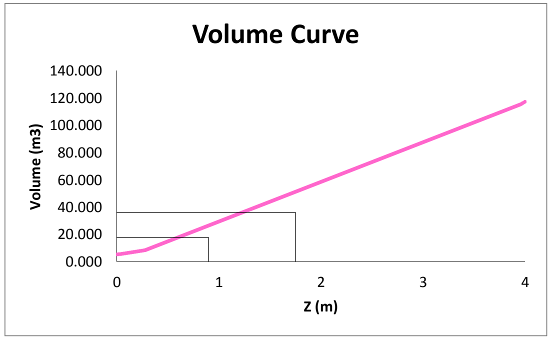
V = A =	5150784.454	m3

GRENFELL ET AL
(2009)



WL vs. VOLUME RELATIONSHIP

WL	Area (km2)	Volume (m3)	Volume (Mm3)
0	15.452	5150784.454	5.151
0.01	15.542	5251234.454	5.251
0.02	15.632	5352584.454	5.353
0.03	15.722	5454834.454	5.455
0.04	15.812	5557984.454	5.558
0.05	15.902	5662034.454	5.662
0.06	15.992	5766984.454	5.767
0.07	16.082	5872834.454	5.873
0.08	16.172	5979584.454	5.980
0.09	16.262	6087234.454	6.087
0.1	16.352	6195784.454	6.196
0.11	16.442	6305234.454	6.305
0.12	16.532	6415584.454	6.416
0.13	16.622	6526834.454	6.527
0.14	16.712	6638984.454	6.639
0.15	16.802	6752034.454	6.752
0.16	16.892	6865984.454	6.866
0.17	16.982	6980834.454	6.981
0.18	17.072	7096584.454	7.097
0.19	17.162	7213234.454	7.213
0.2	17.252	7330784.454	7.331
0.21	17.342	7449234.454	7.449
0.22	17.432	7568584.454	7.569
0.23	17.522	7688834.454	7.689
0.24	17.612	7809984.454	7.810
0.25	17.702	7932034.454	7.932
0.26	17.792	8054984.454	8.055
0.27	17.882	8178834.454	8.179
0.28	17.972	8303584.454	8.304
3.98	51.272	116232584.5	116.233
3.99	51.362	116691234.5	116.691
4	51.452	117150784.5	117.151



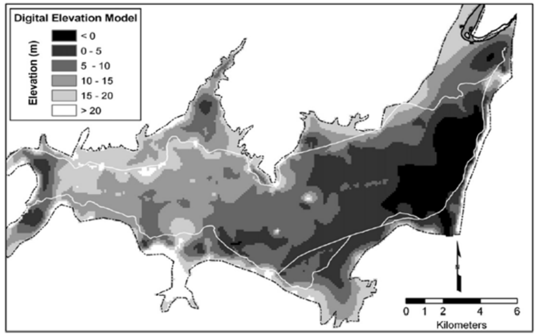
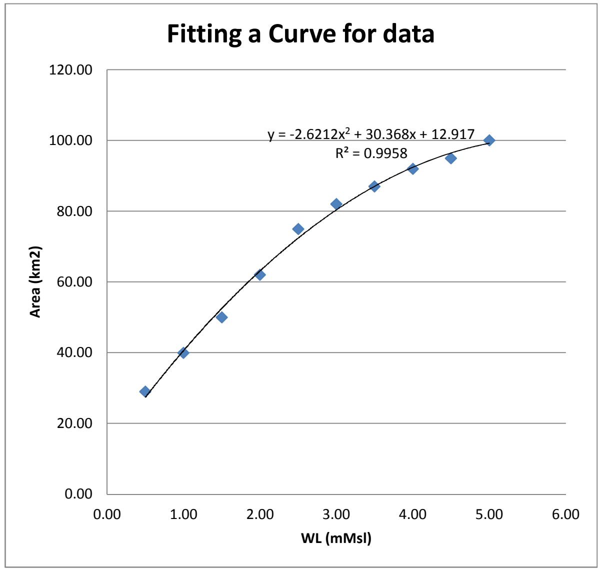


Fig. 6. Digital elevation model created using differentially corrected Trimble GPS data.

Study Conducted by Kelbe & Taylor 2011 indicated that the 'stage storage relationship' can be modeled by the following relationship - this only valid for waterlevels below 4mMSL:

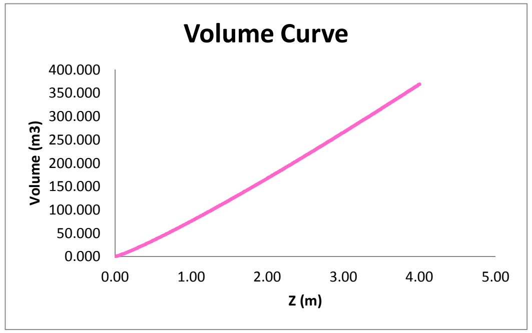
Volume = 76 000 000 h^1.14, where h = stage in mMSL

KELBE & TAYLOR (2011)



WL vs. VOLUME RELATIONSHIP

WL	Area (km2)	Volume (m3)	Volume (Mm3)
0.00	12.917	0	0.000
0.01	13.220	398853.6698	0.399
0.02	13.523	878997.7985	0.879
0.03	13.826	1395506.368	1.396
0.04	14.128	1937144.342	1.937
0.05	14.429	2498270.14	2.498
0.06	14.730	3075431.213	3.075
0.07	15.030	3666277.705	3.666
0.08	15.330	4269098.521	4.269
0.09	15.629	4882587.703	4.883
0.10	15.928	5505713.297	5.506
0.11	16.226	6137637.765	6.138
0.12	16.523	6777666.773	6.778
0.13	16.821	7425214.668	7.425
0.14	17.117	8079780.32	8.080
0.15	17.413	8740929.704	8.741
0.16	17.709	9408283.001	9.408
0.17	18.004	10081504.83	10.082
0.18	18.298	10760296.74	10.760
0.19	18.592	11444391.27	11.444
0.20	18.886	12133547.3	12.134
0.21	19.179	12827546.22	12.828
0.22	19.471	13526188.9	13.526
0.23	19.763	14229293.1	14.229
0.24	20.054	14936691.38	14.937
0.25	20.345	15648229.33	15.648
0.26	20.636	16363764.06	16.364
0.27	20.925	17083162.95	17.083
0.28	21.215	17806302.54	17.806
0.29	21.503	18533067.6	18.533
0.30	21.792	19263350.32	19.263
0.31	22.079	19997049.57	19.997
0.32	22.366	20734070.34	20.734
0.33	22.653	21474323.13	21.474
0.34	22.939	22217723.5	22.218
0.35	23.225	22964191.66	22.964
0.36	23.510	23713652.05	23.714
0.37	23.794	24466033.03	24.466
0.38	24.078	25221266.58	25.221
0.39	24.362	25979287.99	25.979
0.40	24.645	26740035.68	26.740
0.41	24.927	27503450.91	27.503
0.42	25.209	28269477.61	28.269
0.43	25.491	29038062.23	29.038
0.44	25.771	29809153.5	29.809
0.45	26.052	30582702.35	30.583
0.46	26.332	31358661.73	31.359
0.47	26.611	32136986.5	32.137
0.48	26.890	32917633.3	32.918
0.49	27.168	33700560.46	33.701
0.50	27.446	34485727.9	34.486
0.51	27.723	35273097.03	35.273
0.52	28.000	36062630.66	36.063
0.53	28.276	36854292.95	36.854
0.54	28.551	37648049.29	37.648



WL - WEIR	0.90	0.00
VOL - WEI	66.55	
WL - BERM	1.75	
VOL - BER	142.90	

TABLE TO FORMULATE HYPSOMETRIC CURVE

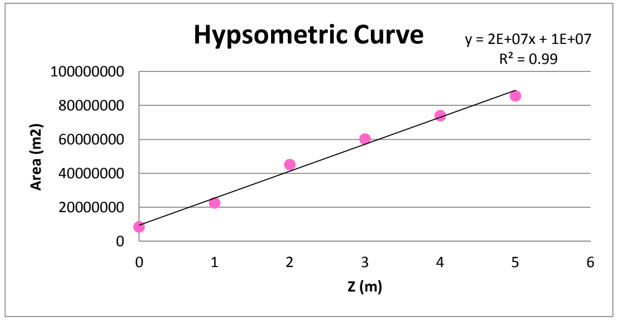
	UPPER LIMIT	AREA (km2)	AREA (m2)
<0 - 0	0	8.329414216	8329414.216
0 - 1	1	22.40543246	22405432.46
1 - 2	2	45.03405436	45034054.36
2 - 3	3	60.1247239	60124723.9
3 - 4	4	73.87275734	73872757.34
4 - 5	5	85.62416417	85624164.17

DETERMING WL _ VOL RELATIONSHIP

V = integral of A . Dz
= (2*10^7)z + 8329414 dz
= (1*10^7)z^2 + 8329414z + A

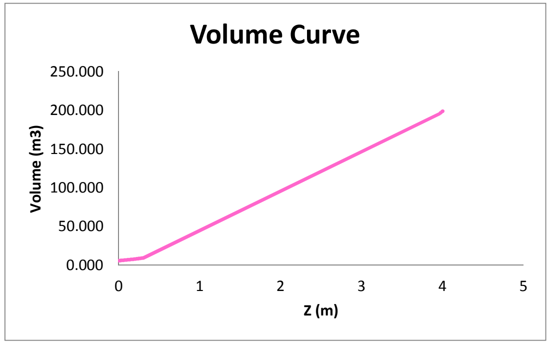
A is the V when the WL is at z=0
therefore find a radius for area < 0
= (area < 0 / pi)^0.5
and assume lowest depth is at z = -2
Drew a cone with above dimensions -
V = A = 5550951.269 m3

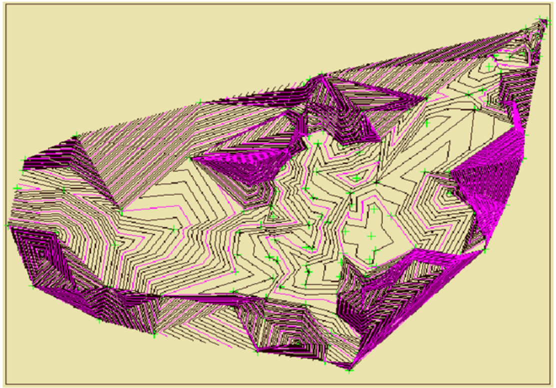
JUGWANTH (2010)



WL vs. VOLUME RELATIONSHIP

WL (gmsl)	Area (km2)	Volume (m3)	Volume (Mm3)
0	8.329	5550951.269	5.551
0.01	8.529	5635245.411	5.635
0.02	8.729	5721539.553	5.722
0.03	8.929	5809833.696	5.810
0.04	9.129	5900127.838	5.900
0.05	9.329	5992421.98	5.992
0.06	9.529	6086716.122	6.087
0.07	9.729	6183010.264	6.183
0.08	9.929	6281304.406	6.281
0.09	10.129	6381598.549	6.382
0.1	10.329	6483892.691	6.484
0.11	10.529	6588186.833	6.588
0.12	10.729	6694480.975	6.694
0.13	10.929	6802775.117	6.803
0.14	11.129	6913069.259	6.913
0.15	11.329	7025363.402	7.025
0.16	11.529	7139657.544	7.140
0.17	11.729	7255951.686	7.256
0.18	11.929	7374245.828	7.374
0.19	12.129	7494539.97	7.495
0.2	12.329	7616834.112	7.617
0.21	12.529	7741128.255	7.741
0.22	12.729	7867422.397	7.867
0.23	12.929	7995716.539	7.996
0.24	13.129	8126010.681	8.126
0.25	13.329	8258304.823	8.258
0.26	13.529	8392598.965	8.393
0.27	13.729	8528893.107	8.529
0.28	13.929	8667187.25	8.667
0.29	14.129	8807481.392	8.807
0.3	14.329	8949775.534	8.950
0.31	14.529	9094069.676	9.094
3.98	87.929	197106019.8	197.106
3.99	88.129	197986314	197.986
4	88.329	198868608.1	198.869

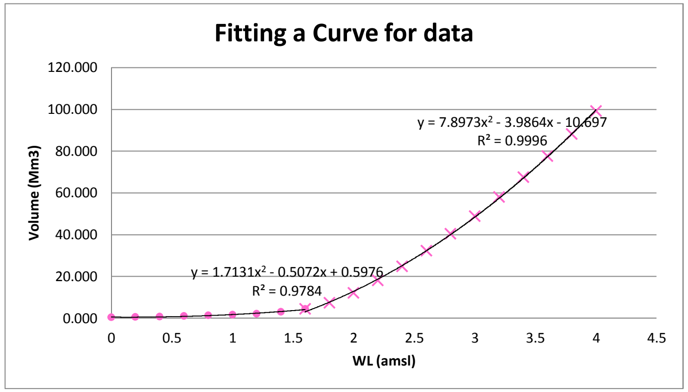




Please not that these values were approximated from the graph distributed
and only has data up until a height of 4amsl

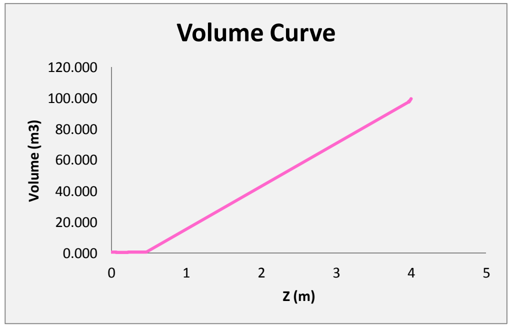
CHRYSTAL
(2012)

Water Level gmsl	Area (m2)	Volume (m3)	Volume (Mm3)	
0	685773.42	437579.32	0.438	0.685773
0.2	909128.04	600121.61	0.600	0.909128
0.4	1189619.99	808884.9	0.809	1.18962
0.6	1393046.28	1066887.71	1.067	1.393046
0.8	1647213.44	1370825.16	1.371	1.647213
1	2061485.38	1738935.74	1.739	2.061485
1.2	2878367.66	2219887.37	2.220	2.878368
1.4	5181509.45	2987765.75	2.988	5.181509
1.6	10163914.14	4474835.09	4.475	10.16391
1.8	19585991.01	7304303.25	7.304	19.58599
2	27068408.47	12026424.5	12.026	27.06841
2.2	32321461.46	18002644.37	18.003	32.32146
2.4	35887435.2	24838958.63	24.839	35.88744
2.6	38792840.66	32312551.61	32.313	38.79284
2.8	41333199.2	40329010.48	40.329	41.3332
3	44101794.13	48846900.92	48.847	44.10179
3.2	46571162.36	57915600.8	57.916	46.57116
3.4	48967092.05	67470763.53	67.471	48.96709
3.6	51614291.7	77515565	77.516	51.61429
3.8	53918544.1	88071773.23	88.072	53.91854
4	56228344.37	99106233.51	99.106	56.22834



WL vs. VOLUME RELATIONSHIP

WL (gmsl)	Area (km2)	Volume (m3)	Volume (Mm3)
0	0.982	598000.000	0.598
0.01	0.967	593101.300	0.593
0.02	0.953	588545.200	0.589
0.03	0.939	584331.700	0.584
0.04	0.926	580460.800	0.580
0.05	0.914	576932.500	0.577
0.06	0.902	573746.800	0.574
0.07	0.890	570903.700	0.571
0.08	0.880	568403.200	0.568
0.09	0.869	566245.300	0.566
0.1	0.860	564430.000	0.564
0.11	0.851	562957.300	0.563
0.12	0.843	561827.200	0.562
0.13	0.835	561039.700	0.561
0.14	0.828	560594.800	0.561
0.15	0.821	560492.500	0.560
0.16	0.815	560732.800	0.561
0.17	0.810	561315.700	0.561
0.18	0.805	562241.200	0.562
0.19	0.801	563509.300	0.564
0.2	0.797	565120.000	0.565
0.21	0.794	567073.300	0.567
0.22	0.792	569369.200	0.569
0.23	0.790	572007.700	0.572
0.24	0.789	574988.800	0.575
0.25	0.788	578312.500	0.578
0.26	0.788	581978.800	0.582
0.27	0.788	585987.700	0.586
0.28	0.789	590339.200	0.590
0.29	0.791	595033.300	0.595
0.3	0.793	600070.000	0.600
0.31	0.796	605449.300	0.605
0.32	0.800	611171.200	0.611
0.33	0.804	617235.700	0.617
0.34	0.809	623642.800	0.624
0.35	0.814	630392.500	0.630
0.36	0.820	637484.800	0.637
0.37	0.826	644919.700	0.645
0.38	0.833	652697.200	0.653
0.39	0.841	660817.300	0.661
0.4	0.849	669280.000	0.669
0.41	0.858	678085.300	0.678
0.42	0.867	687233.200	0.687
0.43	0.877	696723.700	0.697
0.44	0.888	706556.800	0.707
0.45	0.899	716732.500	0.717
0.46	0.911	727250.800	0.727
0.47	0.923	738111.700	0.738
3.98	54.170	98530358.800	98.530
3.99	54.197	99119889.700	99.120
4	54.223	99711000.000	99.711



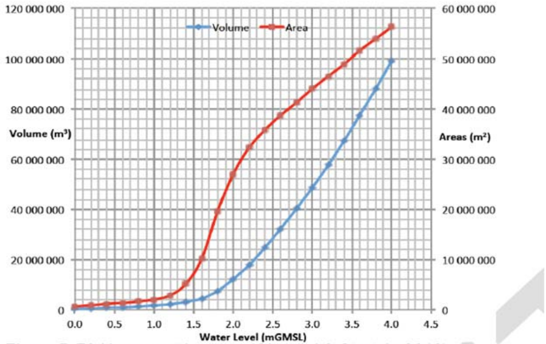
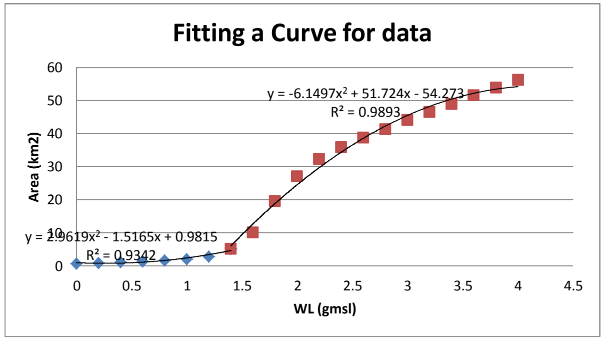


Figure B-70 Hypsometric curve (Chrystal & Stretch, 2010)



WL_{open} (amsl):	0.45
Vol_{open} (Mm^3):	0.72
WL_{breach} (amsl):	1.75
Vol_{breach} (Mm^3):	6.51
WL_{weir} (amsl):	0.90
Vol_{weir} (Mm^3):	1.5036
Weir coeffcient:	0.385
Weir Breadth	30.00
Threshold Flow	6.38

Date	Month	WL_{start} (gmsl)	Vol_{start} (Mm^3)	Prev. Mouth State 1 = closed 0 = open	$Area_{start}$ (km^2)	Simulated Mfolozi Flow (Mm^3/month)	Rainfall on inundated area (Mm^3 /month)	Evaporation on inundated area (Mm^3 /month)	Run-off from floodplain (Mm^3 / month)
Oct-1918	10	0.45	0.717	1	0.899	0.437	0.068	0.098	1.785
Nov-1918	11	0.88	1.504	1	1.941	0.990	0.213	0.227	1.140
Dec-1918	12	0.88	1.504	1	1.941	18.926	0.227	0.254	1.297
Jan-1919	1	0.88	1.504	1	1.941	30.249	0.255	0.254	1.493
Feb-1919	2	0.88	1.504	1	1.941	48.631	0.270	0.221	2.410
Mar-1919	3	0.88	1.504	1	1.941	48.631	0.277	0.219	2.944
Apr-1919	4	0.88	1.504	1	1.941	67.484	0.157	0.167	1.954
May-1919	5	0.45	0.717	0	0.899	57.145	0.058	0.069	1.689
Jun-1919	6	0.45	0.717	0	0.899	26.348	0.046	0.058	1.402
Jul-1919	7	0.45	0.717	0	0.899	12.832	0.039	0.062	1.480
Aug-1919	8	0.45	0.717	0	0.899	8.664	0.039	0.084	1.043
Sep-1919	9	0.45	0.717	0	0.899	6.597	0.068	0.098	1.785
Oct-1919	10	0.45	0.717	0	0.899	5.385	0.087	0.114	1.449
Nov-1919	11	0.45	0.717	0	0.899	12.832	0.098	0.105	1.150
Dec-1919	12	0.45	0.717	0	0.899	15.694	0.105	0.118	1.308
Jan-1920	1	0.45	0.717	0	0.899	324.162	0.118	0.118	1.505
Feb-1920	2	0.45	0.717	0	0.899	324.162	0.125	0.102	2.430
Mar-1920	3	0.45	0.717	0	0.899	681.022	0.128	0.102	2.969
Apr-1920	4	0.45	0.717	0	0.899	253.716	0.073	0.077	1.970
May-1920	5	0.45	0.717	0	0.899	88.059	0.058	0.069	1.689
Jun-1920	6	0.45	0.717	0	0.899	48.631	0.046	0.058	1.402
Jan-2010	1	0.89	1.504	1	1.978	5.385	0.259	0.259	1.492
Feb-2010	2	0.89	1.504	1	1.978	2.507	0.275	0.225	2.409
Mar-2010	3	0.89	1.504	1	1.978	0.990	0.282	0.223	2.943
Apr-2010	4	0.89	1.504	1	1.978	0.990	0.160	0.170	1.953
May-2010	5	0.89	1.504	1	1.978	0.714	0.128	0.152	1.674
Jun-2010	6	0.89	1.504	1	1.978	0.492	0.101	0.127	1.390
Jul-2010	7	0.89	1.504	1	1.978	6.597	0.085	0.135	1.467

Date	Abstractions from Flood Plain (Mm^3 / month)	Sediment Concentrations (g/l)	Sediment Loading : $M_{s\ in}$ (ton)	Resultant Inflow (Mm3 / month)	Vol_o (Mm^3)	Vol_{poss} (Mm^3)	WL_{poss} (gmsl)	$t_{o.prelim}$ (month)	t_o (month)	H_{min} (gmsl)	Q_{min} (Mm^3 / month)
Oct-1918		2.254	985	2.192	1.504	2.909	1.310	0.359	0.359	0.900	0.000
Nov-1918		1.476	1462	2.116	1.504	3.619	1.480	0.000	0.000	0.900	0.000
Dec-1918		1.779	33676	20.195	1.504	6.512	1.750	0.000	0.000	0.900	0.000
Jan-1919		0.758	22918	31.742	1.504	6.512	1.750	0.000	0.000	0.900	0.000
Feb-1919		0.334	16242	51.089	1.504	6.512	1.750	0.000	0.000	0.900	0.000
Mar-1919		0.063	3078	51.632	1.504	6.512	1.750	0.000	0.000	0.900	0.000
Apr-1919		0.086	5837	69.429	1.504	6.512	1.750	0.000	0.000	0.900	0.000
May-1919		0.086	4939	58.823	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Jun-1919		0.239	6305	27.739	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Jul-1919		0.462	5931	14.289	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Aug-1919		2.294	19879	9.662	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Sep-1919		2.389	15760	8.352	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Oct-1919		2.254	12137	6.807	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Nov-1919		1.476	18942	13.975	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Dec-1919		1.779	27925	16.989	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Jan-1920		0.758	245596	325.668	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Feb-1920		0.334	108265	326.615	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Mar-1920		0.063	43104	684.017	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Apr-1920		0.086	21944	255.682	1.504	0.717	0.450	1.000	1.000	0.900	0.000
May-1920		0.086	7611	89.737	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Jun-1920		0.239	11637	50.021	1.504	0.717	0.450	1.000	1.000	0.900	0.000
Jan-2010		0.758	4080	6.878	1.504	6.512	1.750	0.000	0.000	0.900	0.000
Feb-2010		0.334	837	4.966	1.504	6.470	1.740	0.000	0.000	0.900	0.000
Mar-2010		0.063	63	3.992	1.504	5.496	1.700	0.000	0.000	0.900	0.000
Apr-2010		0.086	86	2.934	1.504	4.438	1.650	0.000	0.000	0.900	0.000
May-2010		0.086	62	2.364	1.504	3.867	1.530	0.000	0.000	0.900	0.000
Jun-2010		0.239	118	1.856	1.504	3.360	1.420	0.000	0.000	0.900	0.000
Jul-2010		0.462	3049	8.014	1.504	6.512	1.750	0.000	0.000	0.900	0.000

Date	H_{max} (gmsl)	H_{check} (m)	Q_{max} (Mm^3 / month)	Q_{ave} (Mm^3 / month)	t_{prem} (month)	t (month)	t_x / t_w (month)	t_x (month)	t_w (month)	t_{total} (month)	Vol_{acc} (Mm^3)
Oct-1918	1.310	0.410	35.384	17.692	0.000	0.000	tx	0.641	0.000	1.000	2.909
Nov-1918	1.480	0.580	59.535	29.768	0.000	0.000	tx	1.000	0.000	1.000	3.619
Dec-1918	1.750	0.850	105.624	52.812	0.000	0.000	tx	1.000	0.000	1.000	21.699
Jan-1919	1.750	0.850	105.624	52.812	0.000	0.000	tx	1.000	0.000	1.000	33.246
Feb-1919	1.750	0.850	105.624	52.812	0.000	0.000	tx	1.000	0.000	1.000	52.593
Mar-1919	1.750	0.850	105.624	52.812	0.000	0.000	tx	1.000	0.000	1.000	53.136
Apr-1919	1.750	0.850	105.624	52.812	0.301	0.301	tw	0.000	0.699	1.000	22.430
May-1919	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Jun-1919	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Jul-1919	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Aug-1919	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Sep-1919	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Oct-1919	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Nov-1919	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Dec-1919	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Jan-1920	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Feb-1920	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Mar-1920	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Apr-1920	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
May-1920	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
Jun-1920	0.900	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	1.000	0.717
								1.000			
								1.000			
Jan-2010	1.750	0.850	105.624	52.812	0.000	0.000	tx	1.000	0.000	1.000	8.381
Feb-2010	1.740	0.840	103.765	51.883	0.000	0.000	tx	1.000	0.000	1.000	6.470
Mar-2010	1.700	0.800	96.442	48.221	0.000	0.000	tx	1.000	0.000	1.000	5.496
Apr-2010	1.650	0.750	87.544	43.772	0.000	0.000	tx	1.000	0.000	1.000	4.438
May-2010	1.530	0.630	67.397	33.699	0.000	0.000	tx	1.000	0.000	1.000	3.867
Jun-2010	1.420	0.520	50.540	25.270	0.000	0.000	tx	1.000	0.000	1.000	3.360
Jul-2010	1.750	0.850	105.624	52.812	0.000	0.000	tx	1.000	0.000	1.000	9.517

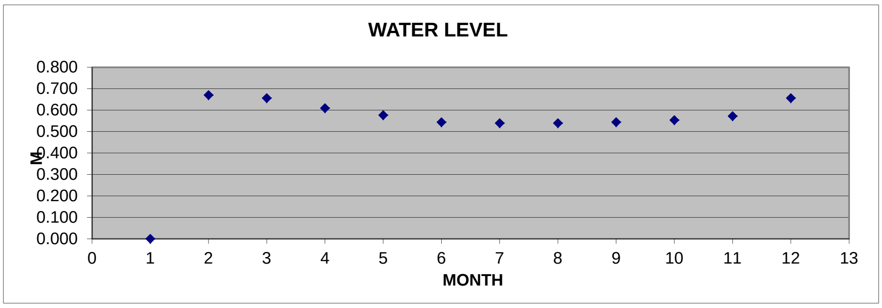
Date	$Q_{weir\ outflow}$ (Mm^3 / month)	Vol_{res} (Mm^3)	Vol_{av} (Mm^3)	WL_{res} (gmsl)	Mouth State 1 = closed 0 = open	Mouth State = closed	Mouth State = opened	Water channel per decade	$Inflow_{peak}$ (m3/s) - see tab 5.1 -	$t_{r\ inflow}$ (s)	$t_{r\ outflow}$ (month)
Oct-1918	1.405	1.504	1.110	0.880	1	1	0		0.166	6694643.589	1.732
Nov-1918	2.116	1.504	1.504	0.880	1	1	0		0.376	4001661.319	1.504
Dec-1918	20.195	1.504	1.504	0.880	1	1	0		41.448	36277.564	1.504
Jan-1919	31.742	1.504	1.504	0.880	1	1	0		66.295	22681.145	1.504
Feb-1919	51.089	1.504	1.504	0.880	1	1	0		103.900	14472.019	1.504
Mar-1919	51.632	1.504	1.504	0.880	1	1	0		103.900	14472.019	1.504
Apr-1919	15.918	0.717	1.110	0.450	0	0	1		138.960	7989.214	0.021
May-1919	0.000	0.717	0.717	0.450	0	0	1		120.173	5964.156	0.012
Jun-1919	0.000	0.717	0.717	0.450	0	0	1		57.880	12383.088	0.026
Jul-1919	0.000	0.717	0.717	0.450	0	0	1		27.545	26020.765	0.050
Aug-1919	0.000	0.717	0.717	0.450	0	0	1		17.823	40214.657	0.074
Sep-1919	0.000	0.717	0.717	0.450	0	0	1		12.936	55405.941	0.086
Oct-1919	0.000	0.717	0.717	0.450	0	0	1		10.051	71312.187	0.105
Nov-1919	0.000	0.717	0.717	0.450	0	0	1		27.545	26020.765	0.051
Dec-1919	0.000	0.717	0.717	0.450	0	0	1		34.121	21005.557	0.042
Jan-1920	0.000	0.717	0.717	0.450	0	0	1		262.671	2728.632	0.002
Feb-1920	0.000	0.717	0.717	0.450	0	0	1		262.671	2728.632	0.002
Mar-1920	0.000	0.717	0.717	0.450	0	0	1		258.433	2773.383	0.001
Apr-1920	0.000	0.717	0.717	0.450	0	0	1		294.315	2435.258	0.003
May-1920	0.000	0.717	0.717	0.450	0	0	1		173.165	4139.004	0.008
Jun-1920	0.000	0.717	0.717	0.450	0	0	1		103.900	6898.317	0.014
	13.957				1						
	11.704				1						
Jan-2010	6.878	1.504	1.504	0.890	1	1	0		10.051	149606.254	1.504
Feb-2010	4.966	1.504	1.504	0.890	1	1	0		3.143	478363.457	1.504
Mar-2010	3.992	1.504	1.504	0.890	1	1	0		0.376	4001661.319	1.504
Apr-2010	2.934	1.504	1.504	0.890	1	1	0		0.376	4001661.319	1.504
May-2010	2.364	1.504	1.504	0.890	1	1	0		0.271	5552727.941	1.504
Jun-2010	1.856	1.504	1.504	0.890	1	1	0		0.187	8048417.870	1.504
Jul-2010	8.014	1.504	1.504	0.890	1	1	0		12.936	116236.447	1.504

	my method										
Date	$t_{r\ outflow}$ (s)	$M_{s\ total}$ (ton)	WL_{av} (gmsl)	C_d (ton/m)	v_s (m) (Maine 2011)	d_s (m)	d_s / WL_{av} (unitless)	Ms st lucia (ton)	$M_{s\ sea}$ (ton)	$M_{s\ scour}$ (ton)	$M_{s\ balance}$ (ton)
Oct-1918	4563991.112	985	0.710	1387	0.002504469	16766.525	23614.82	0	0	0.000	985.004
Nov-1918	3962385.013	1462	0.880	1661	0.000598755	2396.014	2722.74	0	0	0	2447
Dec-1918	3962385.013	33676	0.880	38268	0.001132437	41.082	46.68	0	0	0	36122
Jan-1919	3962385.013	22918	0.880	26043	0.000070817	1.606	1.83	0	0	0	59040
Feb-1919	3962385.013	16242	0.880	18457	0.000035547	0.514	0.58	7088	0	0	68194
Mar-1919	3962385.013	9825	0.880	11165	0.000040541	0.587	0.67	1089	0	0	76930
Apr-1919	54888.347	9111	0.710	12833	0.000040428	0.323	0.45	750	6365	78925	0
May-1919	32108.891	9906	0.450	22013	0.000040428	0.241	0.54	0	9906	0	0
Jun-1919	68090.628	10903	0.450	24229	0.000037444	0.464	1.03	0	10903	0	0
Jul-1919	132184.671	5931	0.450	13180	0.000036141	0.940	2.09	0	5931	0	0
Aug-1919	195489.247	19879	0.450	44176	0.002656782	106.842	237.43	0	19879	0	0
Sep-1919	226147.143	15760	0.450	35023	0.003037164	168.277	373.95	0	15760	0	0
Oct-1919	277481.816	12137	0.450	26971	0.002504469	178.599	396.89	0	12137	0	0
Nov-1919	135152.828	18942	0.450	42093	0.000598755	15.580	34.62	0	18942	0	0
Dec-1919	111172.208	27925	0.450	62056	0.001132437	23.787	52.86	0	27925	0	0
Jan-1920	5799.572	245596	0.450	545769	0.000070817	0.193	0.43	0	245596	0	0
Feb-1920	5782.755	248399	0.450	551999	0.000035547	0.097	0.22	0	248399	0	0
Mar-1920	2761.237	237963	0.450	528806	0.000040541	0.112	0.25	0	237963	0	0
Apr-1920	7387.038	200451	0.450	445446	0.000040428	0.098	0.22	0	200451	0	0
May-1920	21047.502	164207	0.450	364905	0.000040428	0.167	0.37	0	164207	0	0
Jun-1920	37758.982	114784	0.450	255076	0.000037444	0.258	0.57	0	114784	0	0
Jan-2010	3962385.013	4080	0.890	4584	0.000070817	10.595	11.90	0	0	0	228172
Feb-2010	3962385.013	837	0.890	941	0.000035547	17.004	19.11	0	0	0	229010
Mar-2010	3962385.013	63	0.890	70	0.000040541	162.230	182.28	0	0	0	229072
Apr-2010	3962385.013	86	0.890	96	0.000040428	161.778	181.77	0	0	0	229158
May-2010	3962385.013	62	0.890	69	0.000040428	224.487	252.23	0	0	0	229220
Jun-2010	3962385.013	118	0.890	132	0.000037444	301.366	338.61	0	0	0	229338
Jul-2010	3962385.013	3049	0.890	3426	0.000036141	4.201	4.72	0	0	0	232387

				churchill(1948)					
Date	TE$_{my\ method}$ (%)	Vol$_{av}$ (ft^3)	X-Area$_{av}$ (ft^2)	Resultant Inflow (ft^3/s)	S.I.	% Sediment passing	TE$_{churchill}$ (%)	Q$_{max}$ (m^3/s)	Area (m^2)
Oct-1918	100	39175707	60680	29	2759110042	-2	100	13.427	1398074.200
Nov-1918	100	53059679	75209	28	4971083679	-3	100	22.592	1940812.800
Dec-1918	100	53059679	75209	270	54565168	11	89	40.082	1940812.800
Jan-1919	100	53059679	75209	425	22087168	15	85	40.082	1940812.800
Feb-1919	58	53059679	75209	684	8526356	21	79	40.082	1940812.800
Mar-1919	67	53059679	75209	691	8347853	21	79	40.082	1940812.800
Apr-1919	45	39175707	60680	930	2750227	29	71	40.082	1398074.200
May-1919		25291735	38459	788	1567731	34		0.000	899155.000
Jun-1919		25291735	38459	371	7050103	22		0.000	899155.000
Jul-1919		25291735	38459	191	26569476	14		0.000	899155.000
Aug-1919		25291735	38459	129	58112098	10		0.000	899155.000
Sep-1919		25291735	38459	112	77768374	9		0.000	899155.000
Oct-1919		25291735	38459	91	117081927	7		0.000	899155.000
Nov-1919		25291735	38459	187	27776088	14		0.000	899155.000
Dec-1919		25291735	38459	228	18793742	16		0.000	899155.000
Jan-1920		25291735	38459	4361	51146	79		0.000	899155.000
Feb-1920		25291735	38459	4374	50850	80		0.000	899155.000
Mar-1920		25291735	38459	9160	11594	111		0.000	899155.000
Apr-1920		25291735	38459	3424	82978	71		0.000	899155.000
May-1920		25291735	38459	1202	673631	43		0.000	899155.000
Jun-1920		25291735	38459	670	2168010	31		0.000	899155.000
Jan-2010	100	53059679	76064	92	475833932	3	97	40.082	1978070.200
Feb-2010	100	53059679	76064	67	912612892	1	99	39.377	1978070.200
Mar-2010	100	53059679	76064	53	1412185057	0	100	36.598	1978070.200
Apr-2010	100	53059679	76064	39	2614804511	-2	100	33.221	1978070.200
May-2010	100	53059679	76064	32	4028030171	-2	100	25.576	1978070.200
Jun-2010	100	53059679	76064	25	6530459078	-3	100	19.179	1978070.200
Jul-2010	100	53059679	76064	107	350477732	4	96	40.082	1978070.200

Please Note: Year Column indicates the year for the month October, e.g. the row of 1931 will commence with Oct 1931 but will end with Sep 1932.

	WATER LEVEL											
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1918	0.880	0.880	0.880	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450
1919	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1920	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1921	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1922	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.880
1923	0.890	0.890	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.890
1924	0.890	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1925	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.880
1926	0.890	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
1927	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.880
1928	0.880	0.880	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1929	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1930	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.880	0.880	0.880
1980	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
1981	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
1982	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890
1983	0.890	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1984	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1985	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.880
1986	0.880	0.880	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1987	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1988	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.880
1989	0.890	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1990	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1991	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.890	0.890	0.890	0.890
1992	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.890	0.880	0.880
1993	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.880
1994	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
1995	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1996	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
1997	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.880
1998	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.880
1999	0.890	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
2000	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.890
2001	0.890	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
2002	0.890	0.880	0.880	0.880	0.880	0.890	0.890	0.890	0.890	0.890	0.890	0.890
2003	0.890	0.890	0.890	0.890	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.880
2004	0.880	0.880	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.880
2005	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
2006	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.890	0.890
2007	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890
2008	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890
2009	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.000	0.000
AVERAGE	0.000	0.670	0.656	0.609	0.577	0.544	0.539	0.539	0.544	0.554	0.572	0.656



Please Note: Year Column indicates the year for the month October, e.g. the row of 1931 will commence with Oct 1931 but will end with Sep 1932.

RESULTANT WEIR OUTFLOW INTO ST LUCIA (Mm3)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	sum	Av/month
1918	1.41	2.12	20.20	31.74	51.09	51.63	15.92	0.00	0.00	0.00	0.00	0.00	174.10	29.02
1919	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1920	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1921	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1922	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.96	1.96	0.98
1923	3.89	4.81	16.96	17.19	32.71	36.06	0.00	0.00	0.00	0.00	0.00	9.63	121.25	17.32
1924	11.81	31.37	7.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.43	25.22
1925	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.35	6.35	3.18
1926	7.98	11.56	16.96	20.42	32.71	51.63	28.29	17.35	10.03	10.08	6.32	5.39	218.72	18.23
1927	14.21	16.82	36.28	16.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.35	90.02	18.00
1928	6.76	7.72	11.71	23.81	21.38	3.06	0.00	0.00	0.00	0.00	0.00	0.00	74.44	14.89
1929	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1930	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.51	2.83	2.70	9.04	2.26
1980	4.22	11.56	14.10	31.74	37.47	25.32	14.78	28.00	27.71	14.25	11.37	20.63	241.15	20.10
1981	20.30	27.47	20.20	27.84	28.81	51.63	36.95	20.58	10.03	6.80	3.44	4.21	258.27	21.52
1982	7.98	7.72	7.87	10.16	9.06	9.60	7.33	4.49	3.87	4.26	4.62	4.21	81.16	6.76
1983	5.06	31.37	36.28	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.08	24.36
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81	3.81	1.90
1986	5.07	6.51	20.20	42.47	32.71	36.06	0.00	0.00	0.00	0.00	0.00	0.00	143.01	28.60
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.66	4.66	2.33
1989	7.98	3.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.89	11.89
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.11	2.41	1.92	2.69	10.14	2.03
1992	3.28	6.51	9.93	11.93	18.15	18.70	14.78	7.04	4.21	3.32	2.83	3.60	104.27	8.69
1993	46.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.48	49.78	24.89
1994	11.81	13.96	23.58	17.19	12.89	29.35	32.19	23.96	17.06	10.08	6.32	4.55	202.95	16.91
1995	10.04	31.37	3.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.32	22.66
1996	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1997	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81	3.81	1.90
1998	11.81	20.05	42.25	16.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.66	95.13	19.03
1999	7.98	9.79	49.90	3.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.56	23.85
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.63	9.63	4.82
2001	14.21	31.37	36.28	42.47	43.44	29.35	24.26	10.32	7.96	20.34	13.77	12.14	285.91	23.83
2002	7.98	11.56	11.71	11.93	24.77	15.83	10.61	7.03	7.96	5.10	3.44	4.21	122.14	10.18
2003	3.28	6.51	6.65	31.74	38.94	0.00	0.00	0.00	0.00	0.00	0.00	6.35	93.48	15.58
2004	5.07	11.56	14.10	31.74	51.09	36.06	0.00	0.00	0.00	0.00	0.00	3.48	153.10	21.87
2005	4.22	9.79	9.93	23.81	32.71	33.25	28.29	17.35	10.03	5.11	7.53	7.09	189.10	15.76
2006	11.81	20.05	47.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.72	4.54	86.34	17.27
2007	10.04	20.05	14.10	14.32	15.29	18.70	28.29	14.48	10.03	5.10	3.44	4.21	158.06	13.17
2008	3.88	3.97	4.96	14.32	21.38	18.70	12.38	10.31	6.75	4.26	4.62	5.39	110.92	9.24
2009	7.97	13.96	11.70	6.88	4.97	3.99	2.93	2.36	1.86	8.01	0.00	0.00	64.64	6.46
AVERAGE	5.08	7.68	11.28	11.04	10.41	7.84	4.62	3.02	2.07	1.62	1.51	2.76	68.94	14.49
MEDIAN													47.55	10.88
												std dev	78.51	
% EXCEEDED												min	0.00	
2	22.34	31.37	47.70	45.40	51.09	51.63	33.05	24.69	17.64	10.83	11.80	10.69	258.32	
5	18.53	29.23	38.96	39.19	43.44	38.01	28.29	17.35	10.03	8.95	6.87	9.63	221.24	
10	13.97	23.10	36.28	31.74	38.80	33.25	23.42	14.48	7.96	5.11	4.62	6.35	189.89	
25	7.98	12.16	20.20	21.27	18.96	7.59	0.00	0.00	0.00	0.00	2.72	4.55	109.59	
50	3.28	3.77	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.55	
75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Please Note: Year Column indicates the year for the month October, e.g. the row of 1931 will commence with Oct 1931 but will end with Sep 1932.

	MOUTH STATE												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	months closed
1918	1	1	1	1	1	1	0	0	0	0	0	0	6
1919	0	0	0	0	0	0	0	0	0	0	0	0	0
1920	0	0	0	0	0	0	0	0	0	0	0	0	0
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	1	1	2
1923	1	1	1	1	1	0	0	0	0	0	1	1	7
1924	1	1	0	0	0	0	0	0	0	0	0	0	2
1925	0	0	0	0	0	0	0	0	0	0	1	1	2
1926	1	1	1	1	1	1	1	1	1	1	1	1	12
1927	1	1	1	0	0	0	0	0	0	0	1	1	5
1928	1	1	1	1	1	0	0	0	0	0	0	0	5
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0	0	1	1	1	1	4
1980	1	1	1	1	1	1	1	1	1	1	1	1	12
1981	1	1	1	1	1	1	1	1	1	1	1	1	12
1982	1	1	1	1	1	1	1	1	1	1	1	1	12
1983	1	1	1	0	0	0	0	0	0	0	0	0	3
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	1	1	2
1986	1	1	1	1	1	0	0	0	0	0	0	0	5
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	1	1	2
1989	1	0	0	0	0	0	0	0	0	0	0	0	1
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	1	1	1	1	1	5
1992	1	1	1	1	1	1	1	1	1	1	1	1	12
1993	0	0	0	0	0	0	0	0	0	0	1	1	2
1994	1	1	1	1	1	1	1	1	1	1	1	1	12
1995	1	1	0	0	0	0	0	0	0	0	0	0	2
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	1	1	2
1998	1	1	1	0	0	0	0	0	0	0	1	1	5
1999	1	1	1	0	0	0	0	0	0	0	0	0	3
2000	0	0	0	0	0	0	0	0	0	0	1	1	2
2001	1	1	1	1	1	1	1	1	1	1	1	1	12
2002	1	1	1	1	1	1	1	1	1	1	1	1	12
2003	1	1	1	1	0	0	0	0	0	0	1	1	6
2004	1	1	1	1	1	0	0	0	0	0	1	1	7
2005	1	1	1	1	1	1	1	1	1	1	1	1	12
2006	1	1	0	0	0	0	0	0	0	1	1	1	5
2007	1	1	1	1	1	1	1	1	1	1	1	1	12
2008	1	1	1	1	1	1	1	1	1	1	1	1	12
2009	1	1	1	1	1	1	1	1	1	1	0	0	10
MEDIAN	1	1	0	0	0	0	0	0	0	0	0	1	
AVERAGE	0.521739	0.51087	0.478261	0.369565	0.293478	0.217391	0.206522	0.217391	0.23913	0.304348	0.48913	0.521739	4.369565

E % CHANCE OF MOUTH BEING CLOSED

SUM OF 1'S	48	47	44	34	27	20	19	20	22	28	45	48
NO.OF ROWS	92	92	92	92	92	92	92	92	92	92	92	92
CHANCE OBEING CLOSED												
	0.521739	0.51087	0.478261	0.369565	0.293478	0.217391	0.206522	0.217391	0.23913	0.304348	0.48913	0.521739

Please Note: Year Column indicates the year for the month October, e.g. the row of 1931 will commence with Oct 1931 but will end with Sep 1932.

	SEDIMENT INTO ST LUCIA VIA BACKCHANNEL (ton)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	sum	
1918	0.00	0.00	0.00	0.00	7088.14	1089.19	750.45	0.00	0.00	0.00	0.00	0.00	8927.78	
1919	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1920	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1921	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1922	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1923	0.00	0.00	0.00	0.00	915.54	1078.45	0.00	0.00	0.00	0.00	0.00	0.00	1993.99	
1924	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1925	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1926	0.00	0.00	0.00	0.00	915.54	1089.19	0.00	0.00	0.00	0.00	0.00	0.00	2004.73	
1927	0.00	0.00	0.00	2518.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2518.12	
1928	0.00	0.00	0.00	0.00	0.00	141.79	0.00	0.00	0.00	0.00	0.00	0.00	141.79	
1929	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1930	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1980	0.00	0.00	0.00	0.00	2559.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2559.74	
1981	0.00	0.00	0.00	0.00	0.00	1089.19	304.71	0.00	0.00	0.00	0.00	0.00	1393.90	
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1983	0.00	0.00	0.00	171.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	171.09	
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1986	0.00	0.00	0.00	0.00	915.54	1078.45	0.00	0.00	0.00	0.00	0.00	0.00	1993.99	
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1994	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1995	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1996	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1997	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1998	0.00	0.00	0.00	2518.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2518.12	
1999	0.00	0.00	0.00	1443.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1443.81	
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2001	0.00	0.00	0.00	0.00	4568.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4568.03	
2002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2003	0.00	0.00	0.00	0.00	6990.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6990.86	
2004	0.00	0.00	0.00	0.00	7088.14	1078.45	0.00	0.00	0.00	0.00	0.00	0.00	8166.59	
2005	0.00	0.00	0.00	0.00	915.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	915.54	
2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2007	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2009	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
AVERAGE	0.00	0.00	0.00	216.85	820.18	100.55	14.78	3.28	0.00	0.00	0.00	0.00	1155.64	
MEDIAN													0.00	
												max	8927.78	
% EXCEEDED												min	0.00	%
2	0.00	0.00	0.00	2551.20	7088.14	1089.19	304.71	0.00	0.00	0.00	0.00	0.00	7704.65	
5	0.00	0.00	0.00	2214.74	6990.96	1078.45	0.00	0.00	0.00	0.00	0.00	0.00	6990.96	
10	0.00	0.00	0.00	153.98	4420.63	272.05	0.00	0.00	0.00	0.00	0.00	0.00	4420.63	
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1966.51	
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Please Note: Year Column indicates the year for the month October, e.g. the row of 1931 will commence with Oct 1931 but will end with Sep 1932.

	SEDIMENT TRAPPING EFFICIENCY (% trapped) - my method												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	average
1918	100.00	100.00	100.00	100.00	58.46	66.67	45.49						81.52
1919													
1920													
1921													
1922												100.00	100.00
1923	100.00	100.00	100.00	100.00	91.62	52.75						100.00	92.05
1924	100.00	100.00	100.00										100.00
1925												100.00	100.00
1926	100.00	100.00	100.00	100.00	91.62	66.67	100.00	100.00	100.00	100.00	100.00	100.00	96.52
1927	100.00	100.00	100.00	79.69								100.00	95.94
1928	100.00	100.00	100.00	100.00	100.00	26.78							87.80
1929													
1930										100.00	100.00	100.00	100.00
1980	100.00	100.00	100.00	100.00	79.54	100.00	100.00	100.00	100.00	100.00	100.00	100.00	98.30
1981	100.00	100.00	100.00	100.00	100.00	66.67	90.47	100.00	100.00	100.00	100.00	100.00	96.43
1982	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1983	100.00	100.00	100.00	36.94									84.23
1984													
1985												100.00	100.00
1986	100.00	100.00	100.00	100.00	91.62	52.75							90.73
1987													
1988												100.00	100.00
1989	100.00	100.00											100.00
1990													
1991									100.00	100.00	100.00	100.00	100.00
1992	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1993	100.00											100.00	100.00
1994	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1995	100.00	100.00	100.00										100.00
1996													
1997												100.00	100.00
1998	100.00	100.00	100.00	79.69								100.00	95.94
1999	100.00	100.00	100.00	51.03									87.76
2000												100.00	100.00
2001	100.00	100.00	100.00	100.00	68.51	100.00	100.00	100.00	100.00	100.00	100.00	100.00	97.38
2002	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
2003	100.00	100.00	100.00	100.00	46.25							100.00	91.04
2004	100.00	100.00	100.00	100.00	58.46	52.75						100.00	87.32
2005	100.00	100.00	100.00	100.00	91.62	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.30
2006	100.00	100.00	100.00								100.00	100.00	100.00
2007	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
2008	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
2009	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00			100.00
AVERAGE	100.00	100.00	100.00	92.96	78.04	79.70	96.32	99.50	100.00	100.00	100.00	100.00	95.75
MEDIAN													
	min	22.77	max	100.00	median	100.00							
EXCEEDED													
2	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
5	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
25	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
50	100.00	100.00	100.00	100.00	91.62	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
75	100.00	100.00	100.00	100.00	58.46	59.71	100.00	100.00	100.00	100.00	100.00	100.00	90.99
90	100.00	100.00	100.00	68.67	41.87	42.01	90.47	100.00	100.00	100.00	100.00	100.00	87.58

Please Note: Year Column indicates the year for the month October, e.g. the row of 1931 will commence with Oct 1931 but will end with Sep 1932.

DIFFERENCE IN SEDIMENT TRAPPING EFFICIENCY (% trapped) my method - churchill method

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	sum
1918	0.00	0.00	10.68	15.18	-20.66	-12.31	-25.28						-32.38
1919													0.00
1920													0.00
1921													0.00
1922												0.00	0.00
1923	0.00	0.75	9.11	9.27	7.13	-20.32						7.31	13.24
1924	6.26	14.99	33.60										54.86
1925												4.60	4.60
1926	3.61	6.11	9.15	10.78	7.13	-12.31	13.96	9.34	5.14	5.18	2.25	1.38	61.73
1927	7.71	9.08	16.67	8.81								4.60	46.87
1928	2.64	3.44	6.24	12.23	11.21	-30.75							5.00
1929													0.00
1930										1.55	0.00	0.00	1.55
1980	0.13	6.15	7.65	15.18	-3.41	12.83	8.02	13.85	13.74	7.73	6.03	10.88	98.77
1981	10.73	13.66	10.68	13.79	14.15	-12.31	7.35	10.85	5.14	2.68	0.00	0.12	76.85
1982	3.61	3.41	3.52	5.19	4.42	4.81	3.09	0.40	0.00	0.14	0.55	0.09	29.23
1983	1.01	14.99	16.67	34.08									66.76
1984													0.00
1985												1.92	1.92
1986	1.05	2.42	10.68	18.54	7.13	-20.32							19.50
1987													0.00
1988												2.89	2.89
1989	3.61	39.39											43.00
1990													0.00
1991									1.03	0.00	0.00	0.00	1.03
1992	0.00	2.42	5.08	6.38	9.74	9.99	8.02	2.88	0.11	0.00	0.00	0.00	44.61
1993	26.51											1.50	28.01
1994	6.31	7.57	12.13	9.27	6.96	14.34	15.33	12.29	9.20	5.18	2.25	0.49	101.33
1995	5.15	15.05	39.41										59.62
1996													0.00
1997												1.92	1.92
1998	6.31	10.62	18.47	8.81								2.89	47.10
1999	3.61	4.94	20.57	-9.52									19.60
2000												7.31	7.31
2001	7.66	14.99	16.67	18.54	-12.67	14.34	12.41	5.34	3.63	10.75	7.46	6.51	105.63
2002	3.61	6.11	6.24	6.38	12.61	8.53	5.49	2.84	3.60	1.06	0.00	0.09	56.55
2003	0.00	2.39	2.52	15.12	-26.96							4.60	-2.34
2004	1.05	6.15	7.65	15.18	-20.66	-20.32						1.50	-9.46
2005	0.13	4.98	5.08	12.23	7.13	15.69	13.96	9.34	5.14	1.09	3.29	2.92	80.97
2006	6.31	10.62	26.48								0.49	0.46	44.35
2007	5.11	10.57	7.60	7.73	8.25	9.94	13.90	7.81	5.10	1.06	0.00	0.09	77.16
2008	0.00	0.00	0.90	7.73	11.16	9.94	6.61	5.30	2.60	0.14	0.55	1.34	46.27
2009	3.61	7.52	6.20	2.71	0.91	0.00	0.00	0.00	0.00	3.64			24.58
AVERAGE	4.30	7.94	12.14	11.14	-4.45	-2.22	7.81	6.80	4.42	2.49	1.68	2.31	21.95
MEDIAN													2.70

EXCEEDED													
2	15.60	19.69	34.07	22.45	14.15	15.69	15.33	13.29	12.60	9.48	7.46	7.74	187.54
5	10.73	15.03	24.71	18.68	14.15	15.29	15.33	12.45	10.88	7.60	7.03	7.15	159.02
10	9.51	14.99	19.31	18.54	12.61	14.34	14.10	11.14	9.35	5.18	4.73	5.37	139.19
25	6.31	10.62	16.67	15.18	9.74	10.72	13.96	8.60	5.14	3.66	2.25	3.86	106.71
50	3.61	6.83	10.68	12.23	5.69	7.93	8.02	7.81	3.63	1.09	0.55	1.50	69.57
75	1.01	3.44	6.92	8.54	-20.66	-16.31	6.61	4.56	3.35	1.06	0.00	0.46	-1.03
90	0.00	0.77	4.46	3.45	-29.54	-26.72	2.78	2.36	0.10	0.14	0.00	0.04	-42.17

Sediment Trapping efficiency - supporting Calculations:

CHURCHILL METHOD (1948)

Calculation of Average Cross-Sectional Area

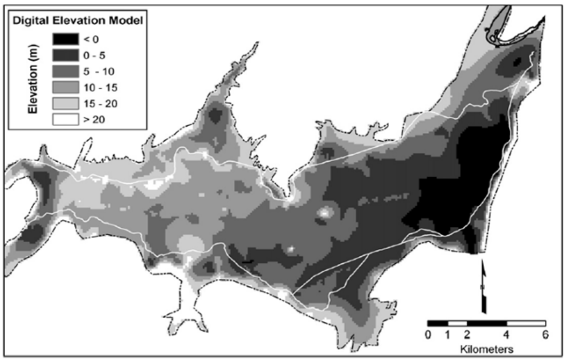
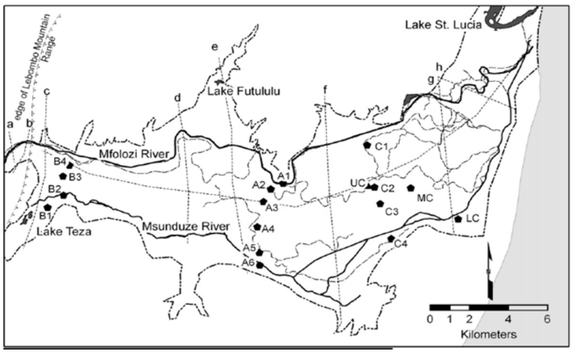


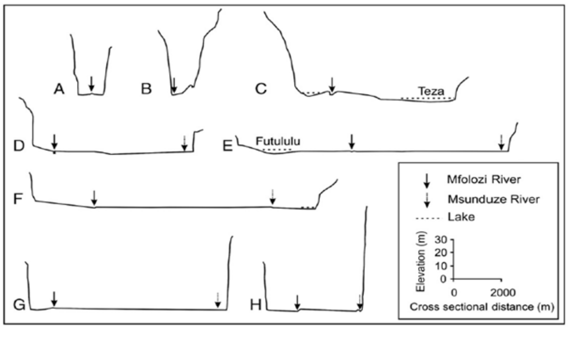
Fig. 6. Digital elevation model created using differentially corrected Trimble GPS data.

images from
Grenfell et al (2009)

look at extent of
area under 5m



see that cross sections
H-H, G-G & F_F
applicable to floodplain
</= 4 gmsl

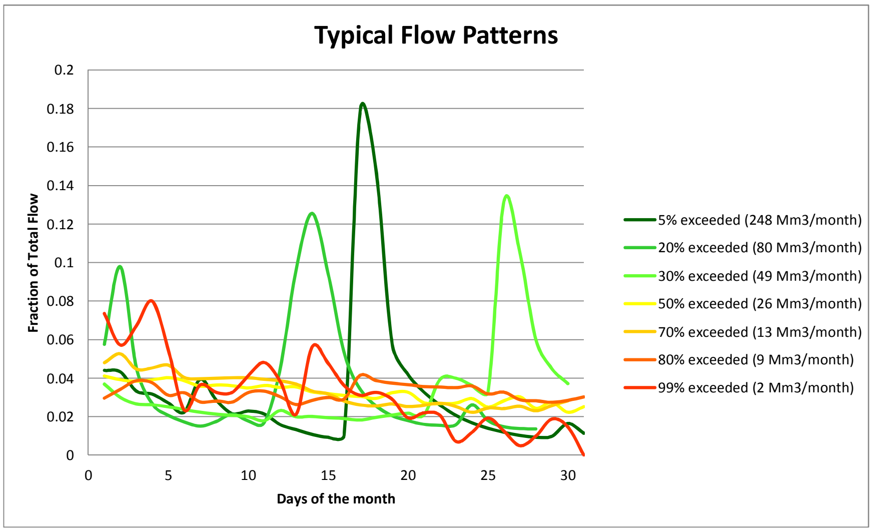


width F-F = 11 667 m
width G-G = 8 167 m
width H-H = 4 000m

average = 7 944 m

My Method

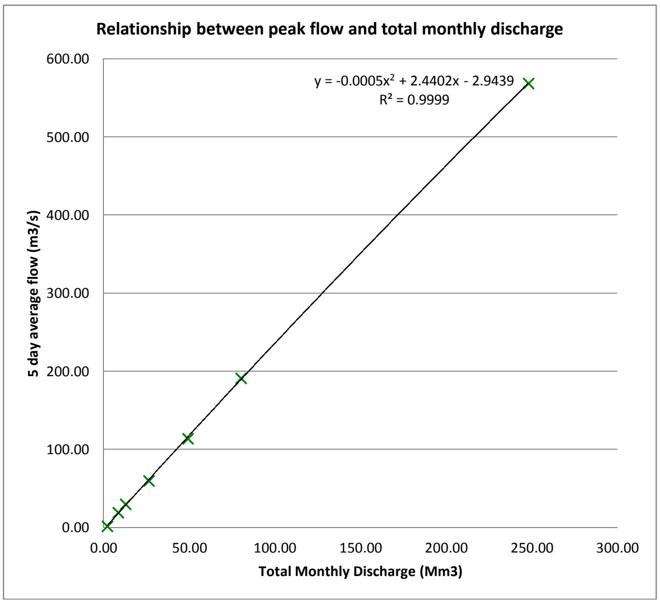
Calcultion of Peak Inflow Rates



	prob. Exd.	99%	80%	70%	50%	30%	20%	5%
	Mm3/month	2.19	8.60	12.80	26.50	49.20	80.30	248.00
5	Int 1	1.69	3.41	7.03	12.13	16.47	46.16	103.03
10	Int 2	0.84	2.95	5.93	11.14	12.28	16.51	77.47
15	Int 3	1.07	2.95	5.33	10.52	11.44	70.25	40.54
20	Int 4	0.75	3.65	3.89	9.55	11.31	28.17	251.04
25	Int 5	0.41	3.46	3.69	8.29	19.24	16.98	63.28
30	Int 6	0.31	2.92	3.75	8.05	43.08	13.06	33.06
	max (m3/s)	1.69	19.33	29.62	59.69	113.82	191.12	568.42

Note: Each interval is a period of 5 days. Each tabled figure refers to average m3/s flow from daily data relevant 5 day period.

Mm3	peak (m3/s)
2.19	1.69
8.60	19.33
12.80	29.62
26.50	59.69
49.20	113.82
80.30	191.12
248.00	568.42



SEDIMENT SETTLING VELOCITY

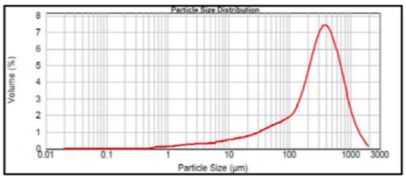


Figure 4-33: showing the particle size distribution for Mfolozi silt sample 1

PARTICLE SIZES OF MFOLOZI SILT - data from C. Maine (2010)

SAMPLE NAME	d_{10} (mm)	d_{50} (mm)	d_{90} (mm)		
Mfolozi Silt Sam	0.031	0.303	0.780		
Mfolozi Silt Sam	0.040	0.314	0.712		
Average	0.036	0.309	0.746		
settling velocity (stokes) m/s	0.0051	0.0962	2.2492		
Soulsby (1997)		0.0120		0.509	4.421
Van Rijn (1993)		0.012			

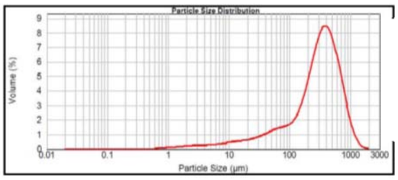
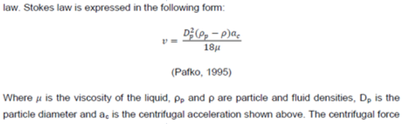


Figure 4-34: showing the particle size distribution for Mfolozi silt sample 2



law. Stokes law is expressed in the following form:

$$v = \frac{D_p^2(\rho_p - \rho)a_c}{18\mu}$$

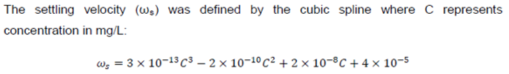
(Pafko, 1995)

Where μ is the viscosity of the liquid, ρ_p and ρ are particle and fluid densities, D_p is the particle diameter and a_c is the centrifugal acceleration shown above. The centrifugal force

	floc	sediment	
ρp =	1300.0	2650	kg/m3
ρf =	1000.0	1000	kg/m3
g =	9.810	9.810	m/s2
μ =	0.001	0.001	N s/m2

Stoke's theory

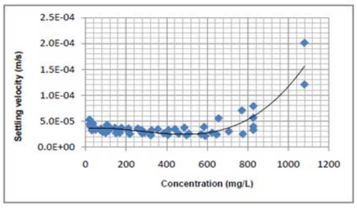
Particle size distribution curves completed by Maine (2011)



The settling velocity (ω_s) was defined by the cubic spline where C represents concentration in mg/L:

$$\omega_s = 3 \times 10^{-13}C^3 - 2 \times 10^{-10}C^2 + 2 \times 10^{-8}C + 4 \times 10^{-5}$$

mg/l	m/s
0.00	4.00E-05
200.00	3.84E-05
400.00	3.52E-05
600.00	4.48E-05
800.00	8.16E-05
1000.00	1.60E-04

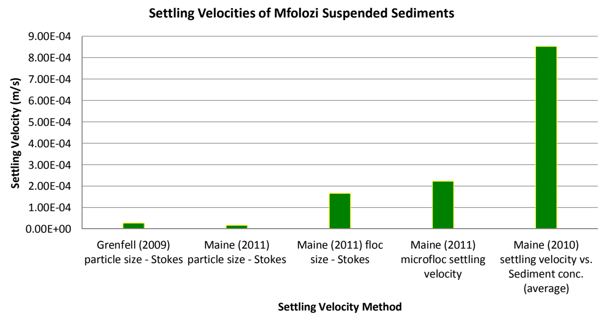


Maine (2010)

GRENFELL & ELLERY (2009) sediment data

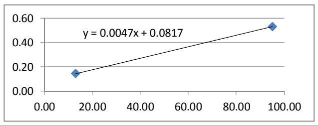
	(mm)	Stokes theory set. Vel (m/s)	Soulsby (1997)	Van Rijn (1993)
Bed Load D_{50}:	0.3500	0.4951		
Suspended Solids D_{50}:	0.0052	0.000027	0.00000403	0.0000040
			0.075	
Maine - floc - stokes	0.0300	0.000165337		
Maine (2011) particle size	0.0040	0.00001631212		

Soil Sample - Method	Settling velocity
Grenfell (2009) particle size - Stokes	0.000027321
Grenfell - Soulsby	0.000004029
Grenfell - Van Rijn	0.000003979
Maine - Stokes	0.096161400
Maine - Soulsby	0.012026746
Maine - Van Rijn	0.011841636
Maine (2011) particle size - Stokes	0.000016312
Maine (2011) floc size - Stokes	0.000165337
Maine (2011) microfloc settling velocity	0.000222700
Maine (2010) settling velocity vs. Sedim	0.000852579
Maine - Conc - Oct	0.002504469
Maine - Conc - Nov	0.000598755
Maine - Conc - Dec	0.001132437
Maine - Conc - Jan	0.000070817
Maine - Conc - Feb	0.000035547
Maine - Conc - Mar	0.000040541
Maine - Conc - Apr	0.000040428
Maine - Conc - May	0.000040428
Maine - Conc - Jun	0.000037444
Maine - Conc - Jul	0.000036141
Maine - Conc - Aug	0.002656782
Maine - Conc - Sep	0.003037164



micro m	mm/s
13.00	0.14
95.12	0.53
30.00	0.22

Maine (2011) fig 4-19 B



Measured Results by Prof Stretch and TUD Delf students

Validation of model

Results taken using *Hatch* turbidity meter

					Ave:	Trapping Eff.
Water entering flood plain (NTU):	473	471	447		464	
Transfer through old backchannel (20m): (flow rate: 1.6 m^3/s)	64	64	63	63	64	86.30%
Transfer through new backchannel (30m): (flow rate: 1.0 m^3/s)	74	74	73	71	73	84.26%
Mfolozi Mouth Area	86	86	87		86	81.38%

Results taken using *YSL*

					Ave:	Trapping Eff.
Water entering flood plain (NTU):	720	700			710	
Mfolozi Mouth Area	110	108	106		108	84.79%
						84.18%

m^3/s		Mm^3
1.60	=	4.22
1.00	=	2.64
		6.85

Email from Ricky Taylor to Prof Stretch (dated 21/11/2011)

	B(m)	Cd	h (m)	Q calc	Q measured	calc/measured	relationship
old outlet	20	0.385	0.262	4.57	0.87	526%	1.04
new outlet	30	0.385	0.262	6.86	2.08	330%	

TUD Delft field measurements

	B(m)	Cd	h (m)	Q calc	Q measured	calc/measured	
old outlet	20	0.385	0.500	12.06	1.60	753%	5.71
new outlet	30	0.385	0.500	18.08	1.00	1808%	

Sensitivity Analysis of Change in Berm Height				
Berm Height (m)	Output into Estuary (Mm3 / year)	General Proportion of time that mouth is closed (%)	Sediment into St Lucia (ton/year)	Sediment Trapping Efficiency (%)
1.00	0.07	2.99%	0.00	98.52
1.20	3.17	7.08%	0.00	99.05
1.50	11.43	12.07%	11.00	98.30
2.00	55.39	26.13%	909.68	95.13
2.25	73.50	30.76%	2326.99	93.96
2.50	85.01	32.30%	3760.72	92.35
3.00	129.16	42.29%	6971.92	92.05
3.50	235.14	56.26%	10564.94	91.98
4.00	256.35	56.81%	17445.89	90.13
5.00	256.35	56.81%	17445.89	90.13

OK!

First Enter Values in Column B for each Parameter, then enter the relevant macro-key:

Parameter	Control value	Macro Key:
Berm Height (amsl)	2	Ctrl+Shift+b
Threshold Flow (Mm3/month)	4	Ctrl+Shift+t
Outflow Weir Height (amsl)	1.2	Ctrl+Shift+w
Breadth of Back Channel (m)	10	Ctrl+Shift+c
Hypsometric Curve	Chrystal (2011)	Ctrl+Shift+d
Settling Velocity	Maine (2010) settling	
Sediment Loading	Ave. of Mtubatuba WTW	

Sensitivity Analysis of Change in Threshold Flow				
Threshold Flow (Mm3)	Output into Estuary (Mm3 / year)	General Proportion of time that mouth is closed (%)	Sediment into St Lucia (ton/year)	Sediment Trapping Efficiency (%)
2.00	11.82	5.90%	153.24	89.38
4.00	55.39	26.13%	909.68	95.13
6.00	84.89	40.56%	1308.00	95.74
8.00	113.41	52.18%	1649.83	95.79
10.00	118.88	55.26%	1767.57	95.83
15.00	145.38	65.61%	2127.41	95.74
20.00	150.22	67.88%	2175.20	95.92
30.00	160.30	72.41%	2245.18	95.93
40.00	169.80	75.68%	2263.95	96.05
50.00	175.04	77.22%	2445.47	95.97

Sensitivity Analysis of Change in Weir Height				
Weir Height (m)	Output into Estuary (Mm3 / year)	General Proportion of time that mouth is closed (%)	Sediment into St Lucia (ton/year)	Sediment Trapping Efficiency (%)
0.45	90.50	34.30%	3733.35	92.28
0.70	71.15	30.76%	2067.03	93.49
0.90	55.39	26.13%	909.68	95.13
1.10	32.89	18.60%	271.13	96.21
1.30	21.96	15.15%	88.49	97.38
1.50	12.04	12.34%	5.59	99.03
1.80	1.17	7.17%	0.00	99.07
2.00	0.00	6.26%	0.00	99.07

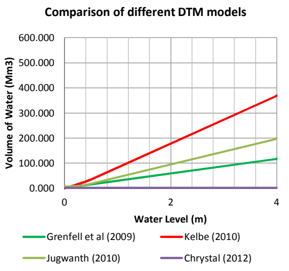
OK!

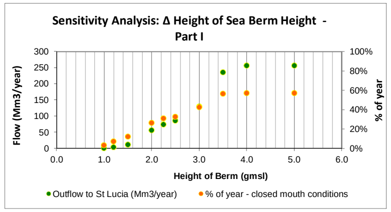
max
value
must

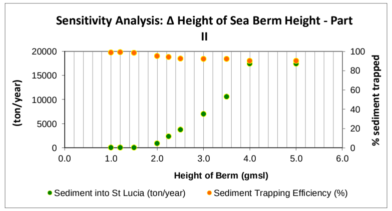
Sensitivity Analysis of Change in Breadth of Backchannel				
Breadth (m)	Output into Estuary (Mm3 / year)	General Proportion of time that mouth is closed (%)	Sediment into St Lucia (ton/year)	Sediment Trapping Efficiency (%)
0.00	0.00	6.26%	0.00	99.07
10.00	23.35	15.34%	137.34	96.69
20.00	55.39	26.13%	909.68	95.13
50.00	122.16	42.11%	5571.88	92.16
100.00	209.92	53.45%	16275.62	89.81
150.00	253.18	56.81%	21926.97	89.00
200.00	314.96	70.42%	26013.73	88.91
300.00	484.44	89.29%	46474.05	87.30
400.00	573.07	98.46%	55537.97	86.79
500.00	573.10	98.46%	55558.50	86.78

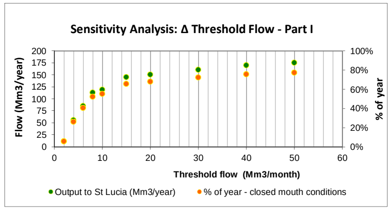
Sensitivity Analysis of Change in DTM model				
Model	Output into Estuary (Mm3 / year)	General Proportion of time that mouth is closed (%)	Sediment into St Lucia (ton/year)	Sediment Trapping Efficiency (%)
Grenfell 2009	123.08	48.64%	0.00	99.76
Kelbe 2010	164.81	57.71%	0.00	99.77
Jugwanth 2010	132.54	50.45%	0.00	99.76
Crystal 2012	73.16	30.76%	2342.83	93.96

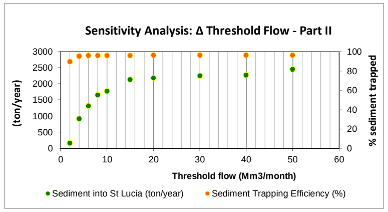
Sensitivity Analysis of Change Sediment Loading Conditions	
Estimate	Sediment into St Lucia (ton/year)
Maro (2012)	4003.86

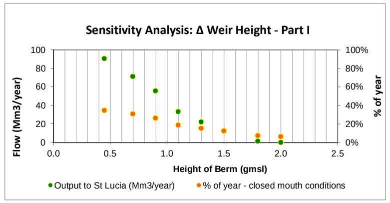


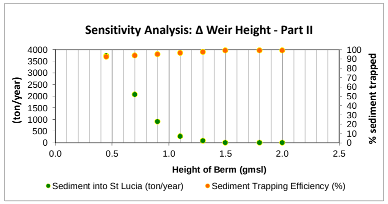


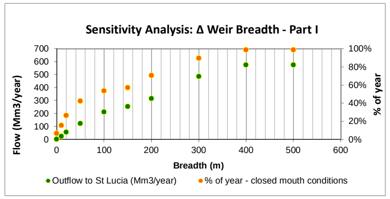


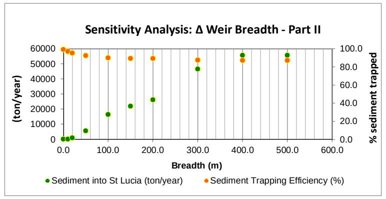


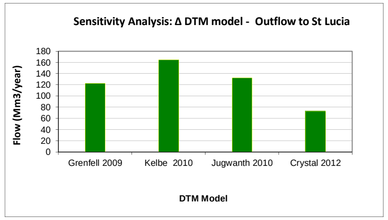


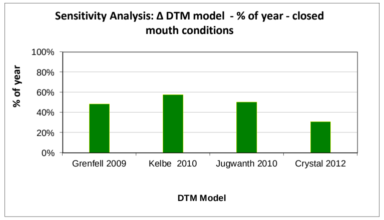


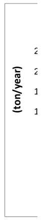


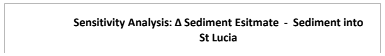


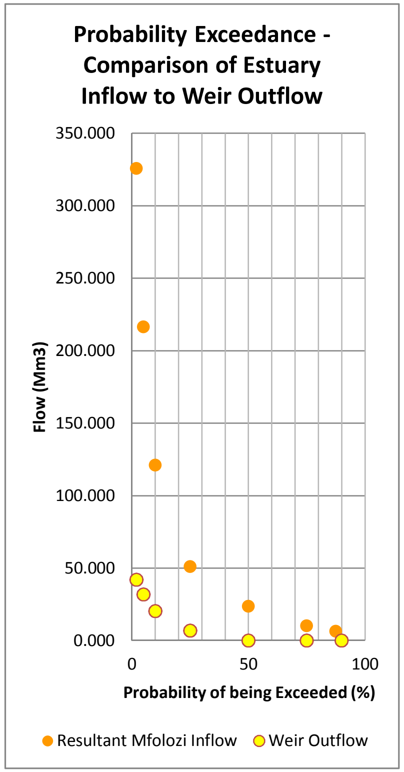










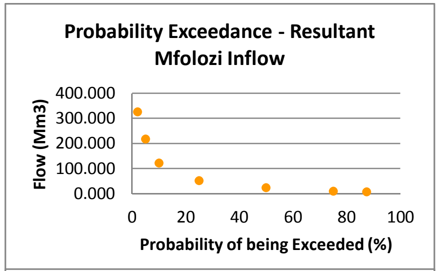


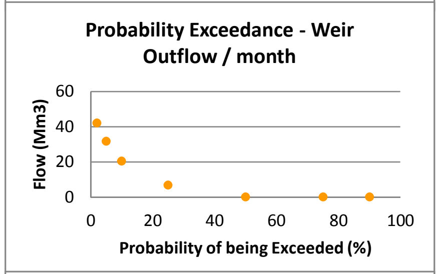
% Exceedance - Mfolozi Flow / month			
% Exceeded		Position	Flow (Mm3)
2	% exceeded	1082	325.668
5	% exceeded	1049	216.513
10	% exceeded	994	121.034
25	% exceeded	828	51.088
50	% exceeded	552	23.704
75	% exceeded	276	10.083
87.5	% exceeded	138	6.382

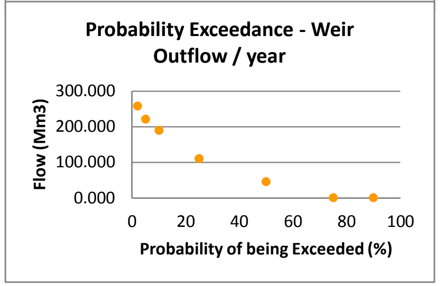
% Exceedance - Flow into Estuary / month (including 0 flows)			
% Exceeded		Position	Flow (Mm3)
2	% exceeded	1082	42.04027745
5	% exceeded	1049	31.74235495
10	% exceeded	994	20.41930495
25	% exceeded	828	6.763226504
50	% exceeded	552	0
75	% exceeded	276	0
90	% exceeded	110	0

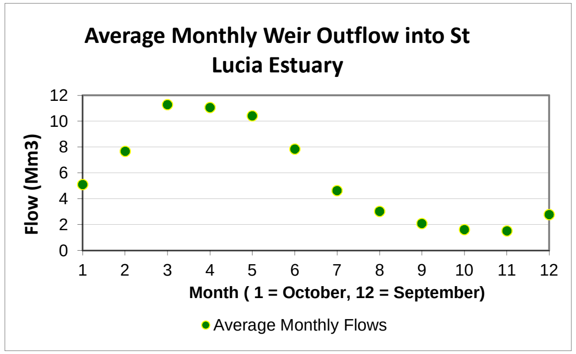
% Exceedance - Flow into Estuary / year			
% Exceeded		Position	Flow (Mm3)
2	% exceeded	90	258.326
5	% exceeded	87	221.522
10	% exceeded	83	189.977
25	% exceeded	69	110.034
50	% exceeded	46	45.322
75	% exceeded	23	0.000
90	% exceeded	9	0.000

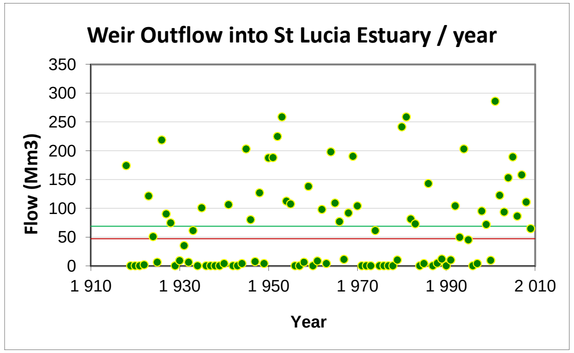
Flow into Estuary / year			
Date	Resultant Inflow into Flood Plain (Mm3)	Flow from river into estuary (Mm3)	Flow into estuary / year
Oct-1918	2.192	1.405	
Nov-1918	2.116	2.116	
Dec-1918	20.195	20.195	
Jan-1919	31.742	31.742	
Feb-1919	51.089	51.089	
Mar-1919	51.632	51.632	
Apr-1919	69.429	15.918	
May-1919	58.823	0.000	
Jun-1919	27.739	0.000	
Jul-1919	14.289	0.000	
Aug-1919	9.662	0.000	
Sep-1919	8.352	0.000	174.098
Oct-1919	6.807	0.000	
Nov-1919	13.975	0.000	
Dec-1919	16.989	0.000	
Jan-1920	325.668	0.000	
Feb-1920	326.615	0.000	
Mar-1920	684.017	0.000	
Apr-1920	255.682	0.000	
May-1920	89.737	0.000	
Jun-1920	50.021	0.000	
Jul-1920	27.805	0.000	
Aug-1920	13.829	0.000	
Sep-1920	12.191	0.000	Jan-1900
Oct-1920	36.431	0.000	
Nov-1920	49.774	0.000	
Dec-1920	89.354	0.000	
Jan-1921	89.564	0.000	
Feb-1921	69.937	0.000	
Mar-1921	139.259	0.000	
Apr-1921	69.450	0.000	
May-1921	42.656	0.000	
Jun-1921	20.316	0.000	
Jul-1921	11.893	0.000	
Aug-1921	6.382	0.000	
Sep-1921	10.419	0.000	Jan-1900
Oct-1921	23.736	0.000	
Nov-1921	126.340	0.000	
Dec-1921	144.683	0.000	
Jun-2010	1.856	1.856	
Jul-2010	8.014	8.014	

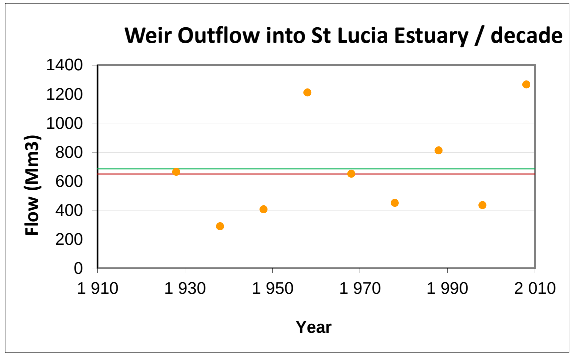






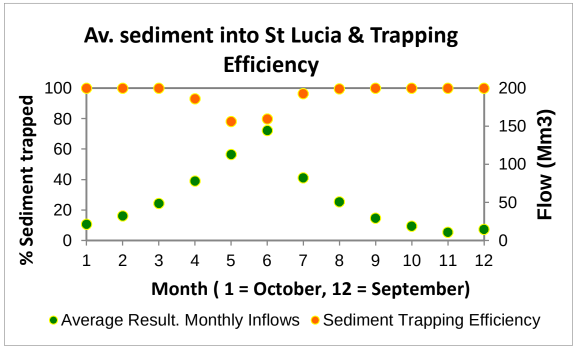

Average Monthly Weir Outflow into St Lucia Estuary

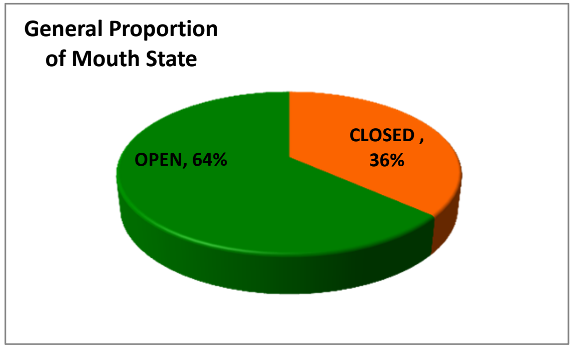

Weir Outflow into St Lucia Estuary / year

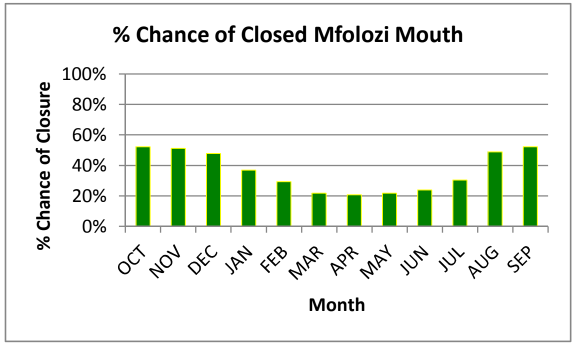

Weir Outflow into St Lucia Estuary / decade

MEDIAN

AVERAGE


Av. sediment into St Lucia & Trapping Efficiency


General Proportion of Mouth State


% Chance of Closed Mfolozi Mouth

General Proportion of Mouth State

% of time mouth is closed: 36.48%

outflow	% closed	sed into s.l	trap eff.
69	36.48%	1156	95.75

Weir Outflow into St Lucia Lake

Yearly Outflow	(Mm^3)
Average:	68.94
Coefficient of Variance:	114%
Decade Outflow	
Average:	685.18
Coefficient of Variance:	51%

Calculate Average Yearly
Weir Outflow:

68.94 Mm3 @ 1156 ton of sediment into St Lucia /year = 16.76 ton/Mm3
95.75% trapping efficiency

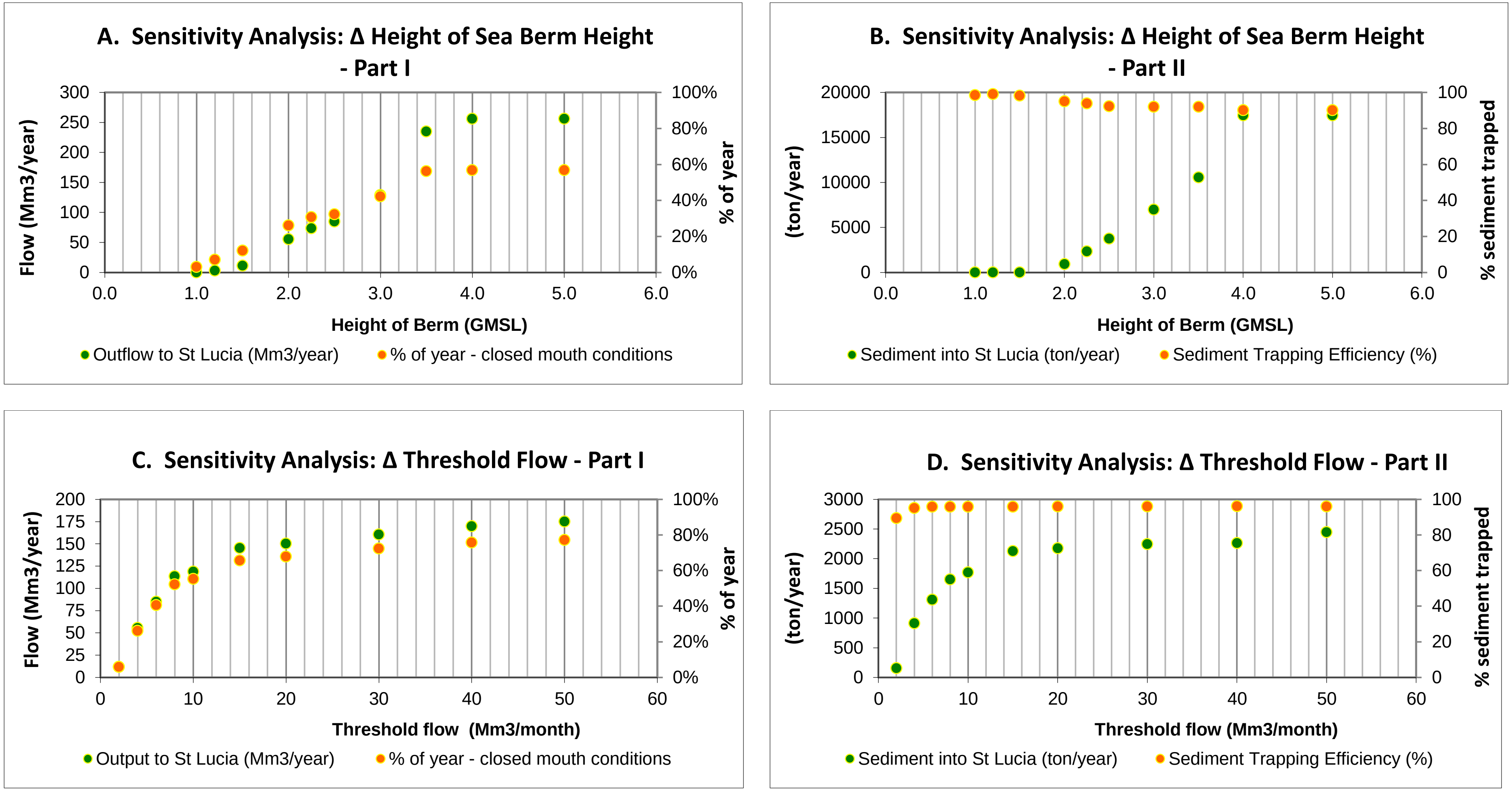


Figure 8-1: Results of sensitivity analysis – change in berm height and threshold flow

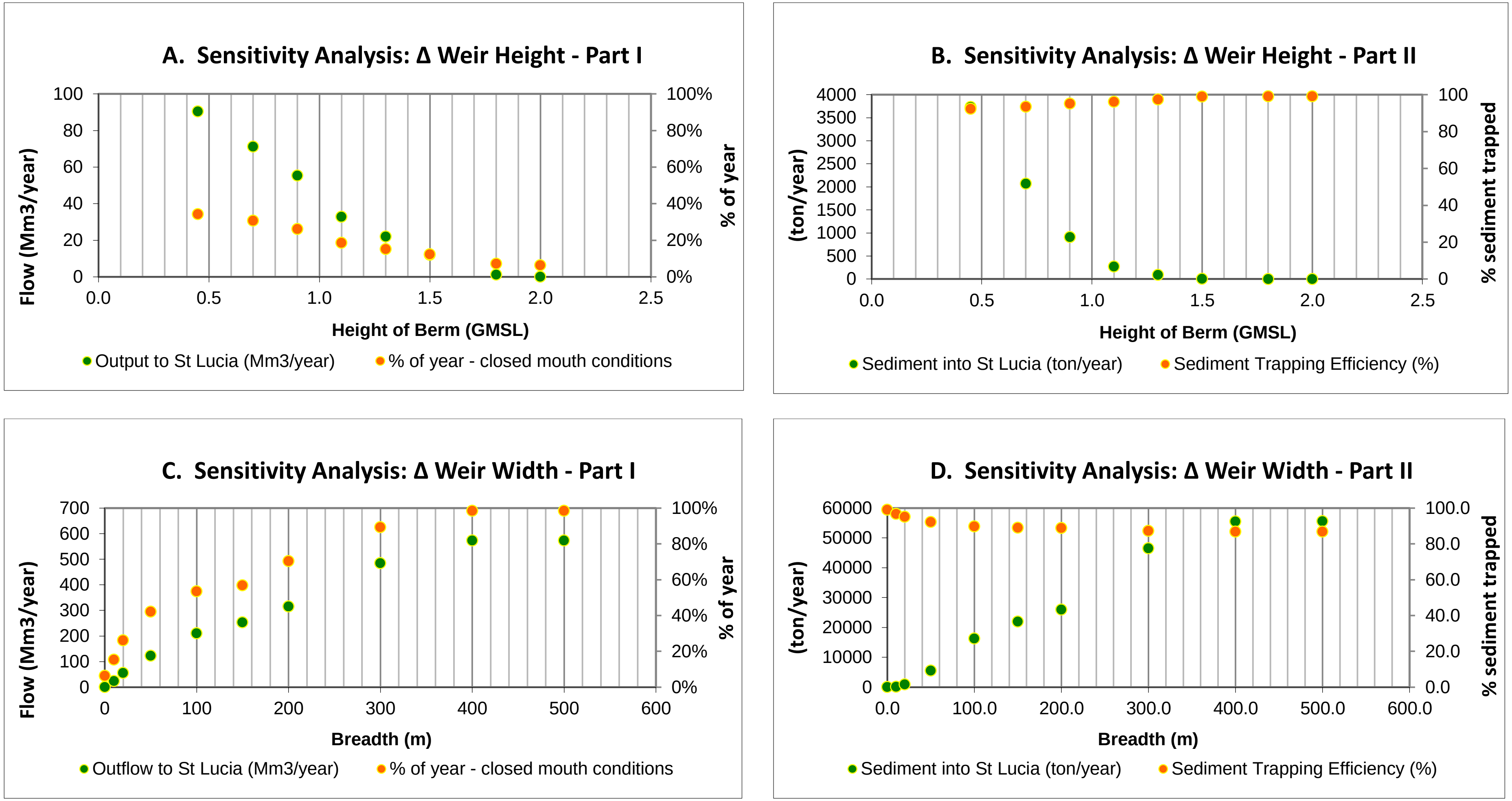


Figure 8-2: Results of sensitivity analysis – change in Backchannel weir height and width

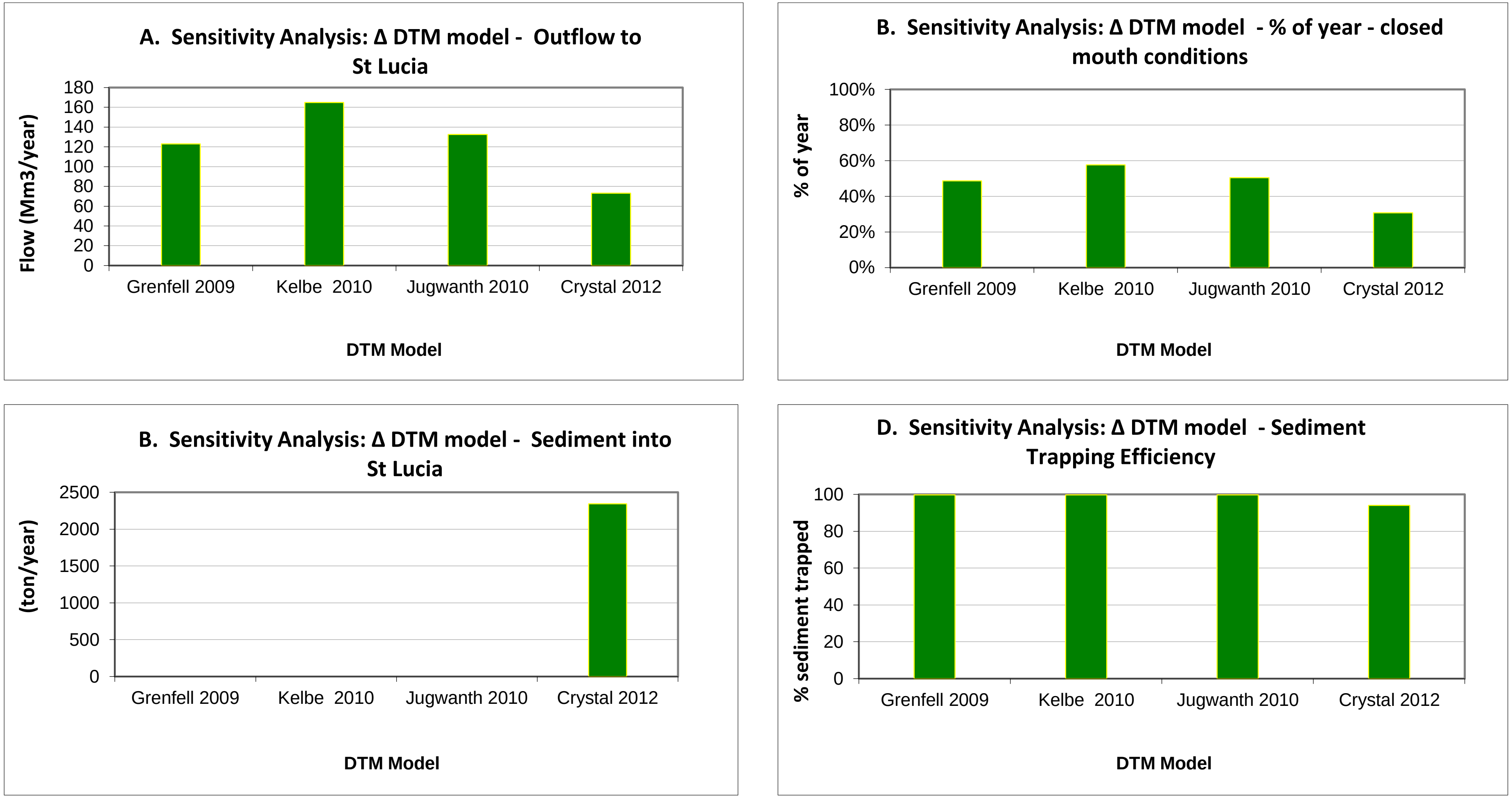


Figure 8-3: Results of sensitivity analysis – change in DTM model

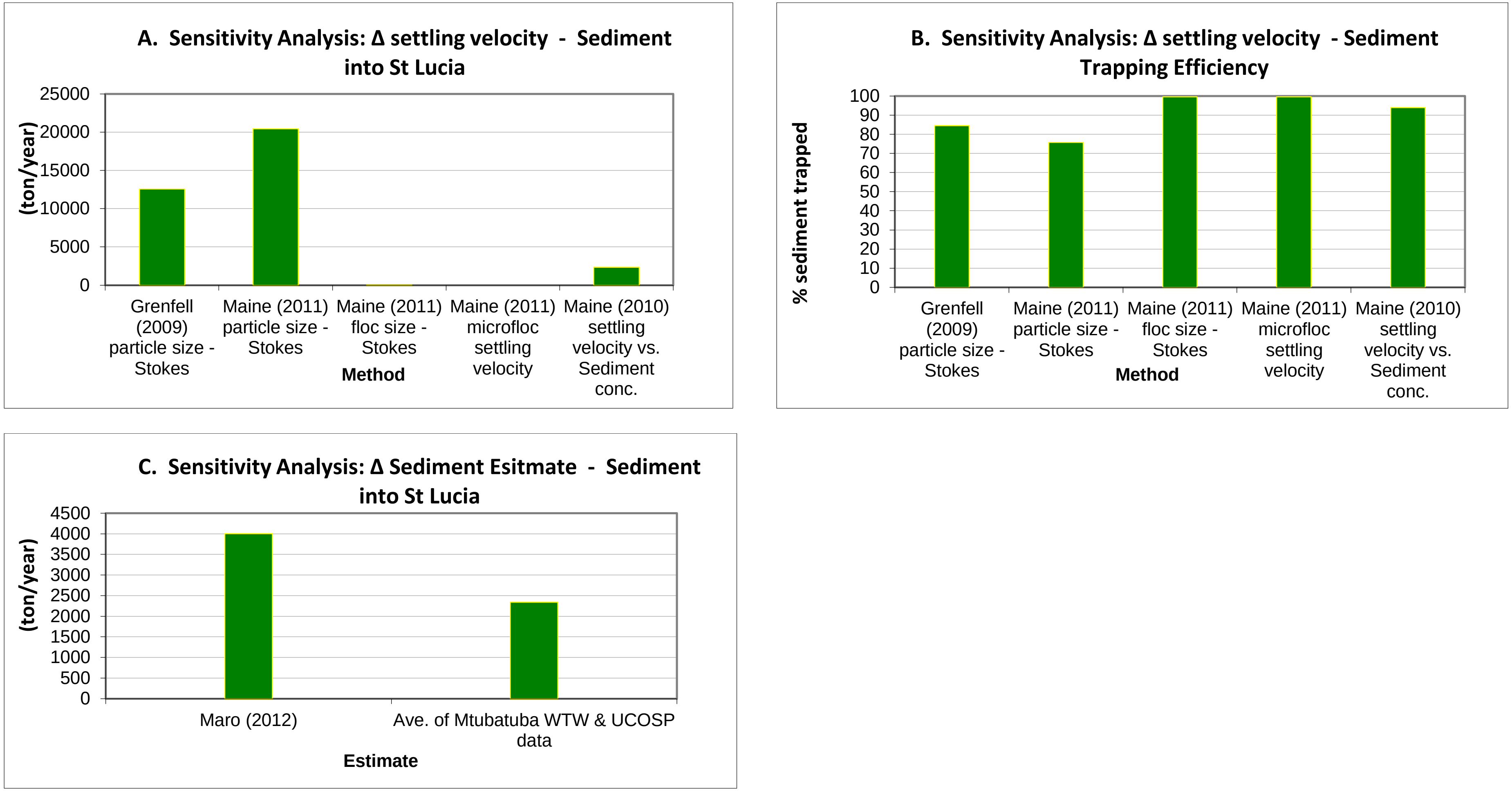


Figure 8-4: Results of sensitivity analysis – change in sediment settling velocity and loading concentrations


photo Ricky Taylor 26/4/2010

Water Balance of the Mfolozi River Flood Plain

UNIVERSITY OF
KWAZULU-NATAL
School of Civil Engineering, Surveying & Const

The water balance of the St Lucia Estuary has been modelled by Lawrie & Stretch (2008) in order to provide a decision making tool regarding the management of the estuary. This model has the ability to include the impact that the Mfolozi River could have on the water balance of the estuary if a certain amount of fresh water from the river is allowed to flow through a channel into the estuary – as attempted in the winter of 2008. That particular experiment allowed 15 million m^3 of fresh water to enter the estuary over six months (Vuuren 2009). In order to establish the effect of this scheme over a wider range of conditions, a water balance model of the Mfolozi River flood plain is required to be developed and used in conjunction with that of the St Lucia estuary.

The aim of creating this model is to simulate the water balance of the Mfolozi River flood plain in order to determine the mouth state, and the volume of water that can be accumulated when the river mouth is closed. By relating the quantity of water retained to a water level, we can determine the volume of fresh water that can be channelled into the St Lucia estuary during these periods, as well as the area that would be innundated.

Samista Jugwanth
Supervisor: Prof. Derek Stretch

Images: Lawrie & Stretch (2008) & Taylor (2010) ruction

Images: Lawrie & Stretch (2008) & Taylor (2010)

Water Balance of the Mfolozi River Flood Plain

UNIVERSITY OF
KWAZULU-NATAL
School of Civil Engineering, Surveying & Const

CONTENTS:

ruction

Parameter Editor

Berm (river to sea):	1.75
Threshold Flow:	6.38
Height of Weir (Back Channel into St Lucia estuary): [level at top of weir (gmsl)] [must be > 0 and < height of berm]	0.9
Width of Back Channel:	30
Flood line Contour:	2
Flood Plain Water Level during Open Mouth Cond.: [must be > 0 and < height of weir]	0.45
Coeffcient for weir equation	0.3849
Area downstream of gauge W2H032:	126
Settling Velocity Method	Maine (2010) settling velocity vs. Se
Selected Settling Velocity	see model
Sediment Concentration Data Set	Ave. of Mtubatuba WTW & UC
Year - Start: (Note: Model to start on month: October)	1918

m

Mm^3

m

m

m above gmsl

m above gmsl

m

km^2

ediment conc.

m/s

OSP data

Month	Rainfall (mm/m^2)	Evaporation (mm/m^2)	Run-off (mm/m^2)
10 October	97	126	12
11 November	110	117	9
12 December	117	131	10
1 January	131	131	12
2 Ferbruary	139	114	19
3 March	143	113	24
4 April	81	86	16
5 May	65	77	13
6 June	51	64	11
7 July	43	68	12
8 August	43	94	8
9 September	75	109	14
Sum	1095	1230	161
	(MAP)	(MAE)	(MAR)

Sediment Rates (g/l)
2.254
1.476
1.779
0.758
0.334
0.063
0.086
0.086
0.239
0.462
2.294
2.389

	R	E	Ru	S
1	131.181	130.780	12.032	0.758
2	139.065	113.937	19.424	0.334
3	142.679	112.906	23.731	0.063
4	81.140	85.968	15.749	0.086
5	64.715	76.836	13.499	0.086
6	51.246	64.239	11.207	0.239
7	43.143	68.441	11.828	0.462
8	43.472	93.722	8.335	2.294
9	75.336	109.026	14.271	2.389
10	96.689	126.465	11.582	2.254
11	109.500	117.097	9.192	1.476
12	116.727	131.046	10.457	1.779

Grenfell (2009) parti	0.0000273
Maine (2011) particl	0.0000163
Maine (2011) floc siz	0.0001653
Maine (2011) microf	0.0002227
Maine (2010) settlin	see model

Maro (2012)
Ave. of Mtubatuba WTW & UCOSP data

Hydrology Calculations:

PRECIPITATION

Appendix 2.2, Vol VI, Midgley et al 1994 - pg. 2.92 - 2.93

Month	Monthly Rainfall Factors (%)	Rainfall Station	Period
1 October	8.83%	0 339 415	1919 - 1949 & 1953 - 1987
2 November	10.00%	0 339 357	1926 - 1989
3 December	10.66%	0 339 538	1929 - 1989
4 January	11.98%	0 305 308	1932 - 1989
5 Ferbruary	12.70%		Average:
6 March	13.03%		
7 April	7.41%		
8 May	5.91%		
9 June	4.68%		
10 July	3.94%		
11 August	3.97%		
12 September	6.88%		

MAP
(mm/m^2)
1010
869
1112
1389
1095

EVAPORATION

Appendix 3.1, 3.2 & 3.3.1, Vol VI, Midgley et al 1994 - pg. 3.1 - 3.4

Month	Monthly Evap Factors	Pan Factor for lake evap
	(%)	(unitless)
1 October	10.66%	0.81
2 November	9.75%	0.82
3 December	10.78%	0.83
4 January	10.63%	0.84
5 Ferbruary	8.84%	0.88
6 March	8.76%	0.88
7 April	6.67%	0.88
8 May	6.03%	0.87
9 June	5.16%	0.85
10 July	5.63%	0.83
11 August	7.90%	0.81
12 September	9.19%	0.81

MEAN ANNUAL R

Appendix 7.2 & 8, Vol V

Evap. Station	Period	MAE
		(mm/m^2)
W2E002 (Evap Zone 22B)		
River View		
(A - pan)	1967 - 1978	1864
(S - pan)	(A-pan converted)	1483
W3E001 (Evap Zone 22C)		
Charter's Creek		
(A - pan)	1951 - 1980	1706
(S - pan)	(A-pan converted)	1369
(S - pan)	1951 - 1980	1446
	Average:	1465

	Month
1	October
2	November
3	December
4	January
5	Ferbruary
6	March
7	April
8	May
9	June
10	July
11	August
12	September

UN-OFF

I, Midgley et al 1994 - pg. 7.28 & 8.5 respectively

Simul. MAR for W23 (Mm^3)	Monthly Factor for W23 MAR (%)
10.81	7.18%
8.58	5.70%
9.76	6.48%
11.23	7.46%
18.13	12.04%
22.15	14.71%
14.70	9.76%
12.60	8.37%
10.46	6.95%
11.04	7.33%
7.78	5.17%
13.32	8.85%

Simulated MAR

W23C (tertiary sub-catchment)

MAR (mm)	179
Area (km^2)	313

W23D (tertiary sub-catchment)

MAR (mm)	139
Area (km^2)	248

Weighted Average (mm/m^2)	161

SEDIMENT LOADS

Reference to "Sediment Yield Analysis" spreadsheet

	Month	(Jugwanth 2012) Av. Mtubatuba WTW (g/l)	(van Niekerk 2012) UCOSP (g/l)	(Maro 2012) Simulated 1950-2010 (g/l)
1	October	1.518	2.990	4.211
2	November	1.667	1.285	3.970
3	December	0.959	2.600	2.442
4	January	0.450	1.065	1.474
5	Ferbruary	0.228	0.440	0.464
6	March	0.052	0.075	0.438
7	April	0.083	0.090	0.636
8	May	0.103	0.070	1.494
9	June	0.199	0.280	1.280
10	July	0.604	0.320	3.578
11	August	1.836	2.753	2.484
12	September	1.975	2.803	3.636

Hypsometric Curve Editor:

Choose DTM Model

DTM Model Used:

WATER - VOLUME RELATIONSHIP

WL	Area (km^2)	Volume (m^3)	Volume (Mm^3)
0	0.982	598000.000	0.598
0.01	0.967	593101.300	0.593
0.02	0.953	588545.200	0.589
0.03	0.939	584331.700	0.584
0.04	0.926	580460.800	0.580
0.05	0.914	576932.500	0.577
0.06	0.902	573746.800	0.574
0.07	0.890	570903.700	0.571
0.08	0.880	568403.200	0.568
0.09	0.869	566245.300	0.566
0.1	0.860	564430.000	0.564
0.11	0.851	562957.300	0.563
0.12	0.843	561827.200	0.562
0.13	0.835	561039.700	0.561
0.14	0.828	560594.800	0.561
0.15	0.821	560492.500	0.560
0.16	0.815	560732.800	0.561
0.17	0.810	561315.700	0.561
0.18	0.805	562241.200	0.562
0.19	0.801	563509.300	0.564
0.2	0.797	565120.000	0.565
0.21	0.794	567073.300	0.567
0.22	0.792	569369.200	0.569
0.23	0.790	572007.700	0.572
0.24	0.789	574988.800	0.575
0.25	0.788	578312.500	0.578
0.26	0.788	581978.800	0.582
0.27	0.788	585987.700	0.586
0.28	0.789	590339.200	0.590
0.29	0.791	595033.300	0.595
0.3	0.793	600070.000	0.600
0.31	0.796	605449.300	0.605
0.32	0.800	611171.200	0.611
0.33	0.804	617235.700	0.617
0.34	0.809	623642.800	0.624

0.35	0.814	630392.500	0.630
0.36	0.820	637484.800	0.637
0.37	0.826	644919.700	0.645
0.38	0.833	652697.200	0.653
0.39	0.841	660817.300	0.661
0.4	0.849	669280.000	0.669
0.41	0.858	678085.300	0.678
0.42	0.867	687233.200	0.687
0.43	0.877	696723.700	0.697
0.44	0.888	706556.800	0.707
0.45	0.899	716732.500	0.717
0.46	0.911	727250.800	0.727
0.47	0.923	738111.700	0.738
0.48	0.936	749315.200	0.749
0.49	0.950	760861.300	0.761
0.5	0.964	772750.000	0.773
0.51	0.979	784981.300	0.785
0.52	0.994	797555.200	0.798
0.53	1.010	810471.700	0.810
0.54	1.027	823730.800	0.824
0.55	1.044	837332.500	0.837
0.56	1.061	851276.800	0.851
0.57	1.080	865563.700	0.866
0.58	1.099	880193.200	0.880
0.59	1.118	895165.300	0.895
0.6	1.138	910480.000	0.910
0.61	1.159	926137.300	0.926
0.62	1.180	942137.200	0.942
0.63	1.202	958479.700	0.958
0.64	1.224	975164.800	0.975
0.65	1.247	992192.500	0.992
0.66	1.271	1009562.800	1.010
0.67	1.295	1027275.700	1.027
0.68	1.320	1045331.200	1.045
0.69	1.345	1063729.300	1.064
0.7	1.371	1082470.000	1.082
0.71	1.398	1101553.300	1.102
0.72	1.425	1120979.200	1.121
0.73	1.453	1140747.700	1.141
0.74	1.481	1160858.800	1.161
0.75	1.510	1181312.500	1.181
0.76	1.540	1202108.800	1.202
0.77	1.570	1223247.700	1.223
0.78	1.601	1244729.200	1.245

0.79	1.632	1266553.300	1.267
0.8	1.664	1288720.000	1.289
0.81	1.697	1311229.300	1.311
0.82	1.730	1334081.200	1.334
0.83	1.763	1357275.700	1.357
0.84	1.798	1380812.800	1.381
0.85	1.833	1404692.500	1.405
0.86	1.868	1428914.800	1.429
0.87	1.904	1453479.700	1.453
0.88	1.941	1478387.200	1.478
0.89	1.978	1503637.300	1.504
0.9	2.016	1529230.000	1.529
0.91	2.054	1555165.300	1.555
0.92	2.093	1581443.200	1.581
0.93	2.133	1608063.700	1.608
0.94	2.173	1635026.800	1.635
0.95	2.214	1662332.500	1.662
0.96	2.255	1689980.800	1.690
0.97	2.297	1717971.700	1.718
0.98	2.340	1746305.200	1.746
0.99	2.383	1774981.300	1.775
1	2.427	1804000.000	1.804
1.01	2.471	1833361.300	1.833
1.02	2.516	1863065.200	1.863
1.03	2.562	1893111.700	1.893
1.04	2.608	1923500.800	1.924
1.05	2.655	1954232.500	1.954
1.06	2.702	1985306.800	1.985
1.07	2.750	2016723.700	2.017
1.08	2.799	2048483.200	2.048
1.09	2.848	2080585.300	2.081
1.1	2.897	2113030.000	2.113
1.11	2.948	2145817.300	2.146
1.12	2.998	2178947.200	2.179
1.13	3.050	2212419.700	2.212
1.14	3.102	2246234.800	2.246
1.15	3.155	2280392.500	2.280
1.16	3.208	2314892.800	2.315
1.17	3.262	2349735.700	2.350
1.18	3.316	2384921.200	2.385
1.19	3.371	2420449.300	2.420
1.2	3.427	2456320.000	2.456
1.21	3.483	2492533.300	2.493
1.22	3.540	2529089.200	2.529

	1.23	3.597	2565987.700	2.566
	1.24	3.655	2603228.800	2.603
	1.25	3.714	2640812.500	2.641
	1.26	3.773	2678738.800	2.679
	1.27	3.833	2717007.700	2.717
	1.28	3.893	2755619.200	2.756
	1.29	3.954	2794573.300	2.795
	1.3	4.016	2833870.000	2.834
	1.31	4.078	2873509.300	2.874
	1.32	4.141	2913491.200	2.913
	1.33	4.204	2953815.700	2.954
	1.34	4.268	2994482.800	2.994
	1.35	4.332	3035492.500	3.035
	1.36	4.397	3076844.800	3.077
	1.37	4.463	3118539.700	3.119
	1.38	4.529	3160577.200	3.161
	1.39	4.596	3202957.300	3.203
	1.4	6.087	3245680.000	3.246
	1.41	6.431	3288745.300	3.289
	1.42	6.774	3332153.200	3.332
	1.43	7.116	3375903.700	3.376
	1.44	7.457	3419996.800	3.420
	1.45	7.796	3464432.500	3.464
	1.46	8.135	3509210.800	3.509
	1.47	8.472	3554331.700	3.554
	1.48	8.808	3599795.200	3.600
	1.49	9.142	3645601.300	3.646
	1.5	9.476	3691750.000	3.692
	1.51	9.808	3738241.300	3.738
	1.52	10.139	3785075.200	3.785
	1.53	10.468	3832251.700	3.832
	1.54	10.797	3879770.800	3.880
	1.55	11.124	3927632.500	3.928
	1.56	11.450	3975836.800	3.976
	1.57	11.775	4024383.700	4.024
	1.58	12.098	4073273.200	4.073
	1.59	12.420	4122505.300	4.123
	1.6	12.741	4172080.000	4.172
	1.61	13.061	4221997.300	4.222
	1.62	13.380	4272257.200	4.272
	1.63	13.697	4322859.700	4.323
	1.64	14.013	4373804.800	4.374
	1.65	14.328	4425092.500	4.425
	1.66	14.642	4447213.200	4.447

1.67	14.954	4670323.300	4.670
1.68	15.266	4895012.800	4.895
1.69	15.576	5121281.700	5.121
1.7	15.884	5349130.000	5.349
1.71	16.192	5578557.700	5.579
1.72	16.498	5809564.800	5.810
1.73	16.803	6042151.300	6.042
1.74	17.107	6276317.200	6.276
1.75	17.410	6512062.500	6.512
1.76	17.711	6749387.200	6.749
1.77	18.011	6988291.300	6.988
1.78	18.310	7228774.800	7.229
1.79	18.608	7470837.700	7.471
1.8	18.904	7714480.000	7.714
1.81	19.199	7959701.700	7.960
1.82	19.493	8206502.800	8.207
1.83	19.786	8454883.300	8.455
1.84	20.078	8704843.200	8.705
1.85	20.368	8956382.500	8.956
1.86	20.657	9209501.200	9.210
1.87	20.945	9464199.300	9.464
1.88	21.232	9720476.800	9.720
1.89	21.517	9978333.700	9.978
1.9	21.801	10237770.000	10.238
1.91	22.084	10498785.700	10.499
1.92	22.366	10761380.800	10.761
1.93	22.646	11025555.300	11.026
1.94	22.925	11291309.200	11.291
1.95	23.203	11558642.500	11.559
1.96	23.480	11827555.200	11.828
1.97	23.756	12098047.300	12.098
1.98	24.030	12370118.800	12.370
1.99	24.303	12643769.700	12.644
2	24.575	12919000.000	12.919
2.01	24.846	13195809.700	13.196
2.02	25.115	13474198.800	13.474
2.03	25.383	13754167.300	13.754
2.04	25.650	14035715.200	14.036
2.05	25.916	14318842.500	14.319
2.06	26.180	14603549.200	14.604
2.07	26.444	14889835.300	14.890
2.08	26.706	15177700.800	15.178
2.09	26.966	15467145.700	15.467
2.1	27.226	15758170.000	15.758

2.11	27.484	16050773.700	16.051
2.12	27.741	16344956.800	16.345
2.13	27.997	16640719.300	16.641
2.14	28.252	16938061.200	16.938
2.15	28.505	17236982.500	17.237
2.16	28.757	17537483.200	17.537
2.17	29.008	17839563.300	17.840
2.18	29.258	18143222.800	18.143
2.19	29.507	18448461.700	18.448
2.2	29.754	18755280.000	18.755
2.21	30.000	19063677.700	19.064
2.22	30.245	19373654.800	19.374
2.23	30.488	19685211.300	19.685
2.24	30.731	19998347.200	19.998
2.25	30.972	20313062.500	20.313
2.26	31.211	20629357.200	20.629
2.27	31.450	20947231.300	20.947
2.28	31.688	21266684.800	21.267
2.29	31.924	21587717.700	21.588
2.3	32.159	21910330.000	21.910
2.31	32.392	22234521.700	22.235
2.32	32.625	22560292.800	22.560
2.33	32.856	22887643.300	22.888
2.34	33.086	23216573.200	23.217
2.35	33.315	23547082.500	23.547
2.36	33.543	23879171.200	23.879
2.37	33.769	24212839.300	24.213
2.38	33.994	24548086.800	24.548
2.39	34.218	24884913.700	24.885
2.4	34.441	25223320.000	25.223
2.41	34.662	25563305.700	25.563
2.42	34.882	25904870.800	25.905
2.43	35.101	26248015.300	26.248
2.44	35.319	26592739.200	26.593
2.45	35.535	26939042.500	26.939
2.46	35.751	27286925.200	27.287
2.47	35.965	27636387.300	27.636
2.48	36.178	27987428.800	27.987
2.49	36.389	28340049.700	28.340
2.5	36.599	28694250.000	28.694
2.51	36.809	29050029.700	29.050
2.52	37.017	29407388.800	29.407
2.53	37.223	29766327.300	29.766
2.54	37.429	30126845.200	30.127

2.55	37.633	30488942.500	30.489
2.56	37.836	30852619.200	30.853
2.57	38.038	31217875.300	31.218
2.58	38.238	31584710.800	31.585
2.59	38.437	31953125.700	31.953
2.6	38.635	32323120.000	32.323
2.61	38.832	32694693.700	32.695
2.62	39.028	33067846.800	33.068
2.63	39.222	33442579.300	33.443
2.64	39.415	33818891.200	33.819
2.65	39.607	34196782.500	34.197
2.66	39.798	34576253.200	34.576
2.67	39.987	34957303.300	34.957
2.68	40.176	35339932.800	35.340
2.69	40.363	35724141.700	35.724
2.7	40.548	36109930.000	36.110
2.71	40.733	36497297.700	36.497
2.72	40.916	36886244.800	36.886
2.73	41.098	37276771.300	37.277
2.74	41.279	37668877.200	37.669
2.75	41.459	38062562.500	38.063
2.76	41.637	38457827.200	38.458
2.77	41.814	38854671.300	38.855
2.78	41.990	39253094.800	39.253
2.79	42.165	39653097.700	39.653
2.8	42.338	40054680.000	40.055
2.81	42.510	40457841.700	40.458
2.82	42.681	40862582.800	40.863
2.83	42.851	41268903.300	41.269
2.84	43.020	41676803.200	41.677
2.85	43.187	42086282.500	42.086
2.86	43.353	42497341.200	42.497
2.87	43.518	42909979.300	42.910
2.88	43.682	43324196.800	43.324
2.89	43.844	43739993.700	43.740
2.9	44.005	44157370.000	44.157
2.91	44.165	44576325.700	44.576
2.92	44.324	44996860.800	44.997
2.93	44.481	45418975.300	45.419
2.94	44.637	45842669.200	45.843
2.95	44.792	46267942.500	46.268
2.96	44.946	46694795.200	46.695
2.97	45.099	47123227.300	47.123
2.98	45.250	47553238.800	47.553

2.99	45.400	47984829.700	47.985
3	45.549	48418000.000	48.418
3.01	45.697	48852749.700	48.853
3.02	45.843	49289078.800	49.289
3.03	45.988	49726987.300	49.727
3.04	46.132	50166475.200	50.166
3.05	46.275	50607542.500	50.608
3.06	46.416	51050189.200	51.050
3.07	46.557	51494415.300	51.494
3.08	46.696	51940220.800	51.940
3.09	46.833	52387605.700	52.388
3.1	46.970	52836570.000	52.837
3.11	47.105	53287113.700	53.287
3.12	47.239	53739236.800	53.739
3.13	47.372	54192939.300	54.193
3.14	47.504	54648221.200	54.648
3.15	47.634	55105082.500	55.105
3.16	47.763	55563523.200	55.564
3.17	47.891	56023543.300	56.024
3.18	48.018	56485142.800	56.485
3.19	48.144	56948321.700	56.948
3.2	48.268	57413080.000	57.413
3.21	48.391	57879417.700	57.879
3.22	48.513	58347334.800	58.347
3.23	48.633	58816831.300	58.817
3.24	48.753	59287907.200	59.288
3.25	48.871	59760562.500	59.761
3.26	48.987	60234797.200	60.235
3.27	49.103	60710611.300	60.711
3.28	49.218	61188004.800	61.188
3.29	49.331	61666977.700	61.667
3.3	49.443	62147530.000	62.148
3.31	49.553	62629661.700	62.630
3.32	49.663	63113372.800	63.113
3.33	49.771	63598663.300	63.599
3.34	49.878	64085533.200	64.086
3.35	49.984	64573982.500	64.574
3.36	50.089	65064011.200	65.064
3.37	50.192	65555619.300	65.556
3.38	50.294	66048806.800	66.049
3.39	50.395	66543573.700	66.544
3.4	50.495	67039920.000	67.040
3.41	50.593	67537845.700	67.538
3.42	50.690	68037350.800	68.037

3.43	50.786	68538435.300	68.538
3.44	50.881	69041099.200	69.041
3.45	50.974	69545342.500	69.545
3.46	51.067	70051165.200	70.051
3.47	51.158	70558567.300	70.559
3.48	51.248	71067548.800	71.068
3.49	51.336	71578109.700	71.578
3.5	51.423	72090250.000	72.090
3.51	51.510	72603969.700	72.604
3.52	51.595	73119268.800	73.119
3.53	51.678	73636147.300	73.636
3.54	51.761	74154605.200	74.155
3.55	51.842	74674642.500	74.675
3.56	51.922	75196259.200	75.196
3.57	52.001	75719455.300	75.719
3.58	52.078	76244230.800	76.244
3.59	52.154	76770585.700	76.771
3.6	52.229	77298520.000	77.299
3.61	52.303	77828033.700	77.828
3.62	52.376	78359126.800	78.359
3.63	52.447	78891799.300	78.892
3.64	52.517	79426051.200	79.426
3.65	52.586	79961882.500	79.962
3.66	52.654	80499293.200	80.499
3.67	52.720	81038283.300	81.038
3.68	52.786	81578852.800	81.579
3.69	52.850	82121001.700	82.121
3.7	52.912	82664730.000	82.665
3.71	52.974	83210037.700	83.210
3.72	53.034	83756924.800	83.757
3.73	53.093	84305391.300	84.305
3.74	53.151	84855437.200	84.855
3.75	53.208	85407062.500	85.407
3.76	53.263	85960267.200	85.960
3.77	53.317	86515051.300	86.515
3.78	53.370	87071414.800	87.071
3.79	53.422	87629357.700	87.629
3.8	53.472	88188880.000	88.189
3.81	53.521	88749981.700	88.750
3.82	53.569	89312662.800	89.313
3.83	53.616	89876923.300	89.877
3.84	53.662	90442763.200	90.443
3.85	53.706	91010182.500	91.010
3.86	53.749	91579181.200	91.579

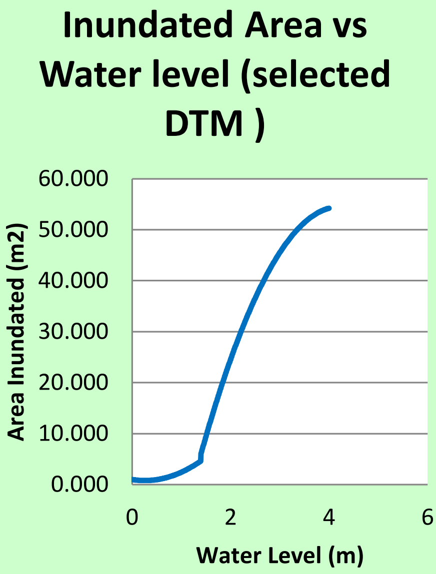
3.87	53.791	92149759.300	92.150
3.88	53.832	92721916.800	92.722
3.89	53.871	93295653.700	93.296
3.9	53.909	93870970.000	93.871
3.91	53.946	94447865.700	94.448
3.92	53.982	95026340.800	95.026
3.93	54.016	95606395.300	95.606
3.94	54.049	96188029.200	96.188
3.95	54.081	96771242.500	96.771
3.96	54.112	97356035.200	97.356
3.97	54.142	97942407.300	97.942
3.98	54.170	98530358.800	98.530
3.99	54.197	99119889.700	99.120
4.00	54.223	99711000.000	99.711

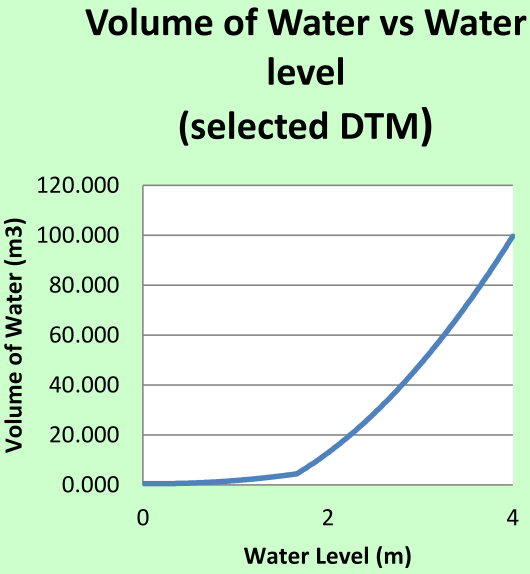
4

Crystal 2011

DTM Models:

1	Grenfell 2009
2	Kelbe 2010
3	Jugwanth 2010
4	Crystal 2012





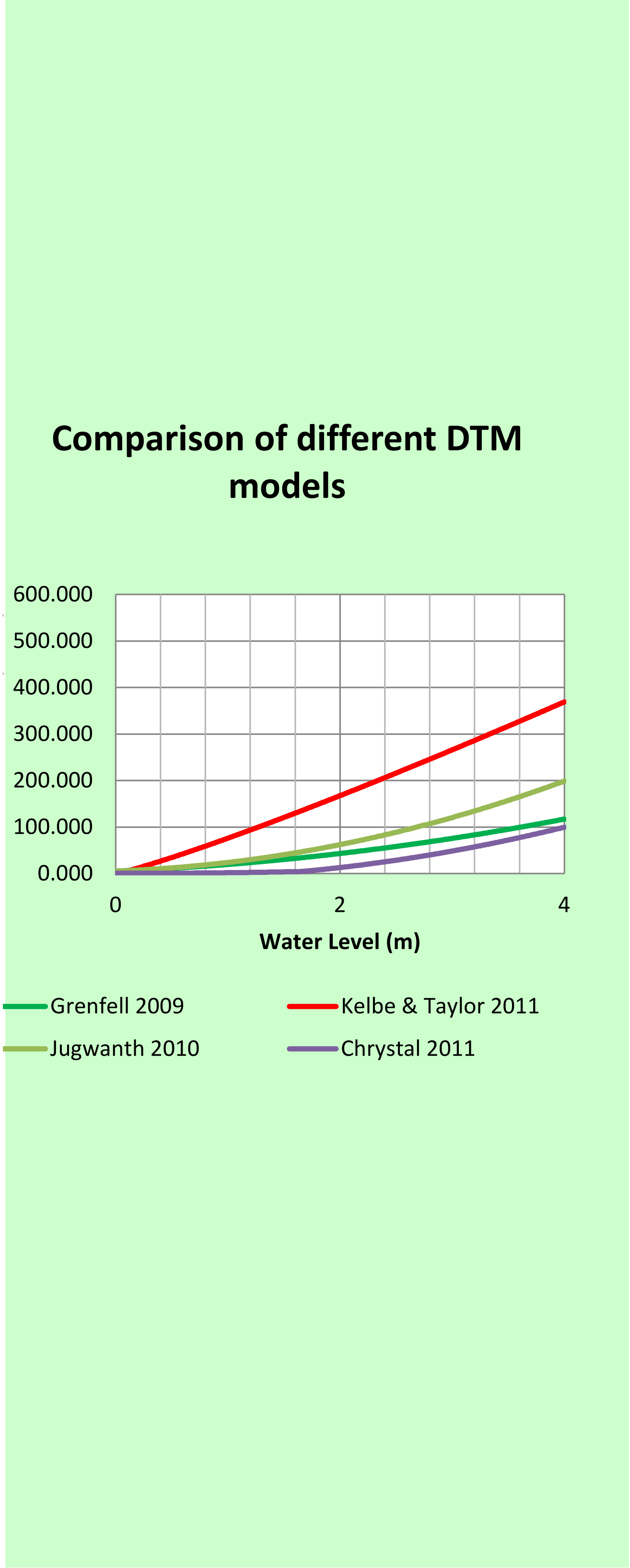

Comparison of different DTM models
600.000
500.000
400.000
300.000
200.000
100.000
0.000
0
2
4
Water Level (m)
Grenfell 2009
Kelbe & Taylor 2011
Jugwanth 2010
Chrystal 2011

TABLE TO FORMULATE HYPSOMETRIC CURVE

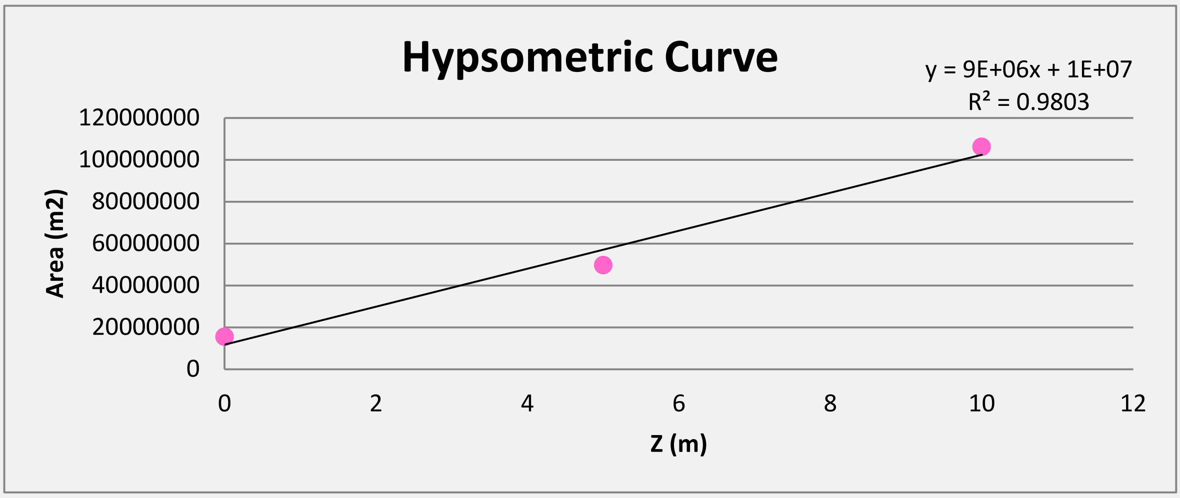
Contour (m)	UPPER LIMIT	AREA (km2)	AREA (m2)
< 0	0	15.45234898	15452348.98
0 - 5	5	49.67224611	49672246.11
5 - 10	10	106.1519646	106151964.6

DETERMING WL _ VOL RELATIONSHIP

V = integral of A . Dz
= (9*10^6)z + 1*10^7 dz
= (4.5*10^6)z^2 + (1*10^7)z + A

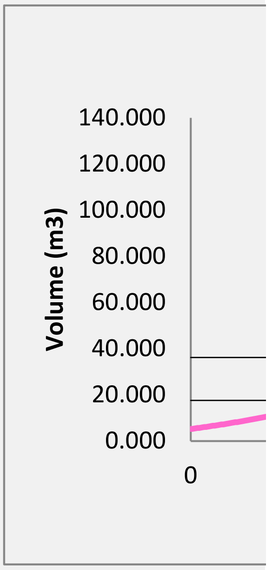
A is the V when the WL is at z=0
therefore find a radius for area < 0
= (area < 0 / pi)^0.5
and assume lowest depth is at z = -1
Drew a cone with above dimensions -
V = A = 5150784.454 m3

GRENFELL ET AL
(2009)



WL vs. VOLUME RELATIONSHIP

WL	Area (km2)	Volume (m3)	Volume (Mm3)
0	15.452	5150784.454	5.151
0.01	15.542	5251234.454	5.251
0.02	15.632	5352584.454	5.353
0.03	15.722	5454834.454	5.455
0.04	15.812	5557984.454	5.558
0.05	15.902	5662034.454	5.662
0.06	15.992	5766984.454	5.767
0.07	16.082	5872834.454	5.873
0.08	16.172	5979584.454	5.980
0.09	16.262	6087234.454	6.087
0.1	16.352	6195784.454	6.196
0.11	16.442	6305234.454	6.305
0.12	16.532	6415584.454	6.416
0.13	16.622	6526834.454	6.527
0.14	16.712	6638984.454	6.639
0.15	16.802	6752034.454	6.752
0.16	16.892	6865984.454	6.866
0.17	16.982	6980834.454	6.981
0.18	17.072	7096584.454	7.097
0.19	17.162	7213234.454	7.213
0.2	17.252	7330784.454	7.331
0.21	17.342	7449234.454	7.449
0.22	17.432	7568584.454	7.569
0.23	17.522	7688834.454	7.689
0.24	17.612	7809984.454	7.810
0.25	17.702	7932034.454	7.932
0.26	17.792	8054984.454	8.055
0.27	17.882	8178834.454	8.179
0.28	17.972	8303584.454	8.304
0.29	18.062	8429234.454	8.429
0.3	18.152	8555784.454	8.556
0.31	18.242	8683234.454	8.683
0.32	18.332	8811584.454	8.812
0.33	18.422	8940834.454	8.941
0.34	18.512	9070984.454	9.071
0.35	18.602	9202034.454	9.202
0.36	18.692	9333984.454	9.334
0.37	18.782	9466834.454	9.467
0.38	18.872	9600584.454	9.601
0.39	18.962	9735234.454	9.735
0.4	19.052	9870784.454	9.871
0.41	19.142	10007234.45	10.007
0.42	19.232	10144584.45	10.145
0.43	19.322	10282834.45	10.283
0.44	19.412	10421984.45	10.422
0.45	19.502	10562034.45	10.562
0.46	19.592	10702984.45	10.703
0.47	19.682	10844834.45	10.845



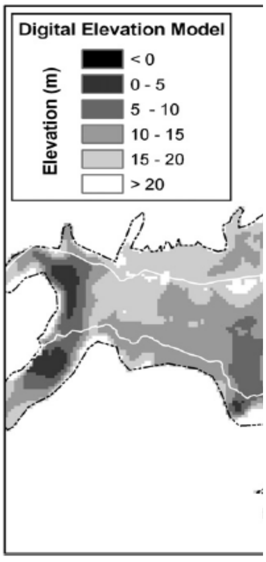


Fig. 6. Digital e

0.48	19.772	10987584.45	10.988
0.49	19.862	11131234.45	11.131
0.5	19.952	11275784.45	11.276
0.51	20.042	11421234.45	11.421
0.52	20.132	11567584.45	11.568
0.53	20.222	11714834.45	11.715
0.54	20.312	11862984.45	11.863
0.55	20.402	12012034.45	12.012
0.56	20.492	12161984.45	12.162
0.57	20.582	12312834.45	12.313
0.58	20.672	12464584.45	12.465
0.59	20.762	12617234.45	12.617
0.6	20.852	12770784.45	12.771
0.61	20.942	12925234.45	12.925
0.62	21.032	13080584.45	13.081
0.63	21.122	13236834.45	13.237
0.64	21.212	13393984.45	13.394
0.65	21.302	13552034.45	13.552
0.66	21.392	13710984.45	13.711
0.67	21.482	13870834.45	13.871
0.68	21.572	14031584.45	14.032
0.69	21.662	14193234.45	14.193
0.7	21.752	14355784.45	14.356
0.71	21.842	14519234.45	14.519
0.72	21.932	14683584.45	14.684
0.73	22.022	14848834.45	14.849
0.74	22.112	15014984.45	15.015
0.75	22.202	15182034.45	15.182
0.76	22.292	15349984.45	15.350
0.77	22.382	15518834.45	15.519
0.78	22.472	15688584.45	15.689
0.79	22.562	15859234.45	15.859
0.8	22.652	16030784.45	16.031
0.81	22.742	16203234.45	16.203
0.82	22.832	16376584.45	16.377
0.83	22.922	16550834.45	16.551
0.84	23.012	16725984.45	16.726
0.85	23.102	16902034.45	16.902
0.86	23.192	17078984.45	17.079
0.87	23.282	17256834.45	17.257
0.88	23.372	17435584.45	17.436
0.89	23.462	17615234.45	17.615
0.9	23.552	17795784.45	17.796
0.91	23.642	17977234.45	17.977
0.92	23.732	18159584.45	18.160
0.93	23.822	18342834.45	18.343
0.94	23.912	18526984.45	18.527
0.95	24.002	18712034.45	18.712
0.96	24.092	18897984.45	18.898
0.97	24.182	19084834.45	19.085

0.98	24.272	19272584.45	19.273
0.99	24.362	19461234.45	19.461
1	24.452	19650784.45	19.651
1.01	24.542	19841234.45	19.841
1.02	24.632	20032584.45	20.033
1.03	24.722	20224834.45	20.225
1.04	24.812	20417984.45	20.418
1.05	24.902	20612034.45	20.612
1.06	24.992	20806984.45	20.807
1.07	25.082	21002834.45	21.003
1.08	25.172	21199584.45	21.200
1.09	25.262	21397234.45	21.397
1.1	25.352	21595784.45	21.596
1.11	25.442	21795234.45	21.795
1.12	25.532	21995584.45	21.996
1.13	25.622	22196834.45	22.197
1.14	25.712	22398984.45	22.399
1.15	25.802	22602034.45	22.602
1.16	25.892	22805984.45	22.806
1.17	25.982	23010834.45	23.011
1.18	26.072	23216584.45	23.217
1.19	26.162	23423234.45	23.423
1.2	26.252	23630784.45	23.631
1.21	26.342	23839234.45	23.839
1.22	26.432	24048584.45	24.049
1.23	26.522	24258834.45	24.259
1.24	26.612	24469984.45	24.470
1.25	26.702	24682034.45	24.682
1.26	26.792	24894984.45	24.895
1.27	26.882	25108834.45	25.109
1.28	26.972	25323584.45	25.324
1.29	27.062	25539234.45	25.539
1.3	27.152	25755784.45	25.756
1.31	27.242	25973234.45	25.973
1.32	27.332	26191584.45	26.192
1.33	27.422	26410834.45	26.411
1.34	27.512	26630984.45	26.631
1.35	27.602	26852034.45	26.852
1.36	27.692	27073984.45	27.074
1.37	27.782	27296834.45	27.297
1.38	27.872	27520584.45	27.521
1.39	27.962	27745234.45	27.745
1.4	28.052	27970784.45	27.971
1.41	28.142	28197234.45	28.197
1.42	28.232	28424584.45	28.425
1.43	28.322	28652834.45	28.653
1.44	28.412	28881984.45	28.882
1.45	28.502	29112034.45	29.112
1.46	28.592	29342984.45	29.343
1.47	28.682	29574834.45	29.575

1.48	28.772	29807584.45	29.808
1.49	28.862	30041234.45	30.041
1.5	28.952	30275784.45	30.276
1.51	29.042	30511234.45	30.511
1.52	29.132	30747584.45	30.748
1.53	29.222	30984834.45	30.985
1.54	29.312	31222984.45	31.223
1.55	29.402	31462034.45	31.462
1.56	29.492	31701984.45	31.702
1.57	29.582	31942834.45	31.943
1.58	29.672	32184584.45	32.185
1.59	29.762	32427234.45	32.427
1.6	29.852	32670784.45	32.671
1.61	29.942	32915234.45	32.915
1.62	30.032	33160584.45	33.161
1.63	30.122	33406834.45	33.407
1.64	30.212	33653984.45	33.654
1.65	30.302	33902034.45	33.902
1.66	30.392	34150984.45	34.151
1.67	30.482	34400834.45	34.401
1.68	30.572	34651584.45	34.652
1.69	30.662	34903234.45	34.903
1.7	30.752	35155784.45	35.156
1.71	30.842	35409234.45	35.409
1.72	30.932	35663584.45	35.664
1.73	31.022	35918834.45	35.919
1.74	31.112	36174984.45	36.175
1.75	31.202	36432034.45	36.432
1.76	31.292	36689984.45	36.690
1.77	31.382	36948834.45	36.949
1.78	31.472	37208584.45	37.209
1.79	31.562	37469234.45	37.469
1.8	31.652	37730784.45	37.731
1.81	31.742	37993234.45	37.993
1.82	31.832	38256584.45	38.257
1.83	31.922	38520834.45	38.521
1.84	32.012	38785984.45	38.786
1.85	32.102	39052034.45	39.052
1.86	32.192	39318984.45	39.319
1.87	32.282	39586834.45	39.587
1.88	32.372	39855584.45	39.856
1.89	32.462	40125234.45	40.125
1.9	32.552	40395784.45	40.396
1.91	32.642	40667234.45	40.667
1.92	32.732	40939584.45	40.940
1.93	32.822	41212834.45	41.213
1.94	32.912	41486984.45	41.487
1.95	33.002	41762034.45	41.762
1.96	33.092	42037984.45	42.038
1.97	33.182	42314834.45	42.315

1.98	33.272	42592584.45	42.593
1.99	33.362	42871234.45	42.871
2	33.452	43150784.45	43.151
2.01	33.542	43431234.45	43.431
2.02	33.632	43712584.45	43.713
2.03	33.722	43994834.45	43.995
2.04	33.812	44277984.45	44.278
2.05	33.902	44562034.45	44.562
2.06	33.992	44846984.45	44.847
2.07	34.082	45132834.45	45.133
2.08	34.172	45419584.45	45.420
2.09	34.262	45707234.45	45.707
2.1	34.352	45995784.45	45.996
2.11	34.442	46285234.45	46.285
2.12	34.532	46575584.45	46.576
2.13	34.622	46866834.45	46.867
2.14	34.712	47158984.45	47.159
2.15	34.802	47452034.45	47.452
2.16	34.892	47745984.45	47.746
2.17	34.982	48040834.45	48.041
2.18	35.072	48336584.45	48.337
2.19	35.162	48633234.45	48.633
2.2	35.252	48930784.45	48.931
2.21	35.342	49229234.45	49.229
2.22	35.432	49528584.45	49.529
2.23	35.522	49828834.45	49.829
2.24	35.612	50129984.45	50.130
2.25	35.702	50432034.45	50.432
2.26	35.792	50734984.45	50.735
2.27	35.882	51038834.45	51.039
2.28	35.972	51343584.45	51.344
2.29	36.062	51649234.45	51.649
2.3	36.152	51955784.45	51.956
2.31	36.242	52263234.45	52.263
2.32	36.332	52571584.45	52.572
2.33	36.422	52880834.45	52.881
2.34	36.512	53190984.45	53.191
2.35	36.602	53502034.45	53.502
2.36	36.692	53813984.45	53.814
2.37	36.782	54126834.45	54.127
2.38	36.872	54440584.45	54.441
2.39	36.962	54755234.45	54.755
2.4	37.052	55070784.45	55.071
2.41	37.142	55387234.45	55.387
2.42	37.232	55704584.45	55.705
2.43	37.322	56022834.45	56.023
2.44	37.412	56341984.45	56.342
2.45	37.502	56662034.45	56.662
2.46	37.592	56982984.45	56.983
2.47	37.682	57304834.45	57.305

2.48	37.772	57627584.45	57.628
2.49	37.862	57951234.45	57.951
2.5	37.952	58275784.45	58.276
2.51	38.042	58601234.45	58.601
2.52	38.132	58927584.45	58.928
2.53	38.222	59254834.45	59.255
2.54	38.312	59582984.45	59.583
2.55	38.402	59912034.45	59.912
2.56	38.492	60241984.45	60.242
2.57	38.582	60572834.45	60.573
2.58	38.672	60904584.45	60.905
2.59	38.762	61237234.45	61.237
2.6	38.852	61570784.45	61.571
2.61	38.942	61905234.45	61.905
2.62	39.032	62240584.45	62.241
2.63	39.122	62576834.45	62.577
2.64	39.212	62913984.45	62.914
2.65	39.302	63252034.45	63.252
2.66	39.392	63590984.45	63.591
2.67	39.482	63930834.45	63.931
2.68	39.572	64271584.45	64.272
2.69	39.662	64613234.45	64.613
2.7	39.752	64955784.45	64.956
2.71	39.842	65299234.45	65.299
2.72	39.932	65643584.45	65.644
2.73	40.022	65988834.45	65.989
2.74	40.112	66334984.45	66.335
2.75	40.202	66682034.45	66.682
2.76	40.292	67029984.45	67.030
2.77	40.382	67378834.45	67.379
2.78	40.472	67728584.45	67.729
2.79	40.562	68079234.45	68.079
2.8	40.652	68430784.45	68.431
2.81	40.742	68783234.45	68.783
2.82	40.832	69136584.45	69.137
2.83	40.922	69490834.45	69.491
2.84	41.012	69845984.45	69.846
2.85	41.102	70202034.45	70.202
2.86	41.192	70558984.45	70.559
2.87	41.282	70916834.45	70.917
2.88	41.372	71275584.45	71.276
2.89	41.462	71635234.45	71.635
2.9	41.552	71995784.45	71.996
2.91	41.642	72357234.45	72.357
2.92	41.732	72719584.45	72.720
2.93	41.822	73082834.45	73.083
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2.95	42.002	73812034.45	73.812
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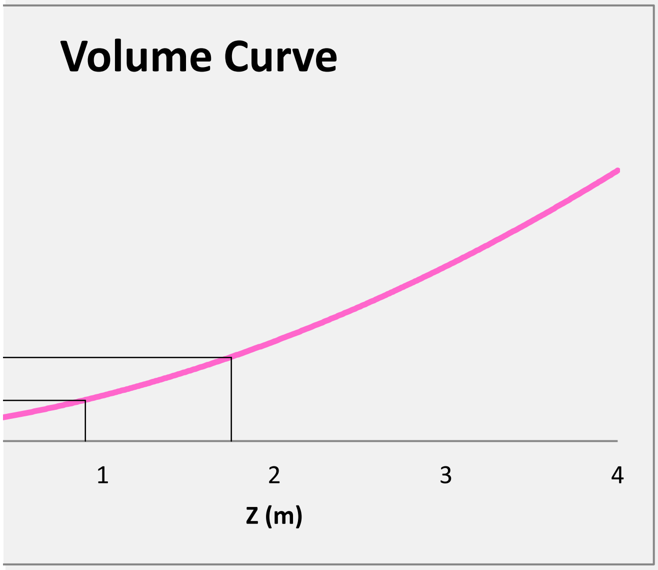
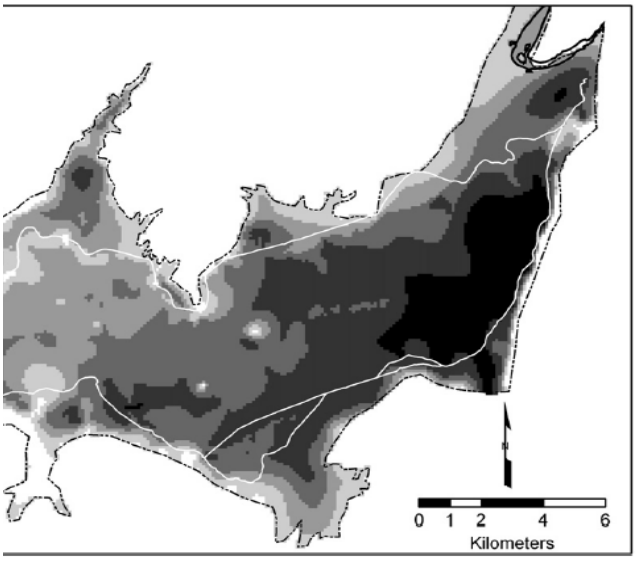
2.97	42.182	74544834.45	74.545

2.98	42.272	74912584.45	74.913
2.99	42.362	75281234.45	75.281
3	42.452	75650784.45	75.651
3.01	42.542	76021234.45	76.021
3.02	42.632	76392584.45	76.393
3.03	42.722	76764834.45	76.765
3.04	42.812	77137984.45	77.138
3.05	42.902	77512034.45	77.512
3.06	42.992	77886984.45	77.887
3.07	43.082	78262834.45	78.263
3.08	43.172	78639584.45	78.640
3.09	43.262	79017234.45	79.017
3.1	43.352	79395784.45	79.396
3.11	43.442	79775234.45	79.775
3.12	43.532	80155584.45	80.156
3.13	43.622	80536834.45	80.537
3.14	43.712	80918984.45	80.919
3.15	43.802	81302034.45	81.302
3.16	43.892	81685984.45	81.686
3.17	43.982	82070834.45	82.071
3.18	44.072	82456584.45	82.457
3.19	44.162	82843234.45	82.843
3.2	44.252	83230784.45	83.231
3.21	44.342	83619234.45	83.619
3.22	44.432	84008584.45	84.009
3.23	44.522	84398834.45	84.399
3.24	44.612	84789984.45	84.790
3.25	44.702	85182034.45	85.182
3.26	44.792	85574984.45	85.575
3.27	44.882	85968834.45	85.969
3.28	44.972	86363584.45	86.364
3.29	45.062	86759234.45	86.759
3.3	45.152	87155784.45	87.156
3.31	45.242	87553234.45	87.553
3.32	45.332	87951584.45	87.952
3.33	45.422	88350834.45	88.351
3.34	45.512	88750984.45	88.751
3.35	45.602	89152034.45	89.152
3.36	45.692	89553984.45	89.554
3.37	45.782	89956834.45	89.957
3.38	45.872	90360584.45	90.361
3.39	45.962	90765234.45	90.765
3.4	46.052	91170784.45	91.171
3.41	46.142	91577234.45	91.577
3.42	46.232	91984584.45	91.985
3.43	46.322	92392834.45	92.393
3.44	46.412	92801984.45	92.802
3.45	46.502	93212034.45	93.212
3.46	46.592	93622984.45	93.623
3.47	46.682	94034834.45	94.035

3.48	46.772	94447584.45	94.448
3.49	46.862	94861234.45	94.861
3.5	46.952	95275784.45	95.276
3.51	47.042	95691234.45	95.691
3.52	47.132	96107584.45	96.108
3.53	47.222	96524834.45	96.525
3.54	47.312	96942984.45	96.943
3.55	47.402	97362034.45	97.362
3.56	47.492	97781984.45	97.782
3.57	47.582	98202834.45	98.203
3.58	47.672	98624584.45	98.625
3.59	47.762	99047234.45	99.047
3.6	47.852	99470784.45	99.471
3.61	47.942	99895234.45	99.895
3.62	48.032	100320584.5	100.321
3.63	48.122	100746834.5	100.747
3.64	48.212	101173984.5	101.174
3.65	48.302	101602034.5	101.602
3.66	48.392	102030984.5	102.031
3.67	48.482	102460834.5	102.461
3.68	48.572	102891584.5	102.892
3.69	48.662	103323234.5	103.323
3.7	48.752	103755784.5	103.756
3.71	48.842	104189234.5	104.189
3.72	48.932	104623584.5	104.624
3.73	49.022	105058834.5	105.059
3.74	49.112	105494984.5	105.495
3.75	49.202	105932034.5	105.932
3.76	49.292	106369984.5	106.370
3.77	49.382	106808834.5	106.809
3.78	49.472	107248584.5	107.249
3.79	49.562	107689234.5	107.689
3.8	49.652	108130784.5	108.131
3.81	49.742	108573234.5	108.573
3.82	49.832	109016584.5	109.017
3.83	49.922	109460834.5	109.461
3.84	50.012	109905984.5	109.906
3.85	50.102	110352034.5	110.352
3.86	50.192	110798984.5	110.799
3.87	50.282	111246834.5	111.247
3.88	50.372	111695584.5	111.696
3.89	50.462	112145234.5	112.145
3.9	50.552	112595784.5	112.596
3.91	50.642	113047234.5	113.047
3.92	50.732	113499584.5	113.500
3.93	50.822	113952834.5	113.953
3.94	50.912	114406984.5	114.407
3.95	51.002	114862034.5	114.862
3.96	51.092	115317984.5	115.318
3.97	51.182	115774834.5	115.775

3.98	51.272	116232584.5	116.233
3.99	51.362	116691234.5	116.691
4	51.452	117150784.5	117.151



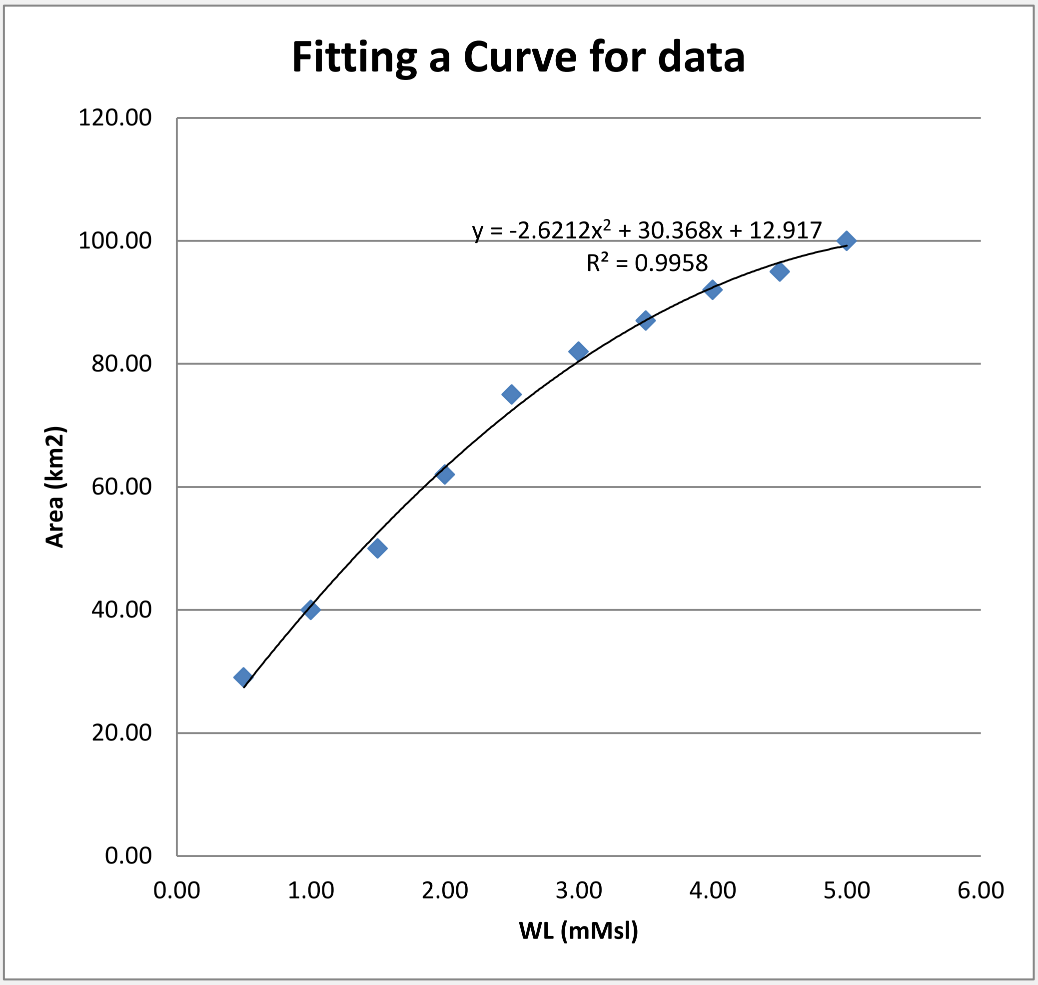


elevation model created using differentially corrected Trimble GPS data.

Study Conducted by Kelbe & Taylor 2011 indicated that the 'stage storage relationship' can be modeled by the following relationship - this only valid for waterlevels below 4mMSL:

Volume = 76 000 000 h^1.14, where h = stage in mMSL

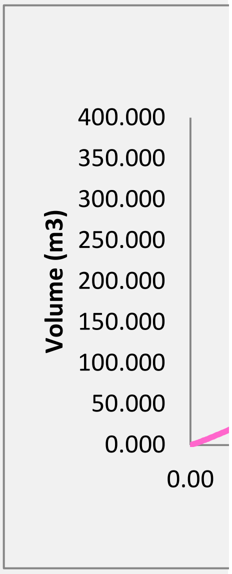
KELBE & TAYLOR (2011)



Stage(mMsl)	Area (m2)	
0.00		
0.50	29000000	29.00
1.00	40000000	40.00
1.50	50000000	50.00
2.00	62000000	62.00
2.50	75000000	75.00
3.00	82000000	82.00
3.50	87000000	87.00
4.00	92000000	92.00
4.50	95000000	95.00
5.00	100000000	100.00

WL vs. VOLUME RELATIONSHIP

WL	Area (km2)	Volume (m3)	Volume (Mm3)
0.00	12.917	0	0.000
0.01	13.220	398853.6698	0.399
0.02	13.523	878997.7985	0.879
0.03	13.826	1395506.368	1.396
0.04	14.128	1937144.342	1.937
0.05	14.429	2498270.14	2.498
0.06	14.730	3075431.213	3.075
0.07	15.030	3666277.705	3.666
0.08	15.330	4269098.521	4.269
0.09	15.629	4882587.703	4.883
0.10	15.928	5505713.297	5.506
0.11	16.226	6137637.765	6.138
0.12	16.523	6777666.773	6.778
0.13	16.821	7425214.668	7.425
0.14	17.117	8079780.32	8.080
0.15	17.413	8740929.704	8.741
0.16	17.709	9408283.001	9.408
0.17	18.004	10081504.83	10.082
0.18	18.298	10760296.74	10.760
0.19	18.592	11444391.27	11.444
0.20	18.886	12133547.3	12.134
0.21	19.179	12827546.22	12.828
0.22	19.471	13526188.9	13.526
0.23	19.763	14229293.1	14.229
0.24	20.054	14936691.38	14.937
0.25	20.345	15648229.33	15.648
0.26	20.636	16363764.06	16.364
0.27	20.925	17083162.95	17.083
0.28	21.215	17806302.54	17.806
0.29	21.503	18533067.6	18.533
0.30	21.792	19263350.32	19.263
0.31	22.079	19997049.57	19.997
0.32	22.366	20734070.34	20.734
0.33	22.653	21474323.13	21.474
0.34	22.939	22217723.5	22.218
0.35	23.225	22964191.66	22.964
0.36	23.510	23713652.05	23.714
0.37	23.794	24466033.03	24.466
0.38	24.078	25221266.58	25.221
0.39	24.362	25979287.99	25.979
0.40	24.645	26740035.68	26.740
0.41	24.927	27503450.91	27.503
0.42	25.209	28269477.61	28.269
0.43	25.491	29038062.23	29.038
0.44	25.771	29809153.5	29.809
0.45	26.052	30582702.35	30.583
0.46	26.332	31358661.73	31.359
0.47	26.611	32136986.5	32.137



WL - WEIR
VOL - WEIF
WL - BERM
VOL - BERN

0.48	26.890	32917633.3	32.918
0.49	27.168	33700560.46	33.701
0.50	27.446	34485727.9	34.486
0.51	27.723	35273097.03	35.273
0.52	28.000	36062630.66	36.063
0.53	28.276	36854292.95	36.854
0.54	28.551	37648049.29	37.648
0.55	28.827	38443866.31	38.444
0.56	29.101	39241711.73	39.242
0.57	29.375	40041554.35	40.042
0.58	29.649	40843364.01	40.843
0.59	29.922	41647111.49	41.647
0.60	30.194	42452768.53	42.453
0.61	30.466	43260307.7	43.260
0.62	30.738	44069702.46	44.070
0.63	31.009	44880927.01	44.881
0.64	31.279	45693956.36	45.694
0.65	31.549	46508766.23	46.509
0.66	31.818	47325333.03	47.325
0.67	32.087	48143633.84	48.144
0.68	32.355	48963646.38	48.964
0.69	32.623	49785348.98	49.785
0.70	32.890	50608720.54	50.609
0.71	33.157	51433740.55	51.434
0.72	33.423	52260389.02	52.260
0.73	33.689	53088646.47	53.089
0.74	33.954	53918493.92	53.918
0.75	34.219	54749912.89	54.750
0.76	34.483	55582885.34	55.583
0.77	34.746	56417393.66	56.417
0.78	35.009	57253420.69	57.253
0.79	35.272	58090949.67	58.091
0.80	35.534	58929964.23	58.930
0.81	35.795	59770448.38	59.770
0.82	36.056	60612386.52	60.612
0.83	36.317	61455763.37	61.456
0.84	36.577	62300564.01	62.301
0.85	36.836	63146773.87	63.147
0.86	37.095	63994378.66	63.994
0.87	37.353	64843364.42	64.843
0.88	37.611	65693717.49	65.694
0.89	37.868	66545424.51	66.545
0.90	38.125	67398472.36	67.398
0.91	38.381	68252848.24	68.253
0.92	38.637	69108539.58	69.109
0.93	38.892	69965534.08	69.966
0.94	39.147	70823819.66	70.824
0.95	39.401	71683384.52	71.683
0.96	39.655	72544217.07	72.544
0.97	39.908	73406305.93	73.406

0.98	40.160	74269639.96	74.270
0.99	40.412	75134208.23	75.134
1.00	40.664	76000000	76.000
1.01	40.915	76867004.75	76.867
1.02	41.165	77735212.14	77.735
1.03	41.415	78604612.02	78.605
1.04	41.665	79475194.43	79.475
1.05	41.914	80346949.59	80.347
1.06	42.162	81219867.88	81.220
1.07	42.410	82093939.86	82.094
1.08	42.657	82969156.24	82.969
1.09	42.904	83845507.92	83.846
1.10	43.150	84722985.92	84.723
1.11	43.396	85601581.44	85.602
1.12	43.641	86481285.81	86.481
1.13	43.886	87362090.51	87.362
1.14	44.130	88243987.17	88.244
1.15	44.374	89126967.53	89.127
1.16	44.617	90011023.5	90.011
1.17	44.860	90896147.08	90.896
1.18	45.102	91782330.43	91.782
1.19	45.343	92669565.82	92.670
1.20	45.584	93557845.65	93.558
1.21	45.825	94447162.41	94.447
1.22	46.065	95337508.75	95.338
1.23	46.304	96228877.39	96.229
1.24	46.543	97121261.18	97.121
1.25	46.782	98014653.09	98.015
1.26	47.020	98909046.16	98.909
1.27	47.257	99804433.56	99.804
1.28	47.494	100700808.6	100.701
1.29	47.730	101598164.5	101.598
1.30	47.966	102496494.9	102.496
1.31	48.201	103395793.2	103.396
1.32	48.436	104296053.2	104.296
1.33	48.670	105197268.4	105.197
1.34	48.904	106099432.9	106.099
1.35	49.137	107002540.3	107.003
1.36	49.370	107906584.9	107.907
1.37	49.602	108811560.5	108.812
1.38	49.833	109717461.5	109.717
1.39	50.064	110624281.9	110.624
1.40	50.295	111532016.1	111.532
1.41	50.525	112440658.6	112.441
1.42	50.755	113350203.7	113.350
1.43	50.984	114260646	114.261
1.44	51.212	115171980	115.172
1.45	51.440	116084200.6	116.084
1.46	51.667	116997302.3	116.997
1.47	51.894	117911280	117.911

1.48	52.121	118826128.6	118.826
1.49	52.346	119741843	119.742
1.50	52.572	120658418.2	120.658
1.51	52.797	121575849.3	121.576
1.52	53.021	122494131.4	122.494
1.53	53.245	123413259.7	123.413
1.54	53.468	124333229.4	124.333
1.55	53.690	125254035.8	125.254
1.56	53.913	126175674.3	126.176
1.57	54.134	127098140.3	127.098
1.58	54.355	128021429.2	128.021
1.59	54.576	128945536.7	128.946
1.60	54.796	129870458.1	129.870
1.61	55.016	130796189.2	130.796
1.62	55.235	131722725.7	131.723
1.63	55.453	132650063.2	132.650
1.64	55.671	133578197.6	133.578
1.65	55.889	134507124.6	134.507
1.66	56.105	135436840.1	135.437
1.67	56.322	136367340.1	136.367
1.68	56.538	137298620.4	137.299
1.69	56.753	138230677.2	138.231
1.70	56.968	139163506.3	139.164
1.71	57.182	140097104.1	140.097
1.72	57.396	141031466.5	141.031
1.73	57.609	141966589.7	141.967
1.74	57.822	142902470	142.902
1.75	58.034	143839103.6	143.839
1.76	58.246	144776486.8	144.776
1.77	58.457	145714615.9	145.715
1.78	58.668	146653487.4	146.653
1.79	58.878	147593097.6	147.593
1.80	59.087	148533443	148.533
1.81	59.296	149474520.1	149.475
1.82	59.505	150416325.3	150.416
1.83	59.713	151358855.3	151.359
1.84	59.920	152302106.6	152.302
1.85	60.127	153246075.9	153.246
1.86	60.334	154190759.9	154.191
1.87	60.540	155136155.1	155.136
1.88	60.745	156082258.4	156.082
1.89	60.950	157029066.5	157.029
1.90	61.154	157976576.3	157.977
1.91	61.358	158924784.4	158.925
1.92	61.562	159873687.8	159.874
1.93	61.764	160823283.4	160.823
1.94	61.967	161773568.1	161.774
1.95	62.168	162724538.8	162.725
1.96	62.369	163676192.5	163.676
1.97	62.570	164628526.1	164.629

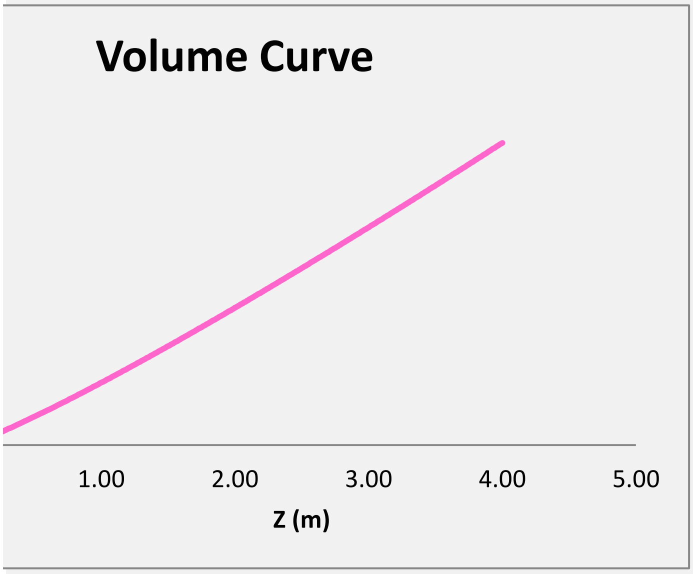
1.98	62.770	165581536.8	165.582
1.99	62.970	166535221.6	166.535
2.00	63.169	167489577.6	167.490
2.01	63.368	168444601.9	168.445
2.02	63.566	169400291.6	169.400
2.03	63.763	170356643.8	170.357
2.04	63.960	171313655.9	171.314
2.05	64.157	172271324.9	172.271
2.06	64.353	173229648.2	173.230
2.07	64.548	174188623	174.189
2.08	64.743	175148246.7	175.148
2.09	64.937	176108516.4	176.109
2.10	65.131	177069429.6	177.069
2.11	65.325	178030983.6	178.031
2.12	65.517	178993175.9	178.993
2.13	65.710	179956003.7	179.956
2.14	65.901	180919464.6	180.919
2.15	66.093	181883556	181.884
2.16	66.283	182848275.4	182.848
2.17	66.474	183813620.3	183.814
2.18	66.663	184779588.2	184.780
2.19	66.852	185746176.7	185.746
2.20	67.041	186713383.2	186.713
2.21	67.229	187681205.5	187.681
2.22	67.417	188649641	188.650
2.23	67.604	189618687.5	189.619
2.24	67.790	190588342.5	190.588
2.25	67.976	191558603.8	191.559
2.26	68.162	192529468.9	192.529
2.27	68.347	193500935.7	193.501
2.28	68.531	194473001.8	194.473
2.29	68.715	195445665	195.446
2.30	68.898	196418923	196.419
2.31	69.081	197392773.6	197.393
2.32	69.263	198367214.6	198.367
2.33	69.445	199342243.7	199.342
2.34	69.627	200317859	200.318
2.35	69.807	201294058.1	201.294
2.36	69.988	202270838.9	202.271
2.37	70.167	203248199.4	203.248
2.38	70.346	204226137.3	204.226
2.39	70.525	205204650.7	205.205
2.40	70.703	206183737.5	206.184
2.41	70.881	207163395.6	207.163
2.42	71.058	208143622.9	208.144
2.43	71.234	209124417.5	209.124
2.44	71.411	210105777.3	210.106
2.45	71.586	211087700.3	211.088
2.46	71.761	212070184.6	212.070
2.47	71.936	213053228.2	213.053

2.48	72.109	214036829.1	214.037
2.49	72.283	215020985.5	215.021
2.50	72.456	216005695.3	216.006
2.51	72.628	216990956.8	216.991
2.52	72.800	217976767.9	217.977
2.53	72.971	218963126.9	218.963
2.54	73.142	219950031.9	219.950
2.55	73.312	220937480.9	220.937
2.56	73.482	221925472.3	221.925
2.57	73.651	222914004.1	222.914
2.58	73.820	223903074.5	223.903
2.59	73.988	224892681.8	224.893
2.60	74.156	225882824.2	225.883
2.61	74.323	226873499.8	226.873
2.62	74.490	227864707	227.865
2.63	74.656	228856444	228.856
2.64	74.821	229848709.1	229.849
2.65	74.986	230841500.5	230.842
2.66	75.151	231834816.5	231.835
2.67	75.315	232828655.5	232.829
2.68	75.478	233823015.7	233.823
2.69	75.641	234817895.5	234.818
2.70	75.804	235813293.2	235.813
2.71	75.965	236809207.2	236.809
2.72	76.127	237805635.8	237.806
2.73	76.288	238802577.4	238.803
2.74	76.448	239800030.4	239.800
2.75	76.608	240797993.2	240.798
2.76	76.767	241796464.2	241.796
2.77	76.926	242795441.7	242.795
2.78	77.084	243794924.3	243.795
2.79	77.242	244794910.4	244.795
2.80	77.399	245795398.4	245.795
2.81	77.555	246796386.7	246.796
2.82	77.712	247797873.9	247.798
2.83	77.867	248799858.4	248.800
2.84	78.022	249802338.7	249.802
2.85	78.177	250805313.3	250.805
2.86	78.331	251808780.7	251.809
2.87	78.484	252812739.4	252.813
2.88	78.637	253817188	253.817
2.89	78.790	254822125	254.822
2.90	78.942	255827548.9	255.828
2.91	79.093	256833458.3	256.833
2.92	79.244	257839851.8	257.840
2.93	79.394	258846727.9	258.847
2.94	79.544	259854085.3	259.854
2.95	79.693	260861922.4	260.862
2.96	79.842	261870238	261.870
2.97	79.990	262879030.6	262.879

2.98	80.138	263888298.8	263.888
2.99	80.285	264898041.2	264.898
3.00	80.432	265908256.6	265.908
3.01	80.578	266918943.5	266.919
3.02	80.724	267930100.7	267.930
3.03	80.869	268941726.6	268.942
3.04	81.013	269953820.1	269.954
3.05	81.158	270966379.9	270.966
3.06	81.301	271979404.4	271.979
3.07	81.444	272992892.6	272.993
3.08	81.587	274006843.1	274.007
3.09	81.729	275021254.5	275.021
3.10	81.870	276036125.7	276.036
3.11	82.011	277051455.3	277.051
3.12	82.151	278067242.1	278.067
3.13	82.291	279083484.7	279.083
3.14	82.431	280100182	280.100
3.15	82.569	281117332.8	281.117
3.16	82.708	282134935.7	282.135
3.17	82.845	283152989.5	283.153
3.18	82.983	284171493	284.171
3.19	83.119	285190445.1	285.190
3.20	83.256	286209844.4	286.210
3.21	83.391	287229689.8	287.230
3.22	83.526	288249980.1	288.250
3.23	83.661	289270714.1	289.271
3.24	83.795	290291890.7	290.292
3.25	83.929	291313508.5	291.314
3.26	84.062	292335566.6	292.336
3.27	84.194	293358063.6	293.358
3.28	84.326	294380998.6	294.381
3.29	84.458	295404370.2	295.404
3.30	84.589	296428177.4	296.428
3.31	84.719	297452419	297.452
3.32	84.849	298477094	298.477
3.33	84.978	299502201.1	299.502
3.34	85.107	300527739.3	300.528
3.35	85.236	301553707.5	301.554
3.36	85.363	302580104.5	302.580
3.37	85.491	303606929.2	303.607
3.38	85.617	304634180.7	304.634
3.39	85.744	305661857.7	305.662
3.40	85.869	306689959.2	306.690
3.41	85.995	307718484.1	307.718
3.42	86.119	308747431.4	308.747
3.43	86.243	309776800	309.777
3.44	86.367	310806588.8	310.807
3.45	86.490	311836796.8	311.837
3.46	86.613	312867422.9	312.867
3.47	86.735	313898466.1	313.898

3.48	86.856	314929925.5	314.930
3.49	86.977	315961799.8	315.962
3.50	87.098	316994088.2	316.994
3.51	87.218	318026789.5	318.027
3.52	87.337	319059902.9	319.060
3.53	87.456	320093427.2	320.093
3.54	87.574	321127361.5	321.127
3.55	87.692	322161704.8	322.162
3.56	87.810	323196456.1	323.196
3.57	87.926	324231614.3	324.232
3.58	88.043	325267178.7	325.267
3.59	88.158	326303148	326.303
3.60	88.274	327339521.4	327.340
3.61	88.388	328376298	328.376
3.62	88.503	329413476.7	329.413
3.63	88.616	330451056.6	330.451
3.64	88.729	331489036.7	331.489
3.65	88.842	332527416.2	332.527
3.66	88.954	333566194	333.566
3.67	89.066	334605369.2	334.605
3.68	89.177	335644940.9	335.645
3.69	89.287	336684908.2	336.685
3.70	89.397	337725270.1	337.725
3.71	89.507	338766025.8	338.766
3.72	89.616	339807174.2	339.807
3.73	89.724	340848714.6	340.849
3.74	89.832	341890646	341.891
3.75	89.939	342932967.4	342.933
3.76	90.046	343975678.1	343.976
3.77	90.152	345018777.1	345.019
3.78	90.258	346062263.5	346.062
3.79	90.363	347106136.5	347.106
3.80	90.468	348150395.1	348.150
3.81	90.572	349195038.6	349.195
3.82	90.676	350240065.9	350.240
3.83	90.779	351285476.4	351.285
3.84	90.882	352331269	352.331
3.85	90.984	353377443	353.377
3.86	91.086	354423997.5	354.424
3.87	91.187	355470931.6	355.471
3.88	91.287	356518244.6	356.518
3.89	91.387	357565935.5	357.566
3.90	91.487	358614003.5	358.614
3.91	91.586	359662447.8	359.662
3.92	91.684	360711267.6	360.711
3.93	91.782	361760462.1	361.760
3.94	91.880	362810030.3	362.810
3.95	91.976	363859971.6	363.860
3.96	92.073	364910285.1	364.910
3.97	92.169	365960970	365.961

3.98	92.264	367012025.4	367.012
3.99	92.359	368063450.6	368.063
4.00	92.453	369115244.9	369.115



0.90	0.00
66.55	
1.75	
142.90	

TABLE TO FORMULATE HYPSOMETRIC CURVE

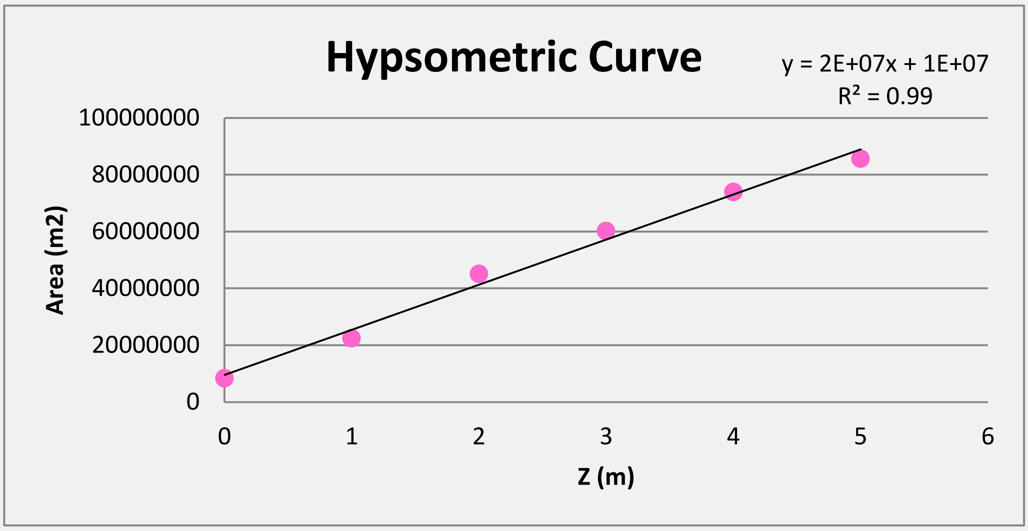
	UPPER LIMIT	AREA (km2)	AREA (m2)
<0 - 0	0	8.329414216	8329414.216
0 - 1	1	22.40543246	22405432.46
1 - 2	2	45.03405436	45034054.36
2 - 3	3	60.1247239	60124723.9
3 - 4	4	73.87275734	73872757.34
4 - 5	5	85.62416417	85624164.17

DETERMING WL _ VOL RELATIONSHIP

V = integral of A . Dz
= (2*10^7)z + 8329414 dz
= (1*10^7)z^2 + 8329414z + A

A is the V when the WL is at z=0
therefore find a radius for area < 0
= (area < 0 / pi)^0.5
and assume lowest depth is at z = -2
Drew a cone with above dimensions -
V = A = 5550951.269 m3

JUGWANTH (2010)



WL vs. VOLUME RELATIONSHIP

WL (gmsl)	Area (km2)	Volume (m3)	Volume (Mm3)
0	8.329	5550951.269	5.551
0.01	8.529	5635245.411	5.635
0.02	8.729	5721539.553	5.722
0.03	8.929	5809833.696	5.810
0.04	9.129	5900127.838	5.900
0.05	9.329	5992421.98	5.992
0.06	9.529	6086716.122	6.087
0.07	9.729	6183010.264	6.183
0.08	9.929	6281304.406	6.281
0.09	10.129	6381598.549	6.382
0.1	10.329	6483892.691	6.484
0.11	10.529	6588186.833	6.588
0.12	10.729	6694480.975	6.694
0.13	10.929	6802775.117	6.803
0.14	11.129	6913069.259	6.913
0.15	11.329	7025363.402	7.025
0.16	11.529	7139657.544	7.140
0.17	11.729	7255951.686	7.256
0.18	11.929	7374245.828	7.374
0.19	12.129	7494539.97	7.495
0.2	12.329	7616834.112	7.617
0.21	12.529	7741128.255	7.741
0.22	12.729	7867422.397	7.867
0.23	12.929	7995716.539	7.996
0.24	13.129	8126010.681	8.126
0.25	13.329	8258304.823	8.258
0.26	13.529	8392598.965	8.393
0.27	13.729	8528893.107	8.529
0.28	13.929	8667187.25	8.667
0.29	14.129	8807481.392	8.807
0.3	14.329	8949775.534	8.950
0.31	14.529	9094069.676	9.094
0.32	14.729	9240363.818	9.240
0.33	14.929	9388657.96	9.389
0.34	15.129	9538952.103	9.539
0.35	15.329	9691246.245	9.691
0.36	15.529	9845540.387	9.846
0.37	15.729	10001834.53	10.002
0.38	15.929	10160128.67	10.160
0.39	16.129	10320422.81	10.320
0.4	16.329	10482716.96	10.483
0.41	16.529	10647011.1	10.647
0.42	16.729	10813305.24	10.813
0.43	16.929	10981599.38	10.982
0.44	17.129	11151893.52	11.152
0.45	17.329	11324187.67	11.324
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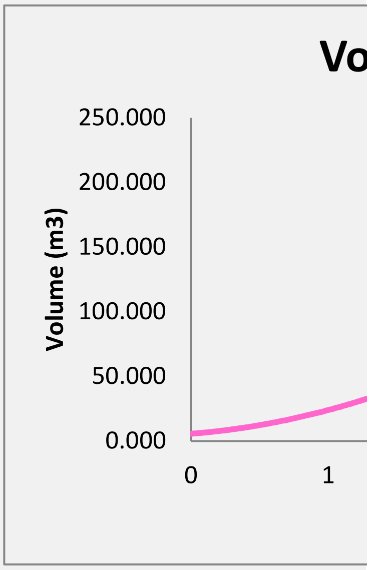
0.47	17.729	11674775.95	11.675



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0.51	18.529	12399952.52	12.400
0.52	18.729	12586246.66	12.586
0.53	18.929	12774540.8	12.775
0.54	19.129	12964834.95	12.965
0.55	19.329	13157129.09	13.157
0.56	19.529	13351423.23	13.351
0.57	19.729	13547717.37	13.548
0.58	19.929	13746011.51	13.746
0.59	20.129	13946305.66	13.946
0.6	20.329	14148599.8	14.149
0.61	20.529	14352893.94	14.353
0.62	20.729	14559188.08	14.559
0.63	20.929	14767482.23	14.767
0.64	21.129	14977776.37	14.978
0.65	21.329	15190070.51	15.190
0.66	21.529	15404364.65	15.404
0.67	21.729	15620658.79	15.621
0.68	21.929	15838952.94	15.839
0.69	22.129	16059247.08	16.059
0.7	22.329	16281541.22	16.282
0.71	22.529	16505835.36	16.506
0.72	22.729	16732129.5	16.732
0.73	22.929	16960423.65	16.960
0.74	23.129	17190717.79	17.191
0.75	23.329	17423011.93	17.423
0.76	23.529	17657306.07	17.657
0.77	23.729	17893600.22	17.894
0.78	23.929	18131894.36	18.132
0.79	24.129	18372188.5	18.372
0.8	24.329	18614482.64	18.614
0.81	24.529	18858776.78	18.859
0.82	24.729	19105070.93	19.105
0.83	24.929	19353365.07	19.353
0.84	25.129	19603659.21	19.604
0.85	25.329	19855953.35	19.856
0.86	25.529	20110247.5	20.110
0.87	25.729	20366541.64	20.367
0.88	25.929	20624835.78	20.625
0.89	26.129	20885129.92	20.885
0.9	26.329	21147424.06	21.147
0.91	26.529	21411718.21	21.412
0.92	26.729	21678012.35	21.678
0.93	26.929	21946306.49	21.946
0.94	27.129	22216600.63	22.217
0.95	27.329	22488894.77	22.489
0.96	27.529	22763188.92	22.763
0.97	27.729	23039483.06	23.039

0.98	27.929	23317777.2	23.318
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1.04	29.129	25029542.05	25.030
1.05	29.329	25321836.2	25.322
1.06	29.529	25616130.34	25.616
1.07	29.729	25912424.48	25.912
1.08	29.929	26210718.62	26.211
1.09	30.129	26511012.76	26.511
1.1	30.329	26813306.91	26.813
1.11	30.529	27117601.05	27.118
1.12	30.729	27423895.19	27.424
1.13	30.929	27732189.33	27.732
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1.17	31.729	28985365.9	28.985
1.18	31.929	29303660.04	29.304
1.19	32.129	29623954.19	29.624
1.2	32.329	29946248.33	29.946
1.21	32.529	30270542.47	30.271
1.22	32.729	30596836.61	30.597
1.23	32.929	30925130.76	30.925
1.24	33.129	31255424.9	31.255
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1.26	33.529	31922013.18	31.922
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1.28	33.929	32596601.47	32.597
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1.3	34.329	33279189.75	33.279
1.31	34.529	33623483.89	33.623
1.32	34.729	33969778.03	33.970
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1.34	35.129	34668366.32	34.668
1.35	35.329	35020660.46	35.021
1.36	35.529	35374954.6	35.375
1.37	35.729	35731248.75	35.731
1.38	35.929	36089542.89	36.090
1.39	36.129	36449837.03	36.450
1.4	36.329	36812131.17	36.812
1.41	36.529	37176425.31	37.176
1.42	36.729	37542719.46	37.543
1.43	36.929	37911013.6	37.911
1.44	37.129	38281307.74	38.281
1.45	37.329	38653601.88	38.654
1.46	37.529	39027896.02	39.028
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1.61	40.529	44882308.16	44.882
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1.63	40.929	45696896.44	45.697
1.64	41.129	46107190.58	46.107
1.65	41.329	46519484.73	46.519
1.66	41.529	46933778.87	46.934
1.67	41.729	47350073.01	47.350
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1.69	42.129	48188661.29	48.189
1.7	42.329	48610955.44	48.611
1.71	42.529	49035249.58	49.035
1.72	42.729	49461543.72	49.462
1.73	42.929	49889837.86	49.890
1.74	43.129	50320132.01	50.320
1.75	43.329	50752426.15	50.752
1.76	43.529	51186720.29	51.187
1.77	43.729	51623014.43	51.623
1.78	43.929	52061308.57	52.061
1.79	44.129	52501602.72	52.502
1.8	44.329	52943896.86	52.944
1.81	44.529	53388191	53.388
1.82	44.729	53834485.14	53.834
1.83	44.929	54282779.28	54.283
1.84	45.129	54733073.43	54.733
1.85	45.329	55185367.57	55.185
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1.89	46.129	57014544.14	57.015
1.9	46.329	57476838.28	57.477
1.91	46.529	57941132.42	57.941
1.92	46.729	58407426.56	58.407
1.93	46.929	58875720.71	58.876
1.94	47.129	59346014.85	59.346
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2.04	49.129	64158956.27	64.159
2.05	49.329	64651250.41	64.651
2.06	49.529	65145544.55	65.146
2.07	49.729	65641838.7	65.642
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2.09	50.129	66640426.98	66.640
2.1	50.329	67142721.12	67.143
2.11	50.529	67647015.27	67.647
2.12	50.729	68153309.41	68.153
2.13	50.929	68661603.55	68.662
2.14	51.129	69171897.69	69.172
2.15	51.329	69684191.83	69.684
2.16	51.529	70198485.98	70.198
2.17	51.729	70714780.12	70.715
2.18	51.929	71233074.26	71.233
2.19	52.129	71753368.4	71.753
2.2	52.329	72275662.54	72.276
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2.22	52.729	73326250.83	73.326
2.23	52.929	73854544.97	73.855
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2.25	53.329	74917133.26	74.917
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2.27	53.729	75987721.54	75.988
2.28	53.929	76526015.68	76.526
2.29	54.129	77066309.82	77.066
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2.33	54.929	79247486.39	79.247
2.34	55.129	79797780.54	79.798
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2.41	56.529	83705839.53	83.706
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2.52	58.729	90045075.09	90.045
2.53	58.929	90633369.24	90.633
2.54	59.129	91223663.38	91.224
2.55	59.329	91815957.52	91.816
2.56	59.529	92410251.66	92.410
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2.58	59.929	93604839.95	93.605
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2.6	60.329	94807428.23	94.807
2.61	60.529	95411722.37	95.412
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2.63	60.929	96626310.66	96.626
2.64	61.129	97236604.8	97.237
2.65	61.329	97848898.94	97.849
2.66	61.529	98463193.08	98.463
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2.69	62.129	100318075.5	100.318
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2.71	62.529	101564663.8	101.565
2.72	62.729	102190957.9	102.191
2.73	62.929	102819252.1	102.819
2.74	63.129	103449546.2	103.450
2.75	63.329	104081840.4	104.082
2.76	63.529	104716134.5	104.716
2.77	63.729	105352428.6	105.352
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2.81	64.529	107917605.2	107.918
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2.83	64.929	109212193.5	109.212
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2.92	66.729	115136840.8	115.137
2.93	66.929	115805134.9	115.805
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3.04	69.129	123288370.5	123.288
3.05	69.329	123980664.6	123.981
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3.07	69.729	125371252.9	125.371
3.08	69.929	126069547.1	126.070
3.09	70.129	126769841.2	126.770
3.1	70.329	127472135.3	127.472
3.11	70.529	128176429.5	128.176
3.12	70.729	128882723.6	128.883
3.13	70.929	129591017.8	129.591
3.14	71.129	130301311.9	130.301
3.15	71.329	131013606.1	131.014
3.16	71.529	131727900.2	131.728
3.17	71.729	132444194.3	132.444
3.18	71.929	133162488.5	133.162
3.19	72.129	133882782.6	133.883
3.2	72.329	134605076.8	134.605
3.21	72.529	135329370.9	135.329
3.22	72.729	136055665	136.056
3.23	72.929	136783959.2	136.784
3.24	73.129	137514253.3	137.514
3.25	73.329	138246547.5	138.247
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3.27	73.729	139717135.8	139.717
3.28	73.929	140455429.9	140.455
3.29	74.129	141195724	141.196
3.3	74.329	141938018.2	141.938
3.31	74.529	142682312.3	142.682
3.32	74.729	143428606.5	143.429
3.33	74.929	144176900.6	144.177
3.34	75.129	144927194.8	144.927
3.35	75.329	145679488.9	145.679
3.36	75.529	146433783	146.434
3.37	75.729	147190077.2	147.190
3.38	75.929	147948371.3	147.948
3.39	76.129	148708665.5	148.709
3.4	76.329	149470959.6	149.471
3.41	76.529	150235253.7	150.235
3.42	76.729	151001547.9	151.002
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3.44	77.129	152540136.2	152.540
3.45	77.329	153312430.3	153.312
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3.48	77.929	155641312.7	155.641
3.49	78.129	156421606.9	156.422
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3.53	78.929	159562783.5	159.563
3.54	79.129	160353077.6	160.353
3.55	79.329	161145371.7	161.145
3.56	79.529	161939665.9	161.940
3.57	79.729	162735960	162.736
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3.59	80.129	164334548.3	164.335
3.6	80.329	165136842.4	165.137
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3.63	80.929	167555724.9	167.556
3.64	81.129	168366019	168.366
3.65	81.329	169178313.2	169.178
3.66	81.529	169992607.3	169.993
3.67	81.729	170808901.4	170.809
3.68	81.929	171627195.6	171.627
3.69	82.129	172447489.7	172.447
3.7	82.329	173269783.9	173.270
3.71	82.529	174094078	174.094
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3.73	82.929	175748666.3	175.749
3.74	83.129	176578960.4	176.579
3.75	83.329	177411254.6	177.411
3.76	83.529	178245548.7	178.246
3.77	83.729	179081842.9	179.082
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3.79	84.129	180760431.1	180.760
3.8	84.329	181602725.3	181.603
3.81	84.529	182447019.4	182.447
3.82	84.729	183293313.6	183.293
3.83	84.929	184141607.7	184.142
3.84	85.129	184991901.9	184.992
3.85	85.329	185844196	185.844
3.86	85.529	186698490.1	186.698
3.87	85.729	187554784.3	187.555
3.88	85.929	188413078.4	188.413
3.89	86.129	189273372.6	189.273
3.9	86.329	190135666.7	190.136
3.91	86.529	190999960.9	191.000
3.92	86.729	191866255	191.866
3.93	86.929	192734549.1	192.735
3.94	87.129	193604843.3	193.605
3.95	87.329	194477137.4	194.477
3.96	87.529	195351431.6	195.351
3.97	87.729	196227725.7	196.228

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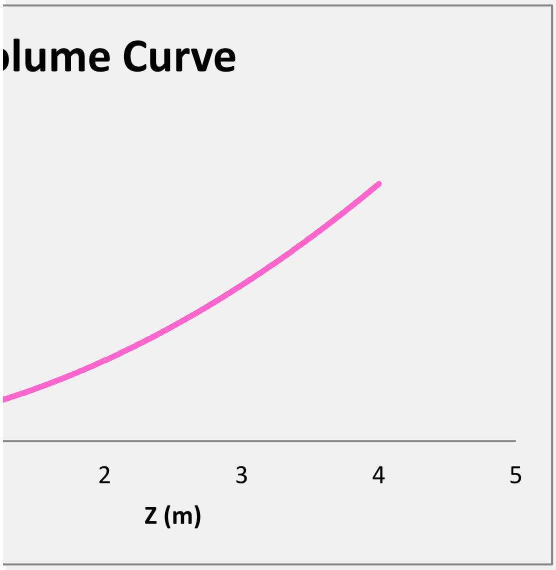
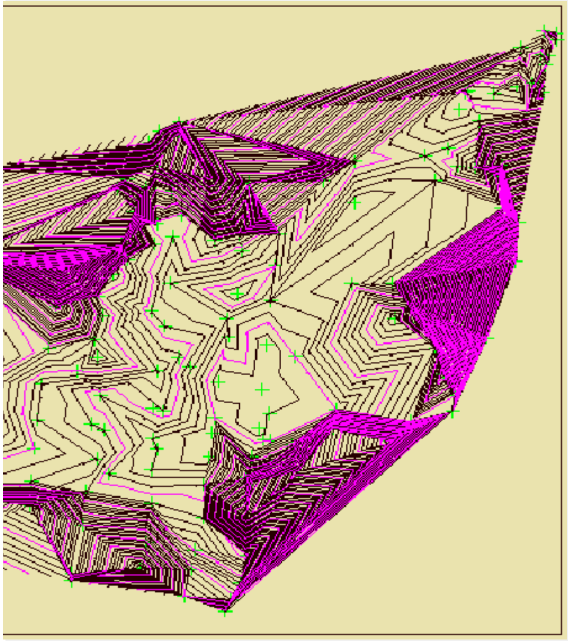
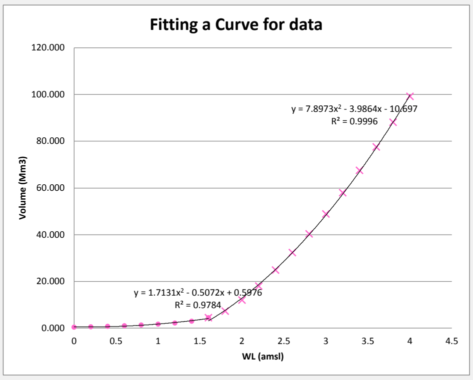

olume Curve
2
3
4
5
Z (m)

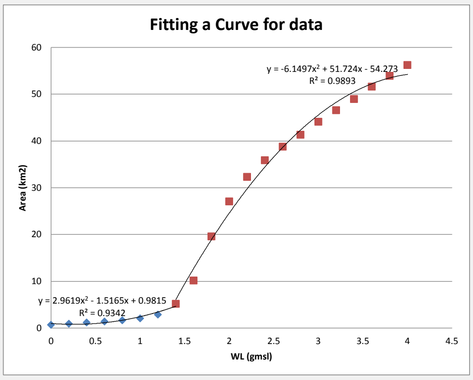


Please not that these values were approximated from the graph distributed
and only has data up until a height of 4amsl

CHRYSTAL
(2012)

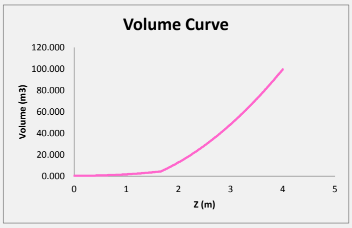
Water Level gmsl	Area (m2)	Volume (m3)	Volume (Mm3)	
0	685773.42	437579.32	0.438	0.685773
0.2	909128.04	600121.61	0.600	0.909128
0.4	1189619.99	808884.9	0.809	1.18962
0.6	1393046.28	1066887.71	1.067	1.393046
0.8	1647213.44	1370825.16	1.371	1.647213
1	2061485.38	1738935.74	1.739	2.061485
1.2	2878367.66	2219887.37	2.220	2.878368
1.4	5181509.45	2987765.75	2.988	5.181509
1.6	10163914.14	4474835.09	4.475	10.16391
1.8	19585991.01	7304303.25	7.304	19.58599
2	27068408.47	12026424.5	12.026	27.06841
2.2	32321461.46	18002644.37	18.003	32.32146
2.4	35887435.2	24838958.63	24.839	35.88744
2.6	38792840.66	32312551.61	32.313	38.79284
2.8	41333199.2	40329010.48	40.329	41.3332
3	44101794.13	48846900.92	48.847	44.10179
3.2	46571162.36	57915600.8	57.916	46.57116
3.4	48967092.05	67470763.53	67.471	48.96709
3.6	51614291.7	77515565	77.516	51.61429
3.8	53918544.1	88071773.23	88.072	53.91854
4	56228344.37	99106233.51	99.106	56.22834





WL vs. VOLUME RELATIONSHIP

WL (gmsl)	Area (km2)	Volume (m3)	Volume (Mm3)
0	0.982	598000.000	0.598
0.01	0.967	593101.300	0.593
0.02	0.953	588545.200	0.589
0.03	0.939	584331.700	0.584
0.04	0.926	580460.800	0.580
0.05	0.914	576932.500	0.577
0.06	0.902	573746.800	0.574
0.07	0.890	570903.700	0.571
0.08	0.880	568403.200	0.568
0.09	0.869	566245.300	0.566
0.1	0.860	564430.000	0.564
0.11	0.851	562957.300	0.563
0.12	0.843	561827.200	0.562
0.13	0.835	561039.700	0.561
0.14	0.828	560594.800	0.561
0.15	0.821	560492.500	0.560
0.16	0.815	560732.800	0.561
0.17	0.810	561315.700	0.561
0.18	0.805	562241.200	0.562
0.19	0.801	563509.300	0.564
0.2	0.797	565120.000	0.565
0.21	0.794	567073.300	0.567
0.22	0.792	569369.200	0.569
0.23	0.790	572007.700	0.572
0.24	0.789	574988.800	0.575
0.25	0.788	578312.500	0.578
0.26	0.788	581978.800	0.582
0.27	0.788	585987.700	0.586
0.28	0.789	590339.200	0.590
0.29	0.791	595033.300	0.595
0.3	0.793	600070.000	0.600
0.31	0.796	605449.300	0.605
0.32	0.800	611171.200	0.611
0.33	0.804	617235.700	0.617
0.34	0.809	623642.800	0.624
0.35	0.814	630392.500	0.630
0.36	0.820	637484.800	0.637
0.37	0.826	644919.700	0.645
0.38	0.833	652697.200	0.653
0.39	0.841	660817.300	0.661
0.4	0.849	669280.000	0.669
0.41	0.858	678085.300	0.678
0.42	0.867	687233.200	0.687
0.43	0.877	696723.700	0.697
0.44	0.888	706556.800	0.707
0.45	0.899	716732.500	0.717
0.46	0.911	727250.800	0.727
0.47	0.923	738111.700	0.738
0.48	0.936	749315.200	0.749
0.49	0.950	760861.300	0.761
0.5	0.964	772750.000	0.773
0.51	0.979	784981.300	0.785
0.52	0.994	797555.200	0.798
0.53	1.010	810471.700	0.810
0.54	1.027	823730.800	0.824
0.55	1.044	837332.500	0.837
0.56	1.061	851276.800	0.851
0.57	1.080	865563.700	0.866
0.58	1.099	880193.200	0.880
0.59	1.118	895165.300	0.895
0.6	1.138	910480.000	0.910
0.61	1.159	926137.300	0.926
0.62	1.180	942137.200	0.942
0.63	1.202	958479.700	0.958
0.64	1.224	975164.800	0.975
0.65	1.247	992192.500	0.992
0.66	1.271	1009562.800	1.010
0.67	1.295	1027275.700	1.027
0.68	1.320	1045331.200	1.045
0.69	1.345	1063729.300	1.064
0.7	1.371	1082470.000	1.082
0.71	1.398	1101553.300	1.102
0.72	1.425	1120979.200	1.121
0.73	1.453	1140747.700	1.141
0.74	1.481	1160858.800	1.161
0.75	1.510	1181312.500	1.181
0.76	1.540	1202108.800	1.202
0.77	1.570	1223247.700	1.223
0.78	1.601	1244729.200	1.245
0.79	1.632	1266553.300	1.267
0.8	1.664	1288720.000	1.289
0.81	1.697	1311229.300	1.311
0.82	1.730	1334081.200	1.334
0.83	1.763	1357275.700	1.357
0.84	1.798	1380812.800	1.381
0.85	1.833	1404692.500	1.405
0.86	1.868	1428914.800	1.429
0.87	1.904	1453479.700	1.453
0.88	1.941	1478387.200	1.478
0.89	1.978	1503637.300	1.504
0.9	2.016	1529230.000	1.529
0.91	2.054	1555165.300	1.555
0.92	2.093	1581443.200	1.581
0.93	2.133	1608063.700	1.608
0.94	2.173	1635026.800	1.635
0.95	2.214	1662332.500	1.662
0.96	2.255	1689980.800	1.690
0.97	2.297	1717971.700	1.718
0.98	2.340	1746305.200	1.746
0.99	2.383	1774981.300	1.775
1	2.427	1804000.000	1.804
1.01	2.471	1833361.300	1.833
1.02	2.516	1863065.200	1.863
1.03	2.562	1893111.700	1.893
1.04	2.608	1923500.800	1.924
1.05	2.655	1954232.500	1.954
1.06	2.702	1985306.800	1.985
1.07	2.750	2016723.700	2.017
1.08	2.799	2048483.200	2.048
1.09	2.848	2080585.300	2.081
1.1	2.897	2113030.000	2.113
1.11	2.948	2145817.300	2.146
1.12	2.998	2178947.200	2.179
1.13	3.050	2212419.700	2.212
1.14	3.102	2246234.800	2.246
1.15	3.155	2280392.500	2.280
1.16	3.208	2314892.800	2.315
1.17	3.262	2349735.700	2.350
1.18	3.316	2384921.200	2.385
1.19	3.371	2420449.300	2.420
1.2	3.427	2456320.000	2.456
1.21	3.483	2492533.300	2.493
1.22	3.540	2529089.200	2.529
1.23	3.597	2565987.700	2.566
1.24	3.655	2603228.800	2.603
1.25	3.714	2640812.500	2.641
1.26	3.773	2678738.800	2.679
1.27	3.833	2717007.700	2.717
1.28	3.893	2755619.200	2.756
1.29	3.954	2794573.300	2.795



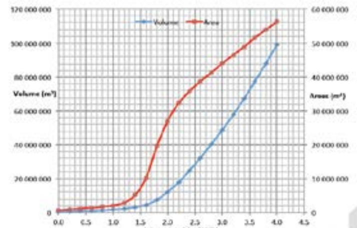


Figure B-70 Hypsometric curve (Chrystal & Stretch, 2010)

1.3	4.016	2833870.000	2.834
1.31	4.078	2873509.300	2.874
1.32	4.141	2913491.200	2.913
1.33	4.204	2953815.700	2.954
1.34	4.268	2994482.800	2.994
1.35	4.332	3035492.500	3.035
1.36	4.397	3076844.800	3.077
1.37	4.463	3118539.700	3.119
1.38	4.529	3160577.200	3.161
1.39	4.596	3202957.300	3.203
1.4	6.087	3245680.000	3.246
1.41	6.431	3288745.300	3.289
1.42	6.774	3332153.200	3.332
1.43	7.116	3375903.700	3.376
1.44	7.457	3419996.800	3.420
1.45	7.796	3464432.500	3.464
1.46	8.135	3509210.800	3.509
1.47	8.472	3554331.700	3.554
1.48	8.808	3599795.200	3.600
1.49	9.142	3645601.300	3.646
1.5	9.476	3691750.000	3.692
1.51	9.808	3738241.300	3.738
1.52	10.139	3785075.200	3.785
1.53	10.468	3832251.700	3.832
1.54	10.797	3879770.800	3.880
1.55	11.124	3927632.500	3.928
1.56	11.450	3975836.800	3.976
1.57	11.775	4024383.700	4.024
1.58	12.098	4073273.200	4.073
1.59	12.420	4122505.300	4.123
1.6	12.741	4172080.000	4.172
1.61	13.061	4221997.300	4.222
1.62	13.380	4272257.200	4.272
1.63	13.697	4322859.700	4.323
1.64	14.013	4373804.800	4.374
1.65	14.328	4425092.500	4.425
1.66	14.642	4447213.200	4.447
1.67	14.954	4670323.300	4.670
1.68	15.266	4895012.800	4.895
1.69	15.576	5121281.700	5.121
1.7	15.884	5349130.000	5.349
1.71	16.192	5578557.700	5.579
1.72	16.498	5809564.800	5.810
1.73	16.803	6042151.300	6.042
1.74	17.107	6276317.200	6.276
1.75	17.410	6512062.500	6.512
1.76	17.711	6749387.200	6.749
1.77	18.011	6988291.300	6.988
1.78	18.310	7228774.800	7.229
1.79	18.608	7470837.700	7.471
1.8	18.904	7714480.000	7.714
1.81	19.199	7959701.700	7.960
1.82	19.493	8206502.800	8.207
1.83	19.786	8454883.300	8.455
1.84	20.078	8704843.200	8.705
1.85	20.368	8956382.500	8.956
1.86	20.657	9209501.200	9.210
1.87	20.945	9464199.300	9.464
1.88	21.232	9720476.800	9.720
1.89	21.517	9978333.700	9.978
1.9	21.801	10237770.000	10.238
1.91	22.084	10498785.700	10.499
1.92	22.366	10761380.800	10.761
1.93	22.646	11025555.300	11.026
1.94	22.925	11291309.200	11.291
1.95	23.203	11558642.500	11.559
1.96	23.480	11827555.200	11.828
1.97	23.756	12098047.300	12.098
1.98	24.030	12370118.800	12.370
1.99	24.303	12643769.700	12.644
2	24.575	12919000.000	12.919
2.01	24.846	13195809.700	13.196
2.02	25.115	13474198.800	13.474
2.03	25.383	13754167.300	13.754
2.04	25.650	14035715.200	14.036
2.05	25.916	14318842.500	14.319
2.06	26.180	14603549.200	14.604
2.07	26.444	14889835.300	14.890
2.08	26.706	15177700.800	15.178
2.09	26.966	15467145.700	15.467
2.1	27.226	15758170.000	15.758
2.11	27.484	16050773.700	16.051
2.12	27.741	16344956.800	16.345
2.13	27.997	16640719.300	16.641
2.14	28.252	16938061.200	16.938
2.15	28.505	17236982.500	17.237
2.16	28.757	17537483.200	17.537
2.17	29.008	17839563.300	17.840
2.18	29.258	18143222.800	18.143
2.19	29.507	18448461.700	18.448
2.2	29.754	18755280.000	18.755
2.21	30.000	19063677.700	19.064
2.22	30.245	19373654.800	19.374
2.23	30.488	19685211.300	19.685
2.24	30.731	19998347.200	19.998
2.25	30.972	20313062.500	20.313
2.26	31.211	20629357.200	20.629
2.27	31.450	20947231.300	20.947
2.28	31.688	21266684.800	21.267
2.29	31.924	21587717.700	21.588
2.3	32.159	21910330.000	21.910
2.31	32.392	22234521.700	22.235
2.32	32.625	22560292.800	22.560
2.33	32.856	22887643.300	22.888
2.34	33.086	23216573.200	23.217
2.35	33.315	23547082.500	23.547
2.36	33.543	23879171.200	23.879
2.37	33.769	24212839.300	24.213
2.38	33.994	24548086.800	24.548
2.39	34.218	24884913.700	24.885
2.4	34.441	25223320.000	25.223
2.41	34.662	25563305.700	25.563
2.42	34.882	25904870.800	25.905
2.43	35.101	26248015.300	26.248
2.44	35.319	26592739.200	26.593
2.45	35.535	26939042.500	26.939
2.46	35.751	27286925.200	27.287
2.47	35.965	27636387.300	27.636
2.48	36.178	27987428.800	27.987
2.49	36.389	28340049.700	28.340
2.5	36.599	28694250.000	28.694
2.51	36.809	29050029.700	29.050
2.52	37.017	29407388.800	29.407
2.53	37.223	29766327.300	29.766
2.54	37.429	30126845.200	30.127
2.55	37.633	30488942.500	30.489
2.56	37.836	30852619.200	30.853
2.57	38.038	31217875.300	31.218
2.58	38.238	31584710.800	31.585
2.59	38.437	31953125.700	31.953
2.6	38.635	32323120.000	32.323
2.61	38.832	32694693.700	32.695

2.62	39.028	33067846.800	33.068
2.63	39.222	33442579.300	33.443
2.64	39.415	33818891.200	33.819
2.65	39.607	34196782.500	34.197
2.66	39.798	34576253.200	34.576
2.67	39.987	34957303.300	34.957
2.68	40.176	35339932.800	35.340
2.69	40.363	35724141.700	35.724
2.7	40.548	36109930.000	36.110
2.71	40.733	36497297.700	36.497
2.72	40.916	36886244.800	36.886
2.73	41.098	37276771.300	37.277
2.74	41.279	37668877.200	37.669
2.75	41.459	38062562.500	38.063
2.76	41.637	38457827.200	38.458
2.77	41.814	38854671.300	38.855
2.78	41.990	39253094.800	39.253
2.79	42.165	39653097.700	39.653
2.8	42.338	40054680.000	40.055
2.81	42.510	40457841.700	40.458
2.82	42.681	40862582.800	40.863
2.83	42.851	41268903.300	41.269
2.84	43.020	41676803.200	41.677
2.85	43.187	42086282.500	42.086
2.86	43.353	42497341.200	42.497
2.87	43.518	42909979.300	42.910
2.88	43.682	43324196.800	43.324
2.89	43.844	43739993.700	43.740
2.9	44.005	44157370.000	44.157
2.91	44.165	44576325.700	44.576
2.92	44.324	44996860.800	44.997
2.93	44.481	45418975.300	45.419
2.94	44.637	45842669.200	45.843
2.95	44.792	46267942.500	46.268
2.96	44.946	46694795.200	46.695
2.97	45.099	47123227.300	47.123
2.98	45.250	47553238.800	47.553
2.99	45.400	47984829.700	47.985
3	45.549	48418000.000	48.418
3.01	45.697	48852749.700	48.853
3.02	45.843	49289078.800	49.289
3.03	45.988	49726987.300	49.727
3.04	46.132	50166475.200	50.166
3.05	46.275	50607542.500	50.608
3.06	46.416	51050189.200	51.050
3.07	46.557	51494415.300	51.494
3.08	46.696	51940220.800	51.940
3.09	46.833	52387605.700	52.388
3.1	46.970	52836570.000	52.837
3.11	47.105	53287113.700	53.287
3.12	47.239	53739236.800	53.739
3.13	47.372	54192939.300	54.193
3.14	47.504	54648221.200	54.648
3.15	47.634	55105082.500	55.105
3.16	47.763	55563523.200	55.564
3.17	47.891	56023543.300	56.024
3.18	48.018	56485142.800	56.485
3.19	48.144	56948321.700	56.948
3.2	48.268	57413080.000	57.413
3.21	48.391	57879417.700	57.879
3.22	48.513	58347334.800	58.347
3.23	48.633	58816831.300	58.817
3.24	48.753	59287907.200	59.288
3.25	48.871	59760562.500	59.761
3.26	48.987	60234797.200	60.235
3.27	49.103	60710611.300	60.711
3.28	49.218	61188004.800	61.188
3.29	49.331	61666977.700	61.667
3.3	49.443	62147530.000	62.148
3.31	49.553	62629661.700	62.630
3.32	49.663	63113372.800	63.113
3.33	49.771	63598663.300	63.599
3.34	49.878	64085533.200	64.086
3.35	49.984	64573982.500	64.574
3.36	50.089	65064011.200	65.064
3.37	50.192	65555619.300	65.556
3.38	50.294	66048806.800	66.049
3.39	50.395	66543573.700	66.544
3.4	50.495	67039920.000	67.040
3.41	50.593	67537845.700	67.538
3.42	50.690	68037350.800	68.037
3.43	50.786	68538435.300	68.538
3.44	50.881	69041099.200	69.041
3.45	50.974	69545342.500	69.545
3.46	51.067	70051165.200	70.051
3.47	51.158	70558567.300	70.559
3.48	51.248	71067548.800	71.068
3.49	51.336	71578109.700	71.578
3.5	51.423	72090250.000	72.090
3.51	51.510	72603969.700	72.604
3.52	51.595	73119268.800	73.119
3.53	51.678	73636147.300	73.636
3.54	51.761	74154605.200	74.155
3.55	51.842	74674642.500	74.675
3.56	51.922	75196259.200	75.196
3.57	52.001	75719455.300	75.719
3.58	52.078	76244230.800	76.244
3.59	52.154	76770585.700	76.771
3.6	52.229	77298520.000	77.299
3.61	52.303	77828033.700	77.828
3.62	52.376	78359126.800	78.359
3.63	52.447	78891799.300	78.892
3.64	52.517	79426051.200	79.426
3.65	52.586	79961882.500	79.962
3.66	52.654	80499293.200	80.499
3.67	52.720	81038283.300	81.038
3.68	52.786	81578852.800	81.579
3.69	52.850	82121001.700	82.121
3.7	52.912	82664730.000	82.665
3.71	52.974	83210037.700	83.210
3.72	53.034	83756924.800	83.757
3.73	53.093	84305391.300	84.305
3.74	53.151	84855437.200	84.855
3.75	53.208	85407062.500	85.407
3.76	53.263	85960267.200	85.960
3.77	53.317	86515051.300	86.515
3.78	53.370	87071414.800	87.071
3.79	53.422	87629357.700	87.629
3.8	53.472	88188880.000	88.189
3.81	53.521	88749981.700	88.750
3.82	53.569	89312662.800	89.313
3.83	53.616	89876923.300	89.877
3.84	53.662	90442763.200	90.443
3.85	53.706	91010182.500	91.010
3.86	53.749	91579181.200	91.579
3.87	53.791	92149759.300	92.150
3.88	53.832	92721916.800	92.722
3.89	53.871	93295653.700	93.296
3.9	53.909	93870970.000	93.871
3.91	53.946	94447865.700	94.448
3.92	53.982	95026340.800	95.026
3.93	54.016	95606395.300	95.606

3.94	54.049	96188029.200	96.188
3.95	54.081	96771242.500	96.771
3.96	54.112	97356035.200	97.356
3.97	54.142	97942407.300	97.942
3.98	54.170	98530358.800	98.530
3.99	54.197	99119889.700	99.120
4	54.223	99711000.000	99.711

WL_{open} (amsl):	
	0.45
Vol_{open} (Mm^3):	
	0.72
WL_{breach} (amsl):	
	1.75
Vol_{breach} (Mm^3):	
	6.51
WL_{weir} (amsl):	
	0.90
Vol_{weir} (Mm^3):	
	1.5036
Weir coeffcient:	
	0.385
Weir Breadth	
	30.00
Threshold Flow	
	6.38

Date	Month	WL_{start} (gmsl)	Vol_{start} (Mm^3)
Oct-1918	10	0.45	0.717
Nov-1918	11	0.88	1.504
Dec-1918	12	0.88	1.504
Jan-1919	1	0.88	1.504
Feb-1919	2	0.88	1.504
Mar-1919	3	0.88	1.504
Apr-1919	4	0.88	1.504
May-1919	5	0.45	0.717
Jun-1919	6	0.45	0.717
Jul-1919	7	0.45	0.717
Aug-1919	8	0.45	0.717
Sep-1919	9	0.45	0.717
Oct-1919	10	0.45	0.717
Nov-1919	11	0.45	0.717
Dec-1919	12	0.45	0.717
Jan-1920	1	0.45	0.717
Feb-1920	2	0.45	0.717
Mar-1920	3	0.45	0.717
Apr-1920	4	0.45	0.717
May-1920	5	0.45	0.717
Jun-1920	6	0.45	0.717
Jul-1920	7	0.45	0.717
Aug-1920	8	0.45	0.717
Sep-1920	9	0.45	0.717
Oct-1920	10	0.45	0.717
Nov-1920	11	0.45	0.717
Dec-1920	12	0.45	0.717
Jan-1921	1	0.45	0.717
Feb-1921	2	0.45	0.717
Mar-1921	3	0.45	0.717
Apr-1921	4	0.45	0.717
May-1921	5	0.45	0.717
Jun-1921	6	0.45	0.717
Jul-1921	7	0.45	0.717
Aug-1921	8	0.45	0.717

Sep-1921	9	0.45	0.717
Oct-1921	10	0.45	0.717
Nov-1921	11	0.45	0.717
Dec-1921	12	0.45	0.717
Jan-1922	1	0.45	0.717
Feb-1922	2	0.45	0.717
Mar-1922	3	0.45	0.717
Apr-1922	4	0.45	0.717
May-1922	5	0.45	0.717
Jun-1922	6	0.45	0.717
Jul-1922	7	0.45	0.717
Aug-1922	8	0.45	0.717
Sep-1922	9	0.45	0.717
Oct-1922	10	0.45	0.717
Nov-1922	11	0.45	0.717
Dec-1922	12	0.45	0.717
Jan-1923	1	0.45	0.717
Feb-1923	2	0.45	0.717
Mar-1923	3	0.45	0.717
Apr-1923	4	0.45	0.717
May-1923	5	0.45	0.717
Jun-1923	6	0.45	0.717
Jul-1923	7	0.45	0.717
Aug-1923	8	0.45	0.717
Sep-1923	9	0.45	0.717
Oct-1923	10	0.88	1.504
Nov-1923	11	0.89	1.504
Dec-1923	12	0.89	1.504
Jan-1924	1	0.88	1.504
Feb-1924	2	0.88	1.504
Mar-1924	3	0.88	1.504
Apr-1924	4	0.45	0.717
May-1924	5	0.45	0.717
Jun-1924	6	0.45	0.717
Jul-1924	7	0.45	0.717
Aug-1924	8	0.45	0.717
Sep-1924	9	0.45	0.717
Oct-1924	10	0.89	1.504
Nov-1924	11	0.89	1.504
Dec-1924	12	0.88	1.504

Jan-1925	1	0.45	0.717
Feb-1925	2	0.45	0.717
Mar-1925	3	0.45	0.717
Apr-1925	4	0.45	0.717
May-1925	5	0.45	0.717
Jun-1925	6	0.45	0.717
Jul-1925	7	0.45	0.717
Aug-1925	8	0.45	0.717
Sep-1925	9	0.45	0.717
Oct-1925	10	0.45	0.717
Nov-1925	11	0.45	0.717
Dec-1925	12	0.45	0.717
Jan-1926	1	0.45	0.717
Feb-1926	2	0.45	0.717
Mar-1926	3	0.45	0.717
Apr-1926	4	0.45	0.717
May-1926	5	0.45	0.717
Jun-1926	6	0.45	0.717
Jul-1926	7	0.45	0.717
Aug-1926	8	0.45	0.717
Sep-1926	9	0.45	0.717
Oct-1926	10	0.88	1.504
Nov-1926	11	0.89	1.504
Dec-1926	12	0.88	1.504
Jan-1927	1	0.88	1.504
Feb-1927	2	0.88	1.504
Mar-1927	3	0.88	1.504
Apr-1927	4	0.88	1.504
May-1927	5	0.88	1.504
Jun-1927	6	0.88	1.504
Jul-1927	7	0.88	1.504
Aug-1927	8	0.88	1.504
Sep-1927	9	0.88	1.504
Oct-1927	10	0.88	1.504
Nov-1927	11	0.88	1.504
Dec-1927	12	0.88	1.504
Jan-1928	1	0.88	1.504
Feb-1928	2	0.45	0.717
Mar-1928	3	0.45	0.717
Apr-1928	4	0.45	0.717

May-1928	5	0.45	0.717
Jun-1928	6	0.45	0.717
Jul-1928	7	0.45	0.717
Aug-1928	8	0.45	0.717
Sep-1928	9	0.45	0.717
Oct-1928	10	0.88	1.504
Nov-1928	11	0.88	1.504
Dec-1928	12	0.88	1.504
Jan-1929	1	0.88	1.504
Feb-1929	2	0.88	1.504
Mar-1929	3	0.88	1.504
Apr-1929	4	0.45	0.717
May-1929	5	0.45	0.717
Jun-1929	6	0.45	0.717
Jul-1929	7	0.45	0.717
Aug-1929	8	0.45	0.717
Sep-1929	9	0.45	0.717
Oct-1929	10	0.45	0.717
Nov-1929	11	0.45	0.717
Dec-1929	12	0.45	0.717
Jan-1930	1	0.45	0.717
Feb-1930	2	0.45	0.717
Mar-1930	3	0.45	0.717
Apr-1930	4	0.45	0.717
May-1930	5	0.45	0.717
Jun-1930	6	0.45	0.717
Jul-1930	7	0.45	0.717
Aug-1930	8	0.45	0.717
Sep-1930	9	0.45	0.717
Oct-1930	10	0.45	0.717
Nov-1930	11	0.45	0.717
Dec-1930	12	0.45	0.717
Jan-1931	1	0.45	0.717
Feb-1931	2	0.45	0.717
Mar-1931	3	0.45	0.717
Apr-1931	4	0.45	0.717
May-1931	5	0.45	0.717
Jun-1931	6	0.45	0.717
Jul-1931	7	0.45	0.717
Aug-1931	8	0.88	1.504

Sep-1931	9	0.88	1.504
Oct-1931	10	0.88	1.504
Nov-1931	11	0.88	1.504
Dec-1931	12	0.88	1.504
Jan-1932	1	0.88	1.504
Feb-1932	2	0.88	1.504
Mar-1932	3	0.45	0.717
Apr-1932	4	0.45	0.717
May-1932	5	0.45	0.717
Jun-1932	6	0.45	0.717
Jul-1932	7	0.45	0.717
Aug-1932	8	0.45	0.717
Sep-1932	9	0.45	0.717
Oct-1932	10	0.45	0.717
Nov-1932	11	0.45	0.717
Dec-1932	12	0.45	0.717
Jan-1933	1	0.45	0.717
Feb-1933	2	0.45	0.717
Mar-1933	3	0.45	0.717
Apr-1933	4	0.45	0.717
May-1933	5	0.45	0.717
Jun-1933	6	0.45	0.717
Jul-1933	7	0.45	0.717
Aug-1933	8	0.45	0.717
Sep-1933	9	0.89	1.504
Oct-1933	10	0.88	1.504
Nov-1933	11	0.89	1.504
Dec-1933	12	0.88	1.504
Jan-1934	1	0.88	1.504
Feb-1934	2	0.45	0.717
Mar-1934	3	0.45	0.717
Apr-1934	4	0.45	0.717
May-1934	5	0.45	0.717
Jun-1934	6	0.45	0.717
Jul-1934	7	0.45	0.717
Aug-1934	8	0.45	0.717
Sep-1934	9	0.45	0.717
Oct-1934	10	0.45	0.717
Nov-1934	11	0.45	0.717
Dec-1934	12	0.45	0.717

Jan-1935	1	0.45	0.717
Feb-1935	2	0.45	0.717
Mar-1935	3	0.45	0.717
Apr-1935	4	0.45	0.717
May-1935	5	0.45	0.717
Jun-1935	6	0.45	0.717
Jul-1935	7	0.45	0.717
Aug-1935	8	0.45	0.717
Sep-1935	9	0.45	0.717
Oct-1935	10	0.45	0.717
Nov-1935	11	0.89	1.504
Dec-1935	12	0.88	1.504
Jan-1936	1	0.88	1.504
Feb-1936	2	0.88	1.504
Mar-1936	3	0.88	1.504
Apr-1936	4	0.45	0.717
May-1936	5	0.45	0.717
Jun-1936	6	0.45	0.717
Jul-1936	7	0.45	0.717
Aug-1936	8	0.45	0.717
Sep-1936	9	0.45	0.717
Oct-1936	10	0.45	0.717
Nov-1936	11	0.45	0.717
Dec-1936	12	0.45	0.717
Jan-1937	1	0.45	0.717
Feb-1937	2	0.45	0.717
Mar-1937	3	0.45	0.717
Apr-1937	4	0.45	0.717
May-1937	5	0.45	0.717
Jun-1937	6	0.45	0.717
Jul-1937	7	0.45	0.717
Aug-1937	8	0.45	0.717
Sep-1937	9	0.45	0.717
Oct-1937	10	0.45	0.717
Nov-1937	11	0.45	0.717
Dec-1937	12	0.45	0.717
Jan-1938	1	0.45	0.717
Feb-1938	2	0.45	0.717
Mar-1938	3	0.45	0.717
Apr-1938	4	0.45	0.717

May-1938	5	0.45	0.717
Jun-1938	6	0.45	0.717
Jul-1938	7	0.45	0.717
Aug-1938	8	0.45	0.717
Sep-1938	9	0.45	0.717
Oct-1938	10	0.45	0.717
Nov-1938	11	0.45	0.717
Dec-1938	12	0.45	0.717
Jan-1939	1	0.45	0.717
Feb-1939	2	0.45	0.717
Mar-1939	3	0.45	0.717
Apr-1939	4	0.45	0.717
May-1939	5	0.45	0.717
Jun-1939	6	0.45	0.717
Jul-1939	7	0.45	0.717
Aug-1939	8	0.45	0.717
Sep-1939	9	0.45	0.717
Oct-1939	10	0.45	0.717
Nov-1939	11	0.45	0.717
Dec-1939	12	0.45	0.717
Jan-1940	1	0.45	0.717
Feb-1940	2	0.45	0.717
Mar-1940	3	0.45	0.717
Apr-1940	4	0.45	0.717
May-1940	5	0.45	0.717
Jun-1940	6	0.45	0.717
Jul-1940	7	0.45	0.717
Aug-1940	8	0.45	0.717
Sep-1940	9	0.45	0.717
Oct-1940	10	0.45	0.717
Nov-1940	11	0.45	0.717
Dec-1940	12	0.45	0.717
Jan-1941	1	0.45	0.717
Feb-1941	2	0.45	0.717
Mar-1941	3	0.45	0.717
Apr-1941	4	0.45	0.717
May-1941	5	0.45	0.717
Jun-1941	6	0.45	0.717
Jul-1941	7	0.45	0.717
Aug-1941	8	0.45	0.717

Sep-1941	9	0.45	0.717
Oct-1941	10	0.88	1.504
Nov-1941	11	0.88	1.504
Dec-1941	12	0.88	1.504
Jan-1942	1	0.88	1.504
Feb-1942	2	0.88	1.504
Mar-1942	3	0.88	1.504
Apr-1942	4	0.45	0.717
May-1942	5	0.45	0.717
Jun-1942	6	0.45	0.717
Jul-1942	7	0.45	0.717
Aug-1942	8	0.45	0.717
Sep-1942	9	0.45	0.717
Oct-1942	10	0.45	0.717
Nov-1942	11	0.45	0.717
Dec-1942	12	0.45	0.717
Jan-1943	1	0.45	0.717
Feb-1943	2	0.45	0.717
Mar-1943	3	0.45	0.717
Apr-1943	4	0.45	0.717
May-1943	5	0.45	0.717
Jun-1943	6	0.45	0.717
Jul-1943	7	0.45	0.717
Aug-1943	8	0.45	0.717
Sep-1943	9	0.45	0.717
Oct-1943	10	0.45	0.717
Nov-1943	11	0.45	0.717
Dec-1943	12	0.45	0.717
Jan-1944	1	0.45	0.717
Feb-1944	2	0.45	0.717
Mar-1944	3	0.45	0.717
Apr-1944	4	0.45	0.717
May-1944	5	0.45	0.717
Jun-1944	6	0.45	0.717
Jul-1944	7	0.45	0.717
Aug-1944	8	0.45	0.717
Sep-1944	9	0.45	0.717
Oct-1944	10	0.45	0.717
Nov-1944	11	0.45	0.717
Dec-1944	12	0.45	0.717

Jan-1945	1	0.45	0.717
Feb-1945	2	0.45	0.717
Mar-1945	3	0.45	0.717
Apr-1945	4	0.45	0.717
May-1945	5	0.45	0.717
Jun-1945	6	0.45	0.717
Jul-1945	7	0.45	0.717
Aug-1945	8	0.45	0.717
Sep-1945	9	0.45	0.717
Oct-1945	10	0.88	1.504
Nov-1945	11	0.88	1.504
Dec-1945	12	0.88	1.504
Jan-1946	1	0.88	1.504
Feb-1946	2	0.88	1.504
Mar-1946	3	0.88	1.504
Apr-1946	4	0.88	1.504
May-1946	5	0.88	1.504
Jun-1946	6	0.88	1.504
Jul-1946	7	0.88	1.504
Aug-1946	8	0.88	1.504
Sep-1946	9	0.88	1.504
Oct-1946	10	0.88	1.504
Nov-1946	11	0.88	1.504
Dec-1946	12	0.88	1.504
Jan-1947	1	0.88	1.504
Feb-1947	2	0.88	1.504
Mar-1947	3	0.45	0.717
Apr-1947	4	0.45	0.717
May-1947	5	0.45	0.717
Jun-1947	6	0.45	0.717
Jul-1947	7	0.45	0.717
Aug-1947	8	0.45	0.717
Sep-1947	9	0.45	0.717
Oct-1947	10	0.45	0.717
Nov-1947	11	0.45	0.717
Dec-1947	12	0.45	0.717
Jan-1948	1	0.45	0.717
Feb-1948	2	0.45	0.717
Mar-1948	3	0.45	0.717
Apr-1948	4	0.45	0.717

May-1948	5	0.45	0.717
Jun-1948	6	0.45	0.717
Jul-1948	7	0.45	0.717
Aug-1948	8	0.45	0.717
Sep-1948	9	0.89	1.504
Oct-1948	10	0.89	1.504
Nov-1948	11	0.89	1.504
Dec-1948	12	0.89	1.504
Jan-1949	1	0.89	1.504
Feb-1949	2	0.88	1.504
Mar-1949	3	0.45	0.717
Apr-1949	4	0.45	0.717
May-1949	5	0.45	0.717
Jun-1949	6	0.45	0.717
Jul-1949	7	0.45	0.717
Aug-1949	8	0.45	0.717
Sep-1949	9	0.45	0.717
Oct-1949	10	0.45	0.717
Nov-1949	11	0.45	0.717
Dec-1949	12	0.45	0.717
Jan-1950	1	0.45	0.717
Feb-1950	2	0.45	0.717
Mar-1950	3	0.45	0.717
Apr-1950	4	0.45	0.717
May-1950	5	0.45	0.717
Jun-1950	6	0.45	0.717
Jul-1950	7	0.45	0.717
Aug-1950	8	0.45	0.717
Sep-1950	9	0.45	0.717
Oct-1950	10	0.88	1.504
Nov-1950	11	0.88	1.504
Dec-1950	12	0.88	1.504
Jan-1951	1	0.88	1.504
Feb-1951	2	0.88	1.504
Mar-1951	3	0.88	1.504
Apr-1951	4	0.88	1.504
May-1951	5	0.88	1.504
Jun-1951	6	0.88	1.504
Jul-1951	7	0.88	1.504
Aug-1951	8	0.88	1.504

	Sep-1951	9	0.88	1.504
	Oct-1951	10	0.88	1.504
	Nov-1951	11	0.88	1.504
	Dec-1951	12	0.88	1.504
	Jan-1952	1	0.88	1.504
	Feb-1952	2	0.88	1.504
	Mar-1952	3	0.88	1.504
	Apr-1952	4	0.88	1.504
	May-1952	5	0.88	1.504
	Jun-1952	6	0.88	1.504
	Jul-1952	7	0.88	1.504
	Aug-1952	8	0.88	1.504
	Sep-1952	9	0.88	1.504
	Oct-1952	10	0.88	1.504
	Nov-1952	11	0.89	1.504
	Dec-1952	12	0.88	1.504
	Jan-1953	1	0.88	1.504
	Feb-1953	2	0.88	1.504
	Mar-1953	3	0.88	1.504
	Apr-1953	4	0.88	1.504
	May-1953	5	0.88	1.504
####	Jun-1953	6	0.88	1.504
	Jul-1953	7	0.88	1.504
	Aug-1953	8	0.88	1.504
	Sep-1953	9	0.88	1.504
	Oct-1953	10	0.88	1.504
	Nov-1953	11	0.88	1.504
	Dec-1953	12	0.88	1.504
	Jan-1954	1	0.88	1.504
	Feb-1954	2	0.88	1.504
	Mar-1954	3	0.88	1.504
	Apr-1954	4	0.88	1.504
	May-1954	5	0.88	1.504
	Jun-1954	6	0.88	1.504
	Jul-1954	7	0.88	1.504
	Aug-1954	8	0.88	1.504
	Sep-1954	9	0.88	1.504
	Oct-1954	10	0.88	1.504
	Nov-1954	11	0.88	1.504
	Dec-1954	12	0.88	1.504

Jan-1955	1	0.88	1.504
Feb-1955	2	0.45	0.717
Mar-1955	3	0.45	0.717
Apr-1955	4	0.45	0.717
May-1955	5	0.45	0.717
Jun-1955	6	0.45	0.717
Jul-1955	7	0.45	0.717
Aug-1955	8	0.45	0.717
Sep-1955	9	0.45	0.717
Oct-1955	10	0.45	0.717
Nov-1955	11	0.89	1.504
Dec-1955	12	0.88	1.504
Jan-1956	1	0.88	1.504
Feb-1956	2	0.88	1.504
Mar-1956	3	0.45	0.717
Apr-1956	4	0.45	0.717
May-1956	5	0.45	0.717
Jun-1956	6	0.45	0.717
Jul-1956	7	0.45	0.717
Aug-1956	8	0.45	0.717
Sep-1956	9	0.45	0.717
Oct-1956	10	0.45	0.717
Nov-1956	11	0.45	0.717
Dec-1956	12	0.45	0.717
Jan-1957	1	0.45	0.717
Feb-1957	2	0.45	0.717
Mar-1957	3	0.45	0.717
Apr-1957	4	0.45	0.717
May-1957	5	0.45	0.717
Jun-1957	6	0.45	0.717
Jul-1957	7	0.45	0.717
Aug-1957	8	0.45	0.717
Sep-1957	9	0.45	0.717
Oct-1957	10	0.45	0.717
Nov-1957	11	0.45	0.717
Dec-1957	12	0.45	0.717
Jan-1958	1	0.45	0.717
Feb-1958	2	0.45	0.717
Mar-1958	3	0.45	0.717
Apr-1958	4	0.45	0.717

May-1958	5	0.45	0.717
Jun-1958	6	0.45	0.717
Jul-1958	7	0.45	0.717
Aug-1958	8	0.45	0.717
Sep-1958	9	0.45	0.717
Oct-1958	10	0.45	0.717
Nov-1958	11	0.45	0.717
Dec-1958	12	0.45	0.717
Jan-1959	1	0.45	0.717
Feb-1959	2	0.45	0.717
Mar-1959	3	0.45	0.717
Apr-1959	4	0.45	0.717
May-1959	5	0.45	0.717
Jun-1959	6	0.45	0.717
Jul-1959	7	0.45	0.717
Aug-1959	8	0.45	0.717
Sep-1959	9	0.45	0.717
Oct-1959	10	0.88	1.504
Nov-1959	11	0.88	1.504
Dec-1959	12	0.88	1.504
Jan-1960	1	0.88	1.504
Feb-1960	2	0.88	1.504
Mar-1960	3	0.45	0.717
Apr-1960	4	0.45	0.717
May-1960	5	0.45	0.717
Jun-1960	6	0.45	0.717
Jul-1960	7	0.45	0.717
Aug-1960	8	0.45	0.717
Sep-1960	9	0.45	0.717
Oct-1960	10	0.45	0.717
Nov-1960	11	0.45	0.717
Dec-1960	12	0.45	0.717
Jan-1961	1	0.45	0.717
Feb-1961	2	0.45	0.717
Mar-1961	3	0.45	0.717
Apr-1961	4	0.45	0.717
May-1961	5	0.45	0.717
Jun-1961	6	0.45	0.717
Jul-1961	7	0.45	0.717
Aug-1961	8	0.45	0.717

Sep-1961	9	0.45	0.717
Oct-1961	10	0.45	0.717
Nov-1961	11	0.45	0.717
Dec-1961	12	0.45	0.717
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Feb-1962	2	0.45	0.717
Mar-1962	3	0.45	0.717
Apr-1962	4	0.45	0.717
May-1962	5	0.45	0.717
Jun-1962	6	0.45	0.717
Jul-1962	7	0.45	0.717
Aug-1962	8	0.45	0.717
Sep-1962	9	0.88	1.504
Oct-1962	10	0.88	1.504
Nov-1962	11	0.89	1.504
Dec-1962	12	0.88	1.504
Jan-1963	1	0.88	1.504
Feb-1963	2	0.45	0.717
Mar-1963	3	0.45	0.717
Apr-1963	4	0.45	0.717
May-1963	5	0.45	0.717
Jun-1963	6	0.45	0.717
Jul-1963	7	0.45	0.717
Aug-1963	8	0.45	0.717
Sep-1963	9	0.45	0.717
Oct-1963	10	0.45	0.717
Nov-1963	11	0.45	0.717
Dec-1963	12	0.45	0.717
Jan-1964	1	0.45	0.717
Feb-1964	2	0.45	0.717
Mar-1964	3	0.45	0.717
Apr-1964	4	0.45	0.717
May-1964	5	0.45	0.717
Jun-1964	6	0.45	0.717
Jul-1964	7	0.45	0.717
Aug-1964	8	0.45	0.717
Sep-1964	9	0.45	0.717
Oct-1964	10	0.88	1.504
Nov-1964	11	0.88	1.504
Dec-1964	12	0.88	1.504

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Feb-1965	2	0.88	1.504
Mar-1965	3	0.88	1.504
Apr-1965	4	0.89	1.504
May-1965	5	0.89	1.504
Jun-1965	6	0.89	1.504
Jul-1965	7	0.89	1.504
Aug-1965	8	0.89	1.504
Sep-1965	9	0.89	1.504
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Nov-1965	11	0.88	1.504
Dec-1965	12	0.88	1.504
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Apr-1966	4	0.45	0.717
May-1966	5	0.45	0.717
Jun-1966	6	0.45	0.717
Jul-1966	7	0.45	0.717
Aug-1966	8	0.45	0.717
Sep-1966	9	0.88	1.504
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Nov-1966	11	0.88	1.504
Dec-1966	12	0.88	1.504
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Feb-1967	2	0.88	1.504
Mar-1967	3	0.45	0.717
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Jul-1967	7	0.45	0.717
Aug-1967	8	0.45	0.717
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Nov-1967	11	0.45	0.717
Dec-1967	12	0.45	0.717
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Feb-1968	2	0.45	0.717
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Apr-1968	4	0.45	0.717

May-1968	5	0.45	0.717
Jun-1968	6	0.45	0.717
Jul-1968	7	0.45	0.717
Aug-1968	8	0.45	0.717
Sep-1968	9	0.88	1.504
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Nov-1968	11	0.88	1.504
Dec-1968	12	0.88	1.504
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Feb-1969	2	0.88	1.504
Mar-1969	3	0.88	1.504
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Jul-1969	7	0.45	0.717
Aug-1969	8	0.45	0.717
Sep-1969	9	0.45	0.717
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Dec-1969	12	0.88	1.504
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Dec-1970	12	0.88	1.504
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Dec-1984	12	0.45	0.717

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Feb-1986	2	0.45	0.717
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Apr-1986	4	0.45	0.717
May-1986	5	0.45	0.717
Jun-1986	6	0.45	0.717
Jul-1986	7	0.45	0.717
Aug-1986	8	0.45	0.717
Sep-1986	9	0.45	0.717
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Nov-1986	11	0.88	1.504
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Jul-1987	7	0.45	0.717
Aug-1987	8	0.45	0.717
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Jul-1988	7	0.45	0.717
Aug-1988	8	0.45	0.717
Sep-1988	9	0.45	0.717
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Dec-1988	12	0.45	0.717
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Feb-1989	2	0.45	0.717
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May-1989	5	0.45	0.717
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Dec-1991	12	0.45	0.717
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Jun-1992	6	0.45	0.717
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Sep-1992	9	0.89	1.504
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Nov-1992	11	0.88	1.504
Dec-1992	12	0.88	1.504
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Feb-1993	2	0.88	1.504
Mar-1993	3	0.88	1.504
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May-1993	5	0.88	1.504
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Apr-1994	4	0.45	0.717
May-1994	5	0.45	0.717
Jun-1994	6	0.45	0.717
Jul-1994	7	0.45	0.717
Aug-1994	8	0.45	0.717
Sep-1994	9	0.45	0.717
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Nov-1994	11	0.88	1.504
Dec-1994	12	0.88	1.504

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Mar-1995	3	0.88	1.504
Apr-1995	4	0.88	1.504
May-1995	5	0.88	1.504
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Jun-1996	6	0.45	0.717
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Dec-1996	12	0.45	0.717
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Feb-1997	2	0.45	0.717
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May-1997	5	0.45	0.717
Jun-1997	6	0.45	0.717
Jul-1997	7	0.45	0.717
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Apr-2001	4	0.45	0.717
May-2001	5	0.45	0.717
Jun-2001	6	0.45	0.717
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Aug-2001	8	0.45	0.717

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Nov-2001	11	0.89	1.504
Dec-2001	12	0.88	1.504
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Feb-2002	2	0.88	1.504
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Dec-2003	12	0.89	1.504
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Feb-2004	2	0.89	1.504
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Jul-2004	7	0.45	0.717
Aug-2004	8	0.45	0.717
Sep-2004	9	0.45	0.717
Oct-2004	10	0.88	1.504
Nov-2004	11	0.88	1.504
Dec-2004	12	0.88	1.504

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Feb-2005	2	0.88	1.504
Mar-2005	3	0.88	1.504
Apr-2005	4	0.45	0.717
May-2005	5	0.45	0.717
Jun-2005	6	0.45	0.717
Jul-2005	7	0.45	0.717
Aug-2005	8	0.45	0.717
Sep-2005	9	0.45	0.717
Oct-2005	10	0.88	1.504
Nov-2005	11	0.88	1.504
Dec-2005	12	0.88	1.504
Jan-2006	1	0.88	1.504
Feb-2006	2	0.88	1.504
Mar-2006	3	0.88	1.504
Apr-2006	4	0.88	1.504
May-2006	5	0.88	1.504
Jun-2006	6	0.88	1.504
Jul-2006	7	0.88	1.504
Aug-2006	8	0.88	1.504
Sep-2006	9	0.88	1.504
Oct-2006	10	0.88	1.504
Nov-2006	11	0.88	1.504
Dec-2006	12	0.88	1.504
Jan-2007	1	0.45	0.717
Feb-2007	2	0.45	0.717
Mar-2007	3	0.45	0.717
Apr-2007	4	0.45	0.717
May-2007	5	0.45	0.717
Jun-2007	6	0.45	0.717
Jul-2007	7	0.45	0.717
Aug-2007	8	0.45	0.717
Sep-2007	9	0.89	1.504
Oct-2007	10	0.89	1.504
Nov-2007	11	0.89	1.504
Dec-2007	12	0.89	1.504
Jan-2008	1	0.89	1.504
Feb-2008	2	0.89	1.504
Mar-2008	3	0.89	1.504
Apr-2008	4	0.89	1.504

May-2008	5	0.89	1.504
Jun-2008	6	0.89	1.504
Jul-2008	7	0.89	1.504
Aug-2008	8	0.89	1.504
Sep-2008	9	0.89	1.504
Oct-2008	10	0.89	1.504
Nov-2008	11	0.89	1.504
Dec-2008	12	0.89	1.504
Jan-2009	1	0.89	1.504
Feb-2009	2	0.89	1.504
Mar-2009	3	0.89	1.504
Apr-2009	4	0.89	1.504
May-2009	5	0.89	1.504
Jun-2009	6	0.89	1.504
Jul-2009	7	0.89	1.504
Aug-2009	8	0.89	1.504
Sep-2009	9	0.89	1.504
Oct-2009	10	0.89	1.504
Nov-2009	11	0.89	1.504
Dec-2009	12	0.89	1.504
Jan-2010	1	0.89	1.504
Feb-2010	2	0.89	1.504
Mar-2010	3	0.89	1.504
Apr-2010	4	0.89	1.504
May-2010	5	0.89	1.504
Jun-2010	6	0.89	1.504
Jul-2010	7	0.89	1.504

Prev. Mouth State 1 = closed 0 = open	Area$_{start}$ (km^2)	Simulated Mfolozi Flow (Mm^3/month)	Rainfall on inundated area (Mm^3 /month)	Evaporation on inundated area (Mm^3 /month)
1	0.899	0.437	0.068	0.098
1	1.941	0.990	0.213	0.227
1	1.941	18.926	0.227	0.254
1	1.941	30.249	0.255	0.254
1	1.941	48.631	0.270	0.221
1	1.941	48.631	0.277	0.219
1	1.941	67.484	0.157	0.167
0	0.899	57.145	0.058	0.069
0	0.899	26.348	0.046	0.058
0	0.899	12.832	0.039	0.062
0	0.899	8.664	0.039	0.084
0	0.899	6.597	0.068	0.098
0	0.899	5.385	0.087	0.114
0	0.899	12.832	0.098	0.105
0	0.899	15.694	0.105	0.118
0	0.899	324.162	0.118	0.118
0	0.899	324.162	0.125	0.102
0	0.899	681.022	0.128	0.102
0	0.899	253.716	0.073	0.077
0	0.899	88.059	0.058	0.069
0	0.899	48.631	0.046	0.058
0	0.899	26.348	0.039	0.062
0	0.899	12.832	0.039	0.084
0	0.899	10.436	0.068	0.098
0	0.899	35.009	0.087	0.114
0	0.899	48.631	0.098	0.105
0	0.899	88.059	0.105	0.118
0	0.899	88.059	0.118	0.118
0	0.899	67.484	0.125	0.102
0	0.899	136.263	0.128	0.102
0	0.899	67.484	0.073	0.077
0	0.899	40.978	0.058	0.069
0	0.899	18.926	0.046	0.058
0	0.899	10.436	0.039	0.062
0	0.899	5.385	0.039	0.084

0	0.899	8.664	0.068	0.098
0	0.899	22.314	0.087	0.114
0	0.899	125.197	0.098	0.105
0	0.899	143.388	0.105	0.118
0	0.899	88.059	0.118	0.118
0	0.899	88.059	0.125	0.102
0	0.899	67.484	0.128	0.102
0	0.899	40.978	0.073	0.077
0	0.899	26.348	0.058	0.069
0	0.899	12.832	0.046	0.058
0	0.899	6.597	0.039	0.062
0	0.899	10.436	0.039	0.084
0	0.899	5.385	0.068	0.098
0	0.899	12.832	0.087	0.114
0	0.899	26.348	0.098	0.105
0	0.899	35.009	0.105	0.118
0	0.899	136.263	0.118	0.118
0	0.899	119.287	0.125	0.102
0	0.899	67.484	0.128	0.102
0	0.899	35.009	0.073	0.077
0	0.899	15.694	0.058	0.069
0	0.899	6.597	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	2.507	0.039	0.084
1	0.899	0.990	0.068	0.098
1	1.941	2.507	0.188	0.245
1	1.978	3.687	0.217	0.232
1	1.978	15.694	0.231	0.259
1	1.941	15.694	0.255	0.254
1	1.941	30.249	0.270	0.221
1	1.941	57.145	0.277	0.219
0	0.899	35.009	0.073	0.077
0	0.899	26.348	0.058	0.069
0	0.899	12.832	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	8.664	0.068	0.098
1	1.978	10.436	0.191	0.250
1	1.978	30.249	0.217	0.232
1	1.941	88.059	0.227	0.254

0	0.899	125.197	0.118	0.118
0	0.899	240.477	0.125	0.102
0	0.899	3220.071	0.128	0.102
0	0.899	1133.845	0.073	0.077
0	0.899	789.977	0.058	0.069
0	0.899	585.479	0.046	0.058
0	0.899	240.477	0.039	0.062
0	0.899	67.484	0.039	0.084
0	0.899	67.484	0.068	0.098
0	0.899	67.484	0.087	0.114
0	0.899	57.145	0.098	0.105
0	0.899	57.145	0.105	0.118
0	0.899	57.145	0.118	0.118
0	0.899	48.631	0.125	0.102
0	0.899	57.145	0.128	0.102
0	0.899	30.249	0.073	0.077
0	0.899	18.926	0.058	0.069
0	0.899	12.832	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	2.841	0.039	0.084
1	0.899	5.385	0.068	0.098
1	1.941	6.597	0.188	0.245
1	1.978	10.436	0.217	0.232
1	1.941	15.694	0.227	0.254
1	1.941	18.926	0.255	0.254
1	1.941	30.249	0.270	0.221
1	1.941	48.631	0.277	0.219
1	1.941	26.348	0.157	0.167
1	1.941	15.694	0.126	0.149
1	1.941	8.664	0.099	0.125
1	1.941	8.664	0.084	0.133
1	1.941	5.385	0.084	0.182
1	1.941	3.687	0.146	0.212
1	1.941	12.832	0.188	0.245
1	1.941	15.694	0.213	0.227
1	1.941	35.009	0.227	0.254
1	1.941	67.484	0.255	0.254
0	0.899	67.484	0.125	0.102
0	0.899	48.631	0.128	0.102
0	0.899	35.009	0.073	0.077

0	0.899	26.348	0.058	0.069
0	0.899	10.436	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	5.385	0.068	0.098
1	1.941	5.385	0.188	0.245
1	1.941	6.597	0.213	0.227
1	1.941	10.436	0.227	0.254
1	1.941	22.314	0.255	0.254
1	1.941	18.926	0.270	0.221
1	1.941	136.263	0.277	0.219
0	0.899	67.484	0.073	0.077
0	0.899	35.009	0.058	0.069
0	0.899	30.249	0.046	0.058
0	0.899	18.926	0.039	0.062
0	0.899	10.436	0.039	0.084
0	0.899	22.314	0.068	0.098
0	0.899	35.009	0.087	0.114
0	0.899	35.009	0.098	0.105
0	0.899	35.009	0.105	0.118
0	0.899	215.008	0.118	0.118
0	0.899	136.263	0.125	0.102
0	0.899	136.263	0.128	0.102
0	0.899	67.484	0.073	0.077
0	0.899	30.249	0.058	0.069
0	0.899	18.926	0.046	0.058
0	0.899	10.436	0.039	0.062
0	0.899	6.597	0.039	0.084
0	0.899	8.664	0.068	0.098
0	0.899	6.597	0.087	0.114
0	0.899	10.436	0.098	0.105
0	0.899	15.694	0.105	0.118
0	0.899	18.926	0.118	0.118
0	0.899	22.314	0.125	0.102
0	0.899	22.314	0.128	0.102
0	0.899	12.832	0.073	0.077
0	0.899	6.597	0.058	0.069
0	0.899	3.687	0.046	0.058
1	0.899	2.841	0.039	0.062
1	1.941	1.898	0.084	0.182

1	1.941	0.990	0.146	0.212
1	1.941	1.898	0.188	0.245
1	1.941	5.385	0.213	0.227
1	1.941	8.664	0.227	0.254
1	1.941	10.436	0.255	0.254
1	1.941	125.197	0.270	0.221
0	0.899	143.388	0.128	0.102
0	0.899	253.716	0.073	0.077
0	0.899	253.716	0.058	0.069
0	0.899	88.059	0.046	0.058
0	0.899	35.009	0.039	0.062
0	0.899	15.694	0.039	0.084
0	0.899	10.436	0.068	0.098
0	0.899	10.436	0.087	0.114
0	0.899	15.694	0.098	0.105
0	0.899	40.978	0.105	0.118
0	0.899	48.631	0.118	0.118
0	0.899	57.145	0.125	0.102
0	0.899	40.978	0.128	0.102
0	0.899	22.314	0.073	0.077
0	0.899	10.436	0.058	0.069
0	0.899	5.385	0.046	0.058
0	0.899	3.687	0.039	0.062
1	0.899	2.507	0.039	0.084
1	1.978	1.898	0.149	0.216
1	1.941	2.507	0.188	0.245
1	1.978	12.832	0.217	0.232
1	1.941	35.009	0.227	0.254
1	1.941	88.059	0.255	0.254
0	0.899	119.287	0.125	0.102
0	0.899	88.059	0.128	0.102
0	0.899	57.145	0.073	0.077
0	0.899	35.009	0.058	0.069
0	0.899	26.348	0.046	0.058
0	0.899	18.926	0.039	0.062
0	0.899	15.694	0.039	0.084
0	0.899	8.664	0.068	0.098
0	0.899	8.664	0.087	0.114
0	0.899	18.926	0.098	0.105
0	0.899	57.145	0.105	0.118

0	0.899	57.145	0.118	0.118
0	0.899	48.631	0.125	0.102
0	0.899	48.631	0.128	0.102
0	0.899	30.249	0.073	0.077
0	0.899	22.314	0.058	0.069
0	0.899	15.694	0.046	0.058
0	0.899	8.664	0.039	0.062
0	0.899	6.597	0.039	0.084
0	0.899	3.687	0.068	0.098
1	0.899	2.841	0.087	0.114
1	1.978	2.841	0.217	0.232
1	1.941	5.385	0.227	0.254
1	1.941	18.926	0.255	0.254
1	1.941	48.631	0.270	0.221
1	1.941	67.484	0.277	0.219
0	0.899	40.978	0.073	0.077
0	0.899	57.145	0.058	0.069
0	0.899	30.249	0.046	0.058
0	0.899	15.694	0.039	0.062
0	0.899	6.597	0.039	0.084
0	0.899	5.385	0.068	0.098
0	0.899	10.436	0.087	0.114
0	0.899	40.978	0.098	0.105
0	0.899	26.348	0.105	0.118
0	0.899	88.059	0.118	0.118
0	0.899	182.916	0.125	0.102
0	0.899	125.197	0.128	0.102
0	0.899	88.059	0.073	0.077
0	0.899	30.249	0.058	0.069
0	0.899	15.694	0.046	0.058
0	0.899	10.436	0.039	0.062
0	0.899	6.597	0.039	0.084
0	0.899	6.597	0.068	0.098
0	0.899	5.385	0.087	0.114
0	0.899	8.664	0.098	0.105
0	0.899	48.631	0.105	0.118
0	0.899	57.145	0.118	0.118
0	0.899	88.059	0.125	0.102
0	0.899	57.145	0.128	0.102
0	0.899	57.145	0.073	0.077

0	0.899	26.348	0.058	0.069
0	0.899	22.314	0.046	0.058
0	0.899	15.694	0.039	0.062
0	0.899	10.436	0.039	0.084
0	0.899	6.597	0.068	0.098
0	0.899	12.832	0.087	0.114
0	0.899	12.832	0.098	0.105
0	0.899	40.978	0.105	0.118
0	0.899	48.631	0.118	0.118
0	0.899	240.477	0.125	0.102
0	0.899	253.716	0.128	0.102
0	0.899	125.197	0.073	0.077
0	0.899	88.059	0.058	0.069
0	0.899	40.978	0.046	0.058
0	0.899	30.249	0.039	0.062
0	0.899	15.694	0.039	0.084
0	0.899	18.926	0.068	0.098
0	0.899	18.926	0.087	0.114
0	0.899	57.145	0.098	0.105
0	0.899	57.145	0.105	0.118
0	0.899	88.059	0.118	0.118
0	0.899	48.631	0.125	0.102
0	0.899	67.484	0.128	0.102
0	0.899	48.631	0.073	0.077
0	0.899	88.059	0.058	0.069
0	0.899	119.287	0.046	0.058
0	0.899	48.631	0.039	0.062
0	0.899	26.348	0.039	0.084
0	0.899	22.314	0.068	0.098
0	0.899	15.694	0.087	0.114
0	0.899	40.978	0.098	0.105
0	0.899	88.059	0.105	0.118
0	0.899	67.484	0.118	0.118
0	0.899	48.631	0.125	0.102
0	0.899	35.009	0.128	0.102
0	0.899	35.009	0.073	0.077
0	0.899	15.694	0.058	0.069
0	0.899	8.664	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	2.841	0.039	0.084

1	0.899	2.841	0.068	0.098
1	1.941	2.841	0.188	0.245
1	1.941	8.664	0.213	0.227
1	1.941	8.664	0.227	0.254
1	1.941	30.249	0.255	0.254
1	1.941	40.978	0.270	0.221
1	1.941	88.059	0.277	0.219
0	0.899	48.631	0.073	0.077
0	0.899	30.249	0.058	0.069
0	0.899	22.314	0.046	0.058
0	0.899	10.436	0.039	0.062
0	0.899	8.664	0.039	0.084
0	0.899	10.436	0.068	0.098
0	0.899	10.436	0.087	0.114
0	0.899	26.348	0.098	0.105
0	0.899	88.059	0.105	0.118
0	0.899	67.484	0.118	0.118
0	0.899	88.059	0.125	0.102
0	0.899	253.716	0.128	0.102
0	0.899	324.162	0.073	0.077
0	0.899	215.008	0.058	0.069
0	0.899	88.059	0.046	0.058
0	0.899	67.484	0.039	0.062
0	0.899	67.484	0.039	0.084
0	0.899	35.009	0.068	0.098
0	0.899	57.145	0.087	0.114
0	0.899	88.059	0.098	0.105
0	0.899	125.197	0.105	0.118
0	0.899	88.059	0.118	0.118
0	0.899	215.008	0.125	0.102
0	0.899	119.287	0.128	0.102
0	0.899	57.145	0.073	0.077
0	0.899	22.314	0.058	0.069
0	0.899	35.009	0.046	0.058
0	0.899	18.926	0.039	0.062
0	0.899	10.436	0.039	0.084
0	0.899	22.314	0.068	0.098
0	0.899	22.314	0.087	0.114
0	0.899	30.249	0.098	0.105
0	0.899	35.009	0.105	0.118

0	0.899	48.631	0.118	0.118
0	0.899	67.484	0.125	0.102
0	0.899	240.477	0.128	0.102
0	0.899	88.059	0.073	0.077
0	0.899	40.978	0.058	0.069
0	0.899	18.926	0.046	0.058
0	0.899	8.664	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	2.841	0.068	0.098
1	1.941	2.841	0.188	0.245
1	1.941	2.507	0.213	0.227
1	1.941	5.385	0.227	0.254
1	1.941	35.009	0.255	0.254
1	1.941	30.249	0.270	0.221
1	1.941	48.631	0.277	0.219
1	1.941	30.249	0.157	0.167
1	1.941	12.832	0.126	0.149
1	1.941	6.597	0.099	0.125
1	1.941	3.687	0.084	0.133
1	1.941	2.507	0.084	0.182
1	1.941	2.507	0.146	0.212
1	1.941	5.385	0.188	0.245
1	1.941	8.664	0.213	0.227
1	1.941	18.926	0.227	0.254
1	1.941	26.348	0.255	0.254
1	1.941	67.484	0.270	0.221
0	0.899	67.484	0.128	0.102
0	0.899	48.631	0.073	0.077
0	0.899	22.314	0.058	0.069
0	0.899	15.694	0.046	0.058
0	0.899	10.436	0.039	0.062
0	0.899	5.385	0.039	0.084
0	0.899	5.385	0.068	0.098
0	0.899	6.597	0.087	0.114
0	0.899	22.314	0.098	0.105
0	0.899	30.249	0.105	0.118
0	0.899	30.249	0.118	0.118
0	0.899	40.978	0.125	0.102
0	0.899	48.631	0.128	0.102
0	0.899	40.978	0.073	0.077

0	0.899	18.926	0.058	0.069
0	0.899	8.664	0.046	0.058
0	0.899	3.687	0.039	0.062
1	0.899	2.507	0.039	0.084
1	1.978	2.841	0.149	0.216
1	1.978	5.385	0.191	0.250
1	1.978	12.832	0.217	0.232
1	1.978	15.694	0.231	0.259
1	1.978	48.631	0.259	0.259
1	1.941	57.145	0.270	0.221
0	0.899	57.145	0.128	0.102
0	0.899	125.197	0.073	0.077
0	0.899	48.631	0.058	0.069
0	0.899	30.249	0.046	0.058
0	0.899	12.832	0.039	0.062
0	0.899	6.597	0.039	0.084
0	0.899	5.385	0.068	0.098
0	0.899	12.832	0.087	0.114
0	0.899	18.926	0.098	0.105
0	0.899	67.484	0.105	0.118
0	0.899	67.484	0.118	0.118
0	0.899	67.484	0.125	0.102
0	0.899	88.059	0.128	0.102
0	0.899	48.631	0.073	0.077
0	0.899	30.249	0.058	0.069
0	0.899	12.832	0.046	0.058
0	0.899	6.597	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	2.841	0.068	0.098
1	1.941	3.687	0.188	0.245
1	1.941	3.687	0.213	0.227
1	1.941	18.926	0.227	0.254
1	1.941	22.314	0.255	0.254
1	1.941	15.694	0.270	0.221
1	1.941	30.249	0.277	0.219
1	1.941	26.348	0.157	0.167
1	1.941	12.832	0.126	0.149
1	1.941	8.664	0.099	0.125
1	1.941	3.687	0.084	0.133
1	1.941	12.832	0.084	0.182

1	1.941	8.664	0.146	0.212
1	1.941	15.694	0.188	0.245
1	1.941	8.664	0.213	0.227
1	1.941	26.348	0.227	0.254
1	1.941	26.348	0.255	0.254
1	1.941	26.348	0.270	0.221
1	1.941	22.314	0.277	0.219
1	1.941	12.832	0.157	0.167
1	1.941	10.436	0.126	0.149
1	1.941	6.597	0.099	0.125
1	1.941	6.597	0.084	0.133
1	1.941	3.687	0.084	0.182
1	1.941	2.507	0.146	0.212
1	1.941	2.507	0.188	0.245
1	1.978	10.436	0.217	0.232
1	1.941	30.249	0.227	0.254
1	1.941	30.249	0.255	0.254
1	1.941	40.978	0.270	0.221
1	1.941	35.009	0.277	0.219
1	1.941	26.348	0.157	0.167
1	1.941	12.832	0.126	0.149
1	1.941	6.597	0.099	0.125
1	1.941	3.687	0.084	0.133
1	1.941	2.841	0.084	0.182
1	1.941	2.841	0.146	0.212
1	1.941	3.687	0.188	0.245
1	1.941	12.832	0.213	0.227
1	1.941	15.694	0.227	0.254
1	1.941	18.926	0.255	0.254
1	1.941	40.978	0.270	0.221
1	1.941	35.009	0.277	0.219
1	1.941	35.009	0.157	0.167
1	1.941	35.009	0.126	0.149
1	1.941	18.926	0.099	0.125
1	1.941	8.664	0.084	0.133
1	1.941	5.385	0.084	0.182
1	1.941	8.664	0.146	0.212
1	1.941	30.249	0.188	0.245
1	1.941	40.978	0.213	0.227
1	1.941	30.249	0.227	0.254

1	1.941	88.059	0.255	0.254
0	0.899	88.059	0.125	0.102
0	0.899	182.916	0.128	0.102
0	0.899	88.059	0.073	0.077
0	0.899	40.978	0.058	0.069
0	0.899	18.926	0.046	0.058
0	0.899	8.664	0.039	0.062
0	0.899	5.385	0.039	0.084
0	0.899	3.687	0.068	0.098
1	0.899	10.436	0.087	0.114
1	1.978	26.348	0.217	0.232
1	1.941	40.978	0.227	0.254
1	1.941	22.314	0.255	0.254
1	1.941	143.388	0.270	0.221
0	0.899	143.388	0.128	0.102
0	0.899	57.145	0.073	0.077
0	0.899	40.978	0.058	0.069
0	0.899	22.314	0.046	0.058
0	0.899	10.436	0.039	0.062
0	0.899	6.597	0.039	0.084
0	0.899	8.664	0.068	0.098
0	0.899	22.314	0.087	0.114
0	0.899	40.978	0.098	0.105
0	0.899	215.008	0.105	0.118
0	0.899	240.477	0.118	0.118
0	0.899	253.716	0.125	0.102
0	0.899	240.477	0.128	0.102
0	0.899	253.716	0.073	0.077
0	0.899	88.059	0.058	0.069
0	0.899	40.978	0.046	0.058
0	0.899	40.978	0.039	0.062
0	0.899	22.314	0.039	0.084
0	0.899	119.287	0.068	0.098
0	0.899	324.162	0.087	0.114
0	0.899	215.008	0.098	0.105
0	0.899	182.916	0.105	0.118
0	0.899	324.162	0.118	0.118
0	0.899	482.381	0.125	0.102
0	0.899	215.008	0.128	0.102
0	0.899	215.008	0.073	0.077

0	0.899	67.484	0.058	0.069
0	0.899	35.009	0.046	0.058
0	0.899	15.694	0.039	0.062
0	0.899	8.664	0.039	0.084
0	0.899	8.664	0.068	0.098
0	0.899	15.694	0.087	0.114
0	0.899	35.009	0.098	0.105
0	0.899	48.631	0.105	0.118
0	0.899	88.059	0.118	0.118
0	0.899	67.484	0.125	0.102
0	0.899	40.978	0.128	0.102
0	0.899	26.348	0.073	0.077
0	0.899	26.348	0.058	0.069
0	0.899	10.436	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	5.385	0.068	0.098
1	1.941	12.832	0.188	0.245
1	1.941	15.694	0.213	0.227
1	1.941	35.009	0.227	0.254
1	1.941	30.249	0.255	0.254
1	1.941	57.145	0.270	0.221
0	0.899	57.145	0.128	0.102
0	0.899	67.484	0.073	0.077
0	0.899	35.009	0.058	0.069
0	0.899	15.694	0.046	0.058
0	0.899	8.664	0.039	0.062
0	0.899	5.385	0.039	0.084
0	0.899	5.385	0.068	0.098
0	0.899	8.664	0.087	0.114
0	0.899	40.978	0.098	0.105
0	0.899	182.916	0.105	0.118
0	0.899	182.916	0.118	0.118
0	0.899	143.388	0.125	0.102
0	0.899	88.059	0.128	0.102
0	0.899	88.059	0.073	0.077
0	0.899	48.631	0.058	0.069
0	0.899	48.631	0.046	0.058
0	0.899	26.348	0.039	0.062
0	0.899	12.832	0.039	0.084

0	0.899	15.694	0.068	0.098
0	0.899	18.926	0.087	0.114
0	0.899	26.348	0.098	0.105
0	0.899	26.348	0.105	0.118
0	0.899	30.249	0.118	0.118
0	0.899	22.314	0.125	0.102
0	0.899	40.978	0.128	0.102
0	0.899	40.978	0.073	0.077
0	0.899	18.926	0.058	0.069
0	0.899	8.664	0.046	0.058
0	0.899	3.687	0.039	0.062
1	0.899	3.687	0.039	0.084
1	1.941	2.841	0.146	0.212
1	1.941	6.597	0.188	0.245
1	1.978	22.314	0.217	0.232
1	1.941	48.631	0.227	0.254
1	1.941	67.484	0.255	0.254
0	0.899	57.145	0.125	0.102
0	0.899	67.484	0.128	0.102
0	0.899	57.145	0.073	0.077
0	0.899	26.348	0.058	0.069
0	0.899	35.009	0.046	0.058
0	0.899	182.916	0.039	0.062
0	0.899	57.145	0.039	0.084
0	0.899	26.348	0.068	0.098
0	0.899	26.348	0.087	0.114
0	0.899	35.009	0.098	0.105
0	0.899	35.009	0.105	0.118
0	0.899	57.145	0.118	0.118
0	0.899	40.978	0.125	0.102
0	0.899	30.249	0.128	0.102
0	0.899	40.978	0.073	0.077
0	0.899	18.926	0.058	0.069
0	0.899	10.436	0.046	0.058
0	0.899	6.597	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	2.841	0.068	0.098
1	1.941	18.926	0.188	0.245
1	1.941	22.314	0.213	0.227
1	1.941	35.009	0.227	0.254

1	1.941	26.348	0.255	0.254
1	1.941	22.314	0.270	0.221
1	1.941	12.832	0.277	0.219
1	1.978	10.436	0.160	0.170
1	1.978	6.597	0.128	0.152
1	1.978	6.597	0.101	0.127
1	1.978	3.687	0.085	0.135
1	1.978	6.597	0.086	0.185
1	1.978	6.597	0.149	0.216
1	1.941	12.832	0.188	0.245
1	1.941	18.926	0.213	0.227
1	1.941	18.926	0.227	0.254
1	1.941	57.145	0.255	0.254
0	0.899	67.484	0.125	0.102
0	0.899	40.978	0.128	0.102
0	0.899	26.348	0.073	0.077
0	0.899	15.694	0.058	0.069
0	0.899	8.664	0.046	0.058
0	0.899	3.687	0.039	0.062
1	0.899	3.687	0.039	0.084
1	1.941	3.687	0.146	0.212
1	1.941	3.687	0.188	0.245
1	1.941	6.597	0.213	0.227
1	1.941	15.694	0.227	0.254
1	1.941	30.249	0.255	0.254
1	1.941	67.484	0.270	0.221
0	0.899	57.145	0.128	0.102
0	0.899	88.059	0.073	0.077
0	0.899	40.978	0.058	0.069
0	0.899	15.694	0.046	0.058
0	0.899	10.436	0.039	0.062
0	0.899	6.597	0.039	0.084
0	0.899	5.385	0.068	0.098
0	0.899	10.436	0.087	0.114
0	0.899	30.249	0.098	0.105
0	0.899	26.348	0.105	0.118
0	0.899	30.249	0.118	0.118
0	0.899	35.009	0.125	0.102
0	0.899	48.631	0.128	0.102
0	0.899	26.348	0.073	0.077

0	0.899	12.832	0.058	0.069
0	0.899	6.597	0.046	0.058
0	0.899	3.687	0.039	0.062
1	0.899	5.385	0.039	0.084
1	1.941	3.687	0.146	0.212
1	1.941	5.385	0.188	0.245
1	1.941	8.664	0.213	0.227
1	1.941	22.314	0.227	0.254
1	1.941	18.926	0.255	0.254
1	1.941	15.694	0.270	0.221
1	1.941	88.059	0.277	0.219
0	0.899	67.484	0.073	0.077
0	0.899	40.978	0.058	0.069
0	0.899	18.926	0.046	0.058
0	0.899	10.436	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	5.385	0.068	0.098
1	1.941	18.926	0.188	0.245
1	1.941	18.926	0.213	0.227
1	1.941	22.314	0.227	0.254
1	1.941	22.314	0.255	0.254
1	1.941	26.348	0.270	0.221
1	1.941	18.926	0.277	0.219
1	1.941	12.832	0.157	0.167
1	1.941	12.832	0.126	0.149
1	1.941	6.597	0.099	0.125
1	1.941	3.687	0.084	0.133
1	1.941	2.841	0.084	0.182
1	1.941	3.687	0.146	0.212
1	1.941	10.436	0.188	0.245
1	1.941	22.314	0.213	0.227
1	1.941	22.314	0.227	0.254
1	1.941	57.145	0.255	0.254
0	0.899	40.978	0.125	0.102
0	0.899	48.631	0.128	0.102
0	0.899	48.631	0.073	0.077
0	0.899	119.287	0.058	0.069
0	0.899	48.631	0.046	0.058
0	0.899	30.249	0.039	0.062
0	0.899	12.832	0.039	0.084

0	0.899	12.832	0.068	0.098
0	0.899	22.314	0.087	0.114
0	0.899	22.314	0.098	0.105
0	0.899	57.145	0.105	0.118
0	0.899	143.388	0.118	0.118
0	0.899	616.225	0.125	0.102
0	0.899	324.162	0.128	0.102
0	0.899	143.388	0.073	0.077
0	0.899	136.263	0.058	0.069
0	0.899	57.145	0.046	0.058
0	0.899	30.249	0.039	0.062
0	0.899	12.832	0.039	0.084
0	0.899	6.597	0.068	0.098
0	0.899	8.664	0.087	0.114
0	0.899	15.694	0.098	0.105
0	0.899	18.926	0.105	0.118
0	0.899	26.348	0.118	0.118
0	0.899	67.484	0.125	0.102
0	0.899	48.631	0.128	0.102
0	0.899	48.631	0.073	0.077
0	0.899	22.314	0.058	0.069
0	0.899	10.436	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	10.436	0.039	0.084
0	0.899	30.249	0.068	0.098
0	0.899	22.314	0.087	0.114
0	0.899	48.631	0.098	0.105
0	0.899	57.145	0.105	0.118
0	0.899	119.287	0.118	0.118
0	0.899	67.484	0.125	0.102
0	0.899	67.484	0.128	0.102
0	0.899	48.631	0.073	0.077
0	0.899	35.009	0.058	0.069
0	0.899	22.314	0.046	0.058
0	0.899	12.832	0.039	0.062
0	0.899	6.597	0.039	0.084
0	0.899	3.687	0.068	0.098
1	0.899	3.687	0.087	0.114
1	1.941	15.694	0.213	0.227
1	1.941	35.009	0.227	0.254

1	1.941	119.287	0.255	0.254
0	0.899	240.477	0.125	0.102
0	0.899	182.916	0.128	0.102
0	0.899	125.197	0.073	0.077
0	0.899	57.145	0.058	0.069
0	0.899	26.348	0.046	0.058
0	0.899	12.832	0.039	0.062
0	0.899	6.597	0.039	0.084
0	0.899	22.314	0.068	0.098
0	0.899	15.694	0.087	0.114
0	0.899	26.348	0.098	0.105
0	0.899	57.145	0.105	0.118
0	0.899	215.008	0.118	0.118
0	0.899	253.716	0.125	0.102
0	0.899	324.162	0.128	0.102
0	0.899	253.716	0.073	0.077
0	0.899	215.008	0.058	0.069
0	0.899	57.145	0.046	0.058
0	0.899	35.009	0.039	0.062
0	0.899	18.926	0.039	0.084
0	0.899	10.436	0.068	0.098
0	0.899	22.314	0.087	0.114
0	0.899	22.314	0.098	0.105
0	0.899	40.978	0.105	0.118
0	0.899	88.059	0.118	0.118
0	0.899	637.904	0.125	0.102
0	0.899	616.225	0.128	0.102
0	0.899	240.477	0.073	0.077
0	0.899	88.059	0.058	0.069
0	0.899	30.249	0.046	0.058
0	0.899	12.832	0.039	0.062
0	0.899	10.436	0.039	0.084
0	0.899	12.832	0.068	0.098
0	0.899	12.832	0.087	0.114
0	0.899	12.832	0.098	0.105
0	0.899	26.348	0.105	0.118
0	0.899	88.059	0.118	0.118
0	0.899	88.059	0.125	0.102
0	0.899	67.484	0.128	0.102
0	0.899	57.145	0.073	0.077

0	0.899	30.249	0.058	0.069
0	0.899	15.694	0.046	0.058
0	0.899	10.436	0.039	0.062
0	0.899	10.436	0.039	0.084
0	0.899	8.664	0.068	0.098
0	0.899	26.348	0.087	0.114
0	0.899	35.009	0.098	0.105
0	0.899	30.249	0.105	0.118
0	0.899	30.249	0.118	0.118
0	0.899	26.348	0.125	0.102
0	0.899	22.314	0.128	0.102
0	0.899	18.926	0.073	0.077
0	0.899	12.832	0.058	0.069
0	0.899	6.597	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	5.385	0.039	0.084
0	0.899	6.597	0.068	0.098
0	0.899	8.664	0.087	0.114
0	0.899	8.664	0.098	0.105
0	0.899	15.694	0.105	0.118
0	0.899	26.348	0.118	0.118
0	0.899	26.348	0.125	0.102
0	0.899	15.694	0.128	0.102
0	0.899	8.664	0.073	0.077
0	0.899	5.385	0.058	0.069
0	0.899	2.841	0.046	0.058
1	0.899	1.898	0.039	0.062
1	1.978	0.990	0.086	0.185
1	1.978	3.687	0.149	0.216
1	1.941	2.841	0.188	0.245
1	1.941	10.436	0.213	0.227
1	1.941	12.832	0.227	0.254
1	1.941	30.249	0.255	0.254
1	1.941	35.009	0.270	0.221
1	1.941	22.314	0.277	0.219
1	1.941	12.832	0.157	0.167
1	1.941	26.348	0.126	0.149
1	1.941	26.348	0.099	0.125
1	1.941	12.832	0.084	0.133
1	1.941	10.436	0.084	0.182

1	1.941	18.926	0.146	0.212
1	1.941	18.926	0.188	0.245
1	1.941	26.348	0.213	0.227
1	1.941	18.926	0.227	0.254
1	1.941	26.348	0.255	0.254
1	1.941	26.348	0.270	0.221
1	1.941	48.631	0.277	0.219
1	1.941	35.009	0.157	0.167
1	1.941	18.926	0.126	0.149
1	1.941	8.664	0.099	0.125
1	1.941	5.385	0.084	0.133
1	1.941	2.507	0.084	0.182
1	1.941	2.507	0.146	0.212
1	1.941	6.597	0.188	0.245
1	1.978	6.597	0.217	0.232
1	1.978	6.597	0.231	0.259
1	1.978	8.664	0.259	0.259
1	1.978	6.597	0.275	0.225
1	1.978	6.597	0.282	0.223
1	1.978	5.385	0.160	0.170
1	1.978	2.841	0.128	0.152
1	1.978	2.507	0.101	0.127
1	1.978	2.841	0.085	0.135
1	1.978	3.687	0.086	0.185
1	1.978	2.507	0.149	0.216
1	1.978	3.687	0.191	0.250
1	1.978	30.249	0.217	0.232
1	1.941	35.009	0.227	0.254
1	1.941	789.977	0.255	0.254
0	0.899	789.977	0.125	0.102
0	0.899	681.022	0.128	0.102
0	0.899	324.162	0.073	0.077
0	0.899	143.388	0.058	0.069
0	0.899	88.059	0.046	0.058
0	0.899	88.059	0.039	0.062
0	0.899	57.145	0.039	0.084
0	0.899	30.249	0.068	0.098
0	0.899	35.009	0.087	0.114
0	0.899	35.009	0.098	0.105
0	0.899	35.009	0.105	0.118

0	0.899	57.145	0.118	0.118
0	0.899	253.716	0.125	0.102
0	0.899	125.197	0.128	0.102
0	0.899	48.631	0.073	0.077
0	0.899	26.348	0.058	0.069
0	0.899	18.926	0.046	0.058
0	0.899	12.832	0.039	0.062
0	0.899	6.597	0.039	0.084
0	0.899	6.597	0.068	0.098
0	0.899	22.314	0.087	0.114
0	0.899	22.314	0.098	0.105
0	0.899	22.314	0.105	0.118
0	0.899	40.978	0.118	0.118
0	0.899	57.145	0.125	0.102
0	0.899	40.978	0.128	0.102
0	0.899	35.009	0.073	0.077
0	0.899	15.694	0.058	0.069
0	0.899	10.436	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	2.841	0.068	0.098
1	1.941	3.687	0.188	0.245
1	1.941	5.385	0.213	0.227
1	1.941	18.926	0.227	0.254
1	1.941	40.978	0.255	0.254
1	1.941	30.249	0.270	0.221
1	1.941	57.145	0.277	0.219
0	0.899	35.009	0.073	0.077
0	0.899	18.926	0.058	0.069
0	0.899	18.926	0.046	0.058
0	0.899	10.436	0.039	0.062
0	0.899	18.926	0.039	0.084
0	0.899	324.162	0.068	0.098
0	0.899	324.162	0.087	0.114
0	0.899	324.162	0.098	0.105
0	0.899	253.716	0.105	0.118
0	0.899	215.008	0.118	0.118
0	0.899	324.162	0.125	0.102
0	0.899	324.162	0.128	0.102
0	0.899	182.916	0.073	0.077

0	0.899	57.145	0.058	0.069
0	0.899	40.978	0.046	0.058
0	0.899	26.348	0.039	0.062
0	0.899	15.694	0.039	0.084
0	0.899	10.436	0.068	0.098
0	0.899	26.348	0.087	0.114
0	0.899	40.978	0.098	0.105
0	0.899	125.197	0.105	0.118
0	0.899	57.145	0.118	0.118
0	0.899	182.916	0.125	0.102
0	0.899	88.059	0.128	0.102
0	0.899	40.978	0.073	0.077
0	0.899	22.314	0.058	0.069
0	0.899	12.832	0.046	0.058
0	0.899	8.664	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	3.687	0.068	0.098
1	1.941	6.597	0.188	0.245
1	1.978	119.287	0.217	0.232
0	0.899	125.197	0.105	0.118
0	0.899	88.059	0.118	0.118
0	0.899	119.287	0.125	0.102
0	0.899	119.287	0.128	0.102
0	0.899	67.484	0.073	0.077
0	0.899	35.009	0.058	0.069
0	0.899	15.694	0.046	0.058
0	0.899	6.597	0.039	0.062
0	0.899	10.436	0.039	0.084
0	0.899	5.385	0.068	0.098
0	0.899	10.436	0.087	0.114
0	0.899	15.694	0.098	0.105
0	0.899	30.249	0.105	0.118
0	0.899	67.484	0.118	0.118
0	0.899	125.197	0.125	0.102
0	0.899	136.263	0.128	0.102
0	0.899	57.145	0.073	0.077
0	0.899	57.145	0.058	0.069
0	0.899	35.009	0.046	0.058
0	0.899	22.314	0.039	0.062
0	0.899	10.436	0.039	0.084

0	0.899	6.597	0.068	0.098
0	0.899	8.664	0.087	0.114
0	0.899	8.664	0.098	0.105
0	0.899	12.832	0.105	0.118
0	0.899	12.832	0.118	0.118
0	0.899	18.926	0.125	0.102
0	0.899	18.926	0.128	0.102
0	0.899	10.436	0.073	0.077
0	0.899	3.687	0.058	0.069
1	0.899	2.507	0.046	0.058
1	1.978	0.990	0.085	0.135
1	1.978	0.990	0.086	0.185
1	1.978	0.990	0.149	0.216
1	1.978	1.898	0.191	0.250
1	1.941	5.385	0.213	0.227
1	1.941	8.664	0.227	0.254
1	1.941	10.436	0.255	0.254
1	1.941	15.694	0.270	0.221
1	1.941	15.694	0.277	0.219
1	1.941	12.832	0.157	0.167
1	1.941	5.385	0.126	0.149
1	1.941	2.841	0.099	0.125
1	1.941	1.898	0.084	0.133
1	1.978	1.898	0.086	0.185
1	1.941	1.898	0.146	0.212
1	1.941	57.145	0.188	0.245
0	0.899	57.145	0.098	0.105
0	0.899	136.263	0.105	0.118
0	0.899	119.287	0.118	0.118
0	0.899	57.145	0.125	0.102
0	0.899	67.484	0.128	0.102
0	0.899	35.009	0.073	0.077
0	0.899	15.694	0.058	0.069
0	0.899	8.664	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	2.507	0.068	0.098
1	1.941	10.436	0.188	0.245
1	1.941	12.832	0.213	0.227
1	1.941	22.314	0.227	0.254

1	1.941	15.694	0.255	0.254
1	1.941	10.436	0.270	0.221
1	1.941	26.348	0.277	0.219
1	1.941	30.249	0.157	0.167
1	1.941	22.314	0.126	0.149
1	1.941	15.694	0.099	0.125
1	1.941	8.664	0.084	0.133
1	1.941	5.385	0.084	0.182
1	1.941	2.841	0.146	0.212
1	1.941	8.664	0.188	0.245
1	1.941	30.249	0.213	0.227
1	1.941	119.287	0.227	0.254
0	0.899	240.477	0.118	0.118
0	0.899	637.904	0.125	0.102
0	0.899	637.904	0.128	0.102
0	0.899	253.716	0.073	0.077
0	0.899	125.197	0.058	0.069
0	0.899	40.978	0.046	0.058
0	0.899	40.978	0.039	0.062
0	0.899	22.314	0.039	0.084
0	0.899	8.664	0.068	0.098
0	0.899	22.314	0.087	0.114
0	0.899	18.926	0.098	0.105
0	0.899	30.249	0.105	0.118
0	0.899	57.145	0.118	0.118
0	0.899	57.145	0.125	0.102
0	0.899	67.484	0.128	0.102
0	0.899	67.484	0.073	0.077
0	0.899	48.631	0.058	0.069
0	0.899	48.631	0.046	0.058
0	0.899	26.348	0.039	0.062
0	0.899	18.926	0.039	0.084
0	0.899	18.926	0.068	0.098
0	0.899	30.249	0.087	0.114
0	0.899	125.197	0.098	0.105
0	0.899	88.059	0.105	0.118
0	0.899	67.484	0.118	0.118
0	0.899	119.287	0.125	0.102
0	0.899	67.484	0.128	0.102
0	0.899	48.631	0.073	0.077

0	0.899	26.348	0.058	0.069
0	0.899	10.436	0.046	0.058
0	0.899	6.597	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	2.841	0.068	0.098
1	1.941	10.436	0.188	0.245
1	1.941	18.926	0.213	0.227
1	1.941	40.978	0.227	0.254
1	1.941	67.484	0.255	0.254
0	0.899	57.145	0.125	0.102
0	0.899	48.631	0.128	0.102
0	0.899	35.009	0.073	0.077
0	0.899	18.926	0.058	0.069
0	0.899	8.664	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	3.687	0.068	0.098
1	1.941	6.597	0.188	0.245
1	1.978	8.664	0.217	0.232
1	1.941	48.631	0.227	0.254
1	1.941	119.287	0.255	0.254
0	0.899	143.388	0.125	0.102
0	0.899	240.477	0.128	0.102
0	0.899	136.263	0.073	0.077
0	0.899	125.197	0.058	0.069
0	0.899	48.631	0.046	0.058
0	0.899	22.314	0.039	0.062
0	0.899	10.436	0.039	0.084
0	0.899	6.597	0.068	0.098
0	0.899	12.832	0.087	0.114
0	0.899	119.287	0.098	0.105
0	0.899	215.008	0.105	0.118
0	0.899	143.388	0.118	0.118
0	0.899	119.287	0.125	0.102
0	0.899	67.484	0.128	0.102
0	0.899	48.631	0.073	0.077
0	0.899	26.348	0.058	0.069
0	0.899	10.436	0.046	0.058
0	0.899	6.597	0.039	0.062
0	0.899	2.841	0.039	0.084

1	0.899	8.664	0.068	0.098
1	1.978	12.832	0.191	0.250
1	1.978	30.249	0.217	0.232
1	1.941	35.009	0.227	0.254
1	1.941	40.978	0.255	0.254
1	1.941	40.978	0.270	0.221
1	1.941	26.348	0.277	0.219
1	1.941	22.314	0.157	0.167
1	1.941	8.664	0.126	0.149
1	1.941	6.597	0.099	0.125
1	1.941	18.926	0.084	0.133
1	1.941	12.832	0.084	0.182
1	1.941	10.436	0.146	0.212
1	1.941	6.597	0.188	0.245
1	1.978	10.436	0.217	0.232
1	1.941	10.436	0.227	0.254
1	1.941	10.436	0.255	0.254
1	1.941	22.314	0.270	0.221
1	1.941	12.832	0.277	0.219
1	1.978	8.664	0.160	0.170
1	1.978	5.385	0.128	0.152
1	1.978	6.597	0.101	0.127
1	1.978	3.687	0.085	0.135
1	1.978	2.507	0.086	0.185
1	1.978	2.507	0.149	0.216
1	1.978	1.898	0.191	0.250
1	1.978	5.385	0.217	0.232
1	1.978	5.385	0.231	0.259
1	1.978	30.249	0.259	0.259
1	1.978	57.145	0.275	0.225
0	0.899	57.145	0.128	0.102
0	0.899	35.009	0.073	0.077
0	0.899	15.694	0.058	0.069
0	0.899	6.597	0.046	0.058
0	0.899	8.664	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	5.385	0.068	0.098
1	1.941	3.687	0.188	0.245
1	1.941	10.436	0.213	0.227
1	1.941	12.832	0.227	0.254

1	1.941	30.249	0.255	0.254
1	1.941	48.631	0.270	0.221
1	1.941	57.145	0.277	0.219
0	0.899	26.348	0.073	0.077
0	0.899	12.832	0.058	0.069
0	0.899	10.436	0.046	0.058
0	0.899	5.385	0.039	0.062
0	0.899	3.687	0.039	0.084
1	0.899	2.507	0.068	0.098
1	1.941	2.841	0.188	0.245
1	1.941	8.664	0.213	0.227
1	1.941	8.664	0.227	0.254
1	1.941	22.314	0.255	0.254
1	1.941	30.249	0.270	0.221
1	1.941	30.249	0.277	0.219
1	1.941	26.348	0.157	0.167
1	1.941	15.694	0.126	0.149
1	1.941	8.664	0.099	0.125
1	1.941	3.687	0.084	0.133
1	1.941	6.597	0.084	0.182
1	1.941	5.385	0.146	0.212
1	1.941	10.436	0.188	0.245
1	1.941	18.926	0.213	0.227
1	1.941	57.145	0.227	0.254
0	0.899	40.978	0.118	0.118
0	0.899	26.348	0.125	0.102
0	0.899	12.832	0.128	0.102
0	0.899	12.832	0.073	0.077
0	0.899	5.385	0.058	0.069
0	0.899	8.664	0.046	0.058
0	0.899	3.687	0.039	0.062
1	0.899	2.507	0.039	0.084
1	1.978	2.841	0.149	0.216
1	1.978	8.664	0.191	0.250
1	1.978	18.926	0.217	0.232
1	1.978	12.832	0.231	0.259
1	1.978	12.832	0.259	0.259
1	1.978	12.832	0.275	0.225
1	1.978	15.694	0.282	0.223
1	1.978	26.348	0.160	0.170

1	1.978	12.832	0.128	0.152
1	1.978	8.664	0.101	0.127
1	1.978	3.687	0.085	0.135
1	1.978	2.507	0.086	0.185
1	1.978	2.507	0.149	0.216
1	1.978	2.507	0.191	0.250
1	1.978	2.841	0.217	0.232
1	1.978	3.687	0.231	0.259
1	1.978	12.832	0.259	0.259
1	1.978	18.926	0.275	0.225
1	1.978	15.694	0.282	0.223
1	1.978	10.436	0.160	0.170
1	1.978	8.664	0.128	0.152
1	1.978	5.385	0.101	0.127
1	1.978	2.841	0.085	0.135
1	1.978	3.687	0.086	0.185
1	1.978	3.687	0.149	0.216
1	1.978	6.597	0.191	0.250
1	1.978	12.832	0.217	0.232
1	1.978	10.436	0.231	0.259
1	1.978	5.385	0.259	0.259
1	1.978	2.507	0.275	0.225
1	1.978	0.990	0.282	0.223
1	1.978	0.990	0.160	0.170
1	1.978	0.714	0.128	0.152
1	1.978	0.492	0.101	0.127
1	1.978	6.597	0.085	0.135

Run-off from floodplain (Mm^3 / month)	Abstractions from Flood Plain (Mm^3 / month)	Sediment Concentrations (g/l)	Sediment Loading : $M_{s\ in}$ (ton)	Resultant Inflow (Mm3 / month)
1.785		2.254	985	2.192
1.140		1.476	1462	2.116
1.297		1.779	33676	20.195
1.493		0.758	22918	31.742
2.410		0.334	16242	51.089
2.944		0.063	3078	51.632
1.954		0.086	5837	69.429
1.689		0.086	4939	58.823
1.402		0.239	6305	27.739
1.480		0.462	5931	14.289
1.043		2.294	19879	9.662
1.785		2.389	15760	8.352
1.449		2.254	12137	6.807
1.150		1.476	18942	13.975
1.308		1.779	27925	16.989
1.505		0.758	245596	325.668
2.430		0.334	108265	326.615
2.969		0.063	43104	684.017
1.970		0.086	21944	255.682
1.689		0.086	7611	89.737
1.402		0.239	11637	50.021
1.480		0.462	12179	27.805
1.043		2.294	29442	13.829
1.785		2.389	24932	12.191
1.449		2.254	78912	36.431
1.150		1.476	71788	49.774
1.308		1.779	156687	89.354
1.505		0.758	66716	89.564
2.430		0.334	22539	69.937
2.969		0.063	8625	139.259
1.970		0.086	5837	69.450
1.689		0.086	3542	42.656
1.402		0.239	4529	20.316
1.480		0.462	4824	11.893
1.043		2.294	12355	6.382

1.785		2.389	20699	10.419
1.449		2.254	50295	23.736
1.150		1.476	184815	126.340
1.308		1.779	255137	144.683
1.505		0.758	66716	89.564
2.430		0.334	29410	90.511
2.969		0.063	4271	70.480
1.970		0.086	3544	42.944
1.689		0.086	2277	28.026
1.402		0.239	3071	14.222
1.480		0.462	3049	8.054
1.043		2.294	23944	11.433
1.785		2.389	12864	7.140
1.449		2.254	28923	14.254
1.150		1.476	38895	27.491
1.308		1.779	62294	36.305
1.505		0.758	103238	137.769
2.430		0.334	39840	121.739
2.969		0.063	4271	70.480
1.970		0.086	3028	36.975
1.689		0.086	1357	17.372
1.402		0.239	1579	7.987
1.480		0.462	2489	6.842
1.043		2.294	5753	3.505
1.785		2.389	2366	2.745
1.437		2.254	5652	3.886
1.140		1.476	5443	4.812
1.297		1.779	27925	16.963
1.493		0.758	11890	17.187
2.410		0.334	10103	32.707
2.944		0.063	3617	60.147
1.970		0.086	3028	36.975
1.689		0.086	2277	28.026
1.402		0.239	3071	14.222
1.480		0.462	2489	6.842
1.043		2.294	8460	4.685
1.785		2.389	20699	10.419
1.436		2.254	23522	11.813
1.140		1.476	44653	31.374
1.297		1.779	156687	89.328

1.505		0.758	94853	126.702
2.430		0.334	80315	242.929
2.969		0.063	203810	3223.066
1.970		0.086	98068	1135.811
1.689		0.086	68282	791.654
1.402		0.239	140106	586.869
1.480		0.462	111153	241.933
1.043		2.294	154840	68.482
1.785		2.389	161226	69.239
1.449		2.254	152110	68.906
1.150		1.476	84357	58.288
1.308		1.779	101681	58.440
1.505		0.758	43295	58.650
2.430		0.334	16242	51.083
2.969		0.063	3617	60.140
1.970		0.086	2616	32.215
1.689		0.086	1636	20.604
1.402		0.239	3071	14.222
1.480		0.462	2489	6.842
1.043		2.294	6519	3.839
1.785		2.389	12864	7.140
1.437		2.254	14869	7.976
1.140		1.476	15405	11.561
1.297		1.779	27925	16.963
1.493		0.758	14339	20.419
2.410		0.334	10103	32.707
2.944		0.063	3078	51.632
1.954		0.086	2279	28.293
1.675		0.086	1357	17.345
1.390		0.239	2073	10.029
1.467		0.462	4005	10.082
1.034		2.294	12355	6.321
1.770		2.389	8808	5.392
1.437		2.254	28923	14.211
1.140		1.476	23167	16.820
1.297		1.779	62294	36.279
1.493		0.758	51128	68.978
2.430		0.334	22539	69.937
2.969		0.063	3078	51.626
1.970		0.086	3028	36.975

1.689		0.086	2277	28.026
1.402		0.239	2497	11.826
1.480		0.462	2489	6.842
1.043		2.294	8460	4.685
1.785		2.389	12864	7.140
1.437		2.254	12137	6.764
1.140		1.476	9738	7.722
1.297		1.779	18569	11.705
1.493		0.758	16906	23.807
2.410		0.334	6321	21.384
2.944		0.063	8625	139.265
1.970		0.086	5837	69.450
1.689		0.086	3026	36.687
1.402		0.239	7239	31.639
1.480		0.462	8748	20.383
1.043		2.294	23944	11.433
1.785		2.389	53309	24.069
1.449		2.254	78912	36.431
1.150		1.476	51681	36.153
1.308		1.779	62294	36.305
1.505		0.758	162897	216.513
2.430		0.334	45510	138.716
2.969		0.063	8625	139.259
1.970		0.086	5837	69.450
1.689		0.086	2615	31.927
1.402		0.239	4529	20.316
1.480		0.462	4824	11.893
1.043		2.294	15136	7.594
1.785		2.389	20699	10.419
1.449		2.254	14869	8.019
1.150		1.476	15405	11.579
1.308		1.779	27925	16.989
1.505		0.758	14339	20.431
2.430		0.334	7452	24.766
2.969		0.063	1412	25.309
1.970		0.086	1110	14.798
1.689		0.086	570	8.275
1.402		0.239	882	5.077
1.480		0.462	1313	4.298
1.034		2.294	4356	2.835

1.770		2.389	2366	2.695
1.437		2.254	4279	3.277
1.140		1.476	7949	6.510
1.297		1.779	15416	9.933
1.493		0.758	7906	11.929
2.410		0.334	41814	127.655
2.969		0.063	9076	146.384
1.970		0.086	21944	255.682
1.689		0.086	21930	255.394
1.402		0.239	21073	89.449
1.480		0.462	16182	36.466
1.043		2.294	36009	16.692
1.785		2.389	24932	12.191
1.449		2.254	23522	11.858
1.150		1.476	23167	16.837
1.308		1.779	72914	42.273
1.505		0.758	36844	50.136
2.430		0.334	19085	59.597
2.969		0.063	2594	43.973
1.970		0.086	1930	24.280
1.689		0.086	902	12.114
1.402		0.239	1289	6.775
1.480		0.462	1704	5.144
1.043		2.294	5753	3.505
1.770		2.389	4535	3.602
1.437		2.254	5652	3.886
1.140		1.476	18942	13.957
1.297		1.779	62294	36.279
1.493		0.758	66716	89.552
2.430		0.334	39840	121.739
2.969		0.063	5574	91.054
1.970		0.086	4943	59.111
1.689		0.086	3026	36.687
1.402		0.239	6305	27.739
1.480		0.462	8748	20.383
1.043		2.294	36009	16.692
1.785		2.389	20699	10.419
1.449		2.254	19529	10.086
1.150		1.476	27938	20.069
1.308		1.779	101681	58.440

1.505		0.758	43295	58.650
2.430		0.334	16242	51.083
2.969		0.063	3078	51.626
1.970		0.086	2616	32.215
1.689		0.086	1929	23.991
1.402		0.239	3756	17.084
1.480		0.462	4005	10.121
1.043		2.294	15136	7.594
1.785		2.389	8808	5.442
1.449		2.254	6404	4.263
1.140		1.476	4194	3.966
1.297		1.779	9581	6.654
1.493		0.758	14339	20.419
2.410		0.334	16242	51.089
2.944		0.063	4271	70.486
1.970		0.086	3544	42.944
1.689		0.086	4939	58.823
1.402		0.239	7239	31.639
1.480		0.462	7254	17.151
1.043		2.294	15136	7.594
1.785		2.389	12864	7.140
1.449		2.254	23522	11.858
1.150		1.476	60491	42.121
1.308		1.779	46883	27.644
1.505		0.758	66716	89.564
2.430		0.334	61091	185.369
2.969		0.063	7924	128.192
1.970		0.086	7616	90.025
1.689		0.086	2615	31.927
1.402		0.239	3756	17.084
1.480		0.462	4824	11.893
1.043		2.294	15136	7.594
1.785		2.389	15760	8.352
1.449		2.254	12137	6.807
1.150		1.476	12790	9.807
1.308		1.779	86531	49.926
1.505		0.758	43295	58.650
2.430		0.334	29410	90.511
2.969		0.063	3617	60.140
1.970		0.086	4943	59.111

1.689		0.086	2277	28.026
1.402		0.239	5340	23.704
1.480		0.462	7254	17.151
1.043		2.294	23944	11.433
1.785		2.389	15760	8.352
1.449		2.254	28923	14.254
1.150		1.476	18942	13.975
1.308		1.779	72914	42.273
1.505		0.758	36844	50.136
2.430		0.334	80315	242.929
2.969		0.063	16059	256.712
1.970		0.086	10828	127.163
1.689		0.086	7611	89.737
1.402		0.239	9806	42.368
1.480		0.462	13982	31.706
1.043		2.294	36009	16.692
1.785		2.389	45216	20.681
1.449		2.254	42659	20.348
1.150		1.476	84357	58.288
1.308		1.779	101681	58.440
1.505		0.758	66716	89.564
2.430		0.334	16242	51.083
2.969		0.063	4271	70.480
1.970		0.086	4206	50.596
1.689		0.086	7611	89.737
1.402		0.239	28545	120.677
1.480		0.462	22478	50.087
1.043		2.294	60455	27.346
1.785		2.389	53309	24.069
1.449		2.254	35374	17.116
1.150		1.476	60491	42.121
1.308		1.779	156687	89.354
1.505		0.758	51128	68.990
2.430		0.334	16242	51.083
2.969		0.063	2216	38.005
1.970		0.086	3028	36.975
1.689		0.086	1357	17.372
1.402		0.239	2073	10.054
1.480		0.462	2489	6.842
1.043		2.294	6519	3.839

1.785		2.389	6787	4.596
1.437		2.254	6404	4.220
1.140		1.476	12790	9.790
1.297		1.779	15416	9.933
1.493		0.758	22918	31.742
2.410		0.334	13686	43.436
2.944		0.063	5574	91.061
1.970		0.086	4206	50.596
1.689		0.086	2615	31.927
1.402		0.239	5340	23.704
1.480		0.462	4824	11.893
1.043		2.294	19879	9.662
1.785		2.389	24932	12.191
1.449		2.254	23522	11.858
1.150		1.476	38895	27.491
1.308		1.779	156687	89.354
1.505		0.758	51128	68.990
2.430		0.334	29410	90.511
2.969		0.063	16059	256.712
1.970		0.086	28037	326.128
1.689		0.086	18584	216.686
1.402		0.239	21073	89.449
1.480		0.462	31193	68.941
1.043		2.294	154840	68.482
1.785		2.389	83641	36.764
1.449		2.254	128805	58.567
1.150		1.476	129992	89.202
1.308		1.779	222769	126.492
1.505		0.758	66716	89.564
2.430		0.334	71809	217.460
2.969		0.063	7550	122.282
1.970		0.086	4943	59.111
1.689		0.086	1929	23.991
1.402		0.239	8378	36.400
1.480		0.462	8748	20.383
1.043		2.294	23944	11.433
1.785		2.389	53309	24.069
1.449		2.254	50295	23.736
1.150		1.476	44653	31.392
1.308		1.779	62294	36.305

1.505		0.758	36844	50.136
2.430		0.334	22539	69.937
2.969		0.063	15221	243.472
1.970		0.086	7616	90.025
1.689		0.086	3542	42.656
1.402		0.239	4529	20.316
1.480		0.462	4005	10.121
1.043		2.294	8460	4.685
1.785		2.389	6787	4.596
1.437		2.254	6404	4.220
1.140		1.476	3701	3.633
1.297		1.779	9581	6.654
1.493		0.758	26524	36.503
2.410		0.334	10103	32.707
2.944		0.063	3078	51.632
1.954		0.086	2616	32.193
1.675		0.086	1109	14.483
1.390		0.239	1579	7.962
1.467		0.462	1704	5.105
1.034		2.294	5753	3.444
1.770		2.389	5990	4.212
1.437		2.254	12137	6.764
1.140		1.476	12790	9.790
1.297		1.779	33676	20.195
1.493		0.758	19962	27.842
2.410		0.334	22539	69.943
2.969		0.063	4271	70.480
1.970		0.086	4206	50.596
1.689		0.086	1929	23.991
1.402		0.239	3756	17.084
1.480		0.462	4824	11.893
1.043		2.294	12355	6.382
1.785		2.389	12864	7.140
1.449		2.254	14869	8.019
1.150		1.476	32939	23.457
1.308		1.779	53823	31.544
1.505		0.758	22918	31.754
2.430		0.334	13686	43.430
2.969		0.063	3078	51.626
1.970		0.086	3544	42.944

1.689		0.086	1636	20.604
1.402		0.239	2073	10.054
1.480		0.462	1704	5.144
1.043		2.294	5753	3.505
1.770		2.389	6787	4.544
1.436		2.254	12137	6.762
1.140		1.476	18942	13.957
1.297		1.779	27925	16.963
1.492		0.758	36844	50.123
2.410		0.334	19085	59.603
2.969		0.063	3617	60.140
1.970		0.086	10828	127.163
1.689		0.086	4203	50.308
1.402		0.239	7239	31.639
1.480		0.462	5931	14.289
1.043		2.294	15136	7.594
1.785		2.389	12864	7.140
1.449		2.254	28923	14.254
1.150		1.476	27938	20.069
1.308		1.779	120078	68.779
1.505		0.758	51128	68.990
2.430		0.334	22539	69.937
2.969		0.063	5574	91.054
1.970		0.086	4206	50.596
1.689		0.086	2615	31.927
1.402		0.239	3071	14.222
1.480		0.462	3049	8.054
1.043		2.294	8460	4.685
1.785		2.389	6787	4.596
1.437		2.254	8310	5.066
1.140		1.476	5443	4.813
1.297		1.779	33676	20.195
1.493		0.758	16906	23.807
2.410		0.334	5242	18.153
2.944		0.063	1915	33.251
1.954		0.086	2279	28.293
1.675		0.086	1109	14.483
1.390		0.239	2073	10.029
1.467		0.462	1704	5.105
1.034		2.294	29442	13.768

1.770		2.389	20699	10.369
1.437		2.254	35374	17.073
1.140		1.476	12790	9.790
1.297		1.779	46883	27.618
1.493		0.758	19962	27.842
2.410		0.334	8800	28.807
2.944		0.063	1412	25.315
1.954		0.086	1110	14.776
1.675		0.086	902	12.087
1.390		0.239	1579	7.962
1.467		0.462	3049	8.015
1.034		2.294	8460	4.623
1.770		2.389	5990	4.212
1.437		2.254	5652	3.886
1.140		1.476	15405	11.561
1.297		1.779	53823	31.518
1.493		0.758	22918	31.742
2.410		0.334	13686	43.436
2.944		0.063	2216	38.011
1.954		0.086	2279	28.293
1.675		0.086	1109	14.483
1.390		0.239	1579	7.962
1.467		0.462	1704	5.105
1.034		2.294	6519	3.778
1.770		2.389	6787	4.546
1.437		2.254	8310	5.066
1.140		1.476	18942	13.957
1.297		1.779	27925	16.963
1.493		0.758	14339	20.419
2.410		0.334	13686	43.436
2.944		0.063	2216	38.011
1.954		0.086	3028	36.954
1.675		0.086	3026	36.661
1.390		0.239	4529	20.291
1.467		0.462	4005	10.082
1.034		2.294	12355	6.321
1.770		2.389	20699	10.369
1.437		2.254	68182	31.628
1.140		1.476	60491	42.103
1.297		1.779	53823	31.518

1.493		0.758	66716	89.552
2.430		0.334	29410	90.511
2.969		0.063	11577	185.912
1.970		0.086	7616	90.025
1.689		0.086	3542	42.656
1.402		0.239	4529	20.316
1.480		0.462	4005	10.121
1.043		2.294	12355	6.382
1.785		2.389	8808	5.442
1.449		2.254	23522	11.858
1.140		1.476	38895	27.473
1.297		1.779	72914	42.247
1.493		0.758	16906	23.807
2.410		0.334	47889	145.846
2.969		0.063	9076	146.384
1.970		0.086	4943	59.111
1.689		0.086	3542	42.656
1.402		0.239	5340	23.704
1.480		0.462	4824	11.893
1.043		2.294	15136	7.594
1.785		2.389	20699	10.419
1.449		2.254	50295	23.736
1.150		1.476	60491	42.121
1.308		1.779	382574	216.303
1.505		0.758	182193	241.982
2.430		0.334	84737	256.169
2.969		0.063	15221	243.472
1.970		0.086	21944	255.682
1.689		0.086	7611	89.737
1.402		0.239	9806	42.368
1.480		0.462	18941	42.435
1.043		2.294	51198	23.311
1.785		2.389	284988	121.042
1.449		2.254	730666	325.584
1.150		1.476	317394	216.151
1.308		1.779	325472	184.211
1.505		0.758	245596	325.668
2.430		0.334	161107	484.834
2.969		0.063	13609	218.003
1.970		0.086	18596	216.974

1.689		0.086	5833	69.162
1.402		0.239	8378	36.400
1.480		0.462	7254	17.151
1.043		2.294	19879	9.662
1.785		2.389	20699	10.419
1.449		2.254	35374	17.116
1.150		1.476	51681	36.153
1.308		1.779	86531	49.926
1.505		0.758	66716	89.564
2.430		0.334	22539	69.937
2.969		0.063	2594	43.973
1.970		0.086	2279	28.314
1.689		0.086	2277	28.026
1.402		0.239	2497	11.826
1.480		0.462	2489	6.842
1.043		2.294	8460	4.685
1.785		2.389	12864	7.140
1.437		2.254	28923	14.211
1.140		1.476	23167	16.820
1.297		1.779	62294	36.279
1.493		0.758	22918	31.742
2.410		0.334	19085	59.603
2.969		0.063	3617	60.140
1.970		0.086	5837	69.450
1.689		0.086	3026	36.687
1.402		0.239	3756	17.084
1.480		0.462	4005	10.121
1.043		2.294	12355	6.382
1.785		2.389	12864	7.140
1.449		2.254	19529	10.086
1.150		1.476	60491	42.121
1.308		1.779	325472	184.211
1.505		0.758	138583	184.422
2.430		0.334	47889	145.841
2.969		0.063	5574	91.054
1.970		0.086	7616	90.025
1.689		0.086	4203	50.308
1.402		0.239	11637	50.021
1.480		0.462	12179	27.805
1.043		2.294	29442	13.829

1.785		2.389	37495	17.449
1.449		2.254	42659	20.348
1.150		1.476	38895	27.491
1.308		1.779	46883	27.644
1.505		0.758	22918	31.754
2.430		0.334	7452	24.766
2.969		0.063	2594	43.973
1.970		0.086	3544	42.944
1.689		0.086	1636	20.604
1.402		0.239	2073	10.054
1.480		0.462	1704	5.144
1.043		2.294	8460	4.685
1.770		2.389	6787	4.546
1.437		2.254	14869	7.976
1.140		1.476	32939	23.439
1.297		1.779	86531	49.900
1.493		0.758	51128	68.978
2.430		0.334	19085	59.597
2.969		0.063	4271	70.480
1.970		0.086	4943	59.111
1.689		0.086	2277	28.026
1.402		0.239	8378	36.400
1.480		0.462	84548	184.373
1.043		2.294	131117	58.142
1.785		2.389	62949	28.103
1.449		2.254	59389	27.770
1.150		1.476	51681	36.153
1.308		1.779	62294	36.305
1.505		0.758	43295	58.650
2.430		0.334	13686	43.430
2.969		0.063	1915	33.244
1.970		0.086	3544	42.944
1.689		0.086	1636	20.604
1.402		0.239	2497	11.826
1.480		0.462	3049	8.054
1.043		2.294	8460	4.685
1.785		2.389	6787	4.596
1.437		2.254	42659	20.305
1.140		1.476	32939	23.439
1.297		1.779	62294	36.279

1.493		0.758	19962	27.842
2.410		0.334	7452	24.772
2.944		0.063	812	15.833
1.953		0.086	903	12.379
1.674		0.086	570	8.247
1.390		0.239	1579	7.961
1.467		0.462	1704	5.104
1.034		2.294	15136	7.531
1.770		2.389	15760	8.300
1.437		2.254	28923	14.211
1.140		1.476	27938	20.052
1.297		1.779	33676	20.195
1.493		0.758	43295	58.638
2.430		0.334	22539	69.937
2.969		0.063	2594	43.973
1.970		0.086	2279	28.314
1.689		0.086	1357	17.372
1.402		0.239	2073	10.054
1.480		0.462	1704	5.144
1.043		2.294	8460	4.685
1.770		2.389	8808	5.392
1.437		2.254	8310	5.066
1.140		1.476	9738	7.722
1.297		1.779	27925	16.963
1.493		0.758	22918	31.742
2.410		0.334	22539	69.943
2.969		0.063	3617	60.140
1.970		0.086	7616	90.025
1.689		0.086	3542	42.656
1.402		0.239	3756	17.084
1.480		0.462	4824	11.893
1.043		2.294	15136	7.594
1.785		2.389	12864	7.140
1.449		2.254	23522	11.858
1.150		1.476	44653	31.392
1.308		1.779	46883	27.644
1.505		0.758	22918	31.754
2.430		0.334	11693	37.462
2.969		0.063	3078	51.626
1.970		0.086	2279	28.314

1.689		0.086	1109	14.510
1.402		0.239	1579	7.987
1.480		0.462	1704	5.144
1.043		2.294	12355	6.382
1.770		2.389	8808	5.392
1.437		2.254	12137	6.764
1.140		1.476	12790	9.790
1.297		1.779	39704	23.583
1.493		0.758	14339	20.419
2.410		0.334	5242	18.153
2.944		0.063	5574	91.061
1.970		0.086	5837	69.450
1.689		0.086	3542	42.656
1.402		0.239	4529	20.316
1.480		0.462	4824	11.893
1.043		2.294	8460	4.685
1.785		2.389	12864	7.140
1.437		2.254	42659	20.305
1.140		1.476	27938	20.052
1.297		1.779	39704	23.583
1.493		0.758	16906	23.807
2.410		0.334	8800	28.807
2.944		0.063	1198	21.928
1.954		0.086	1110	14.776
1.675		0.086	1109	14.483
1.390		0.239	1579	7.962
1.467		0.462	1704	5.105
1.034		2.294	6519	3.778
1.770		2.389	8808	5.392
1.437		2.254	23522	11.815
1.140		1.476	32939	23.439
1.297		1.779	39704	23.583
1.493		0.758	43295	58.638
2.430		0.334	13686	43.430
2.969		0.063	3078	51.626
1.970		0.086	4206	50.596
1.689		0.086	10311	120.965
1.402		0.239	11637	50.021
1.480		0.462	13982	31.706
1.043		2.294	29442	13.829

1.785		2.389	30656	14.587
1.449		2.254	50295	23.736
1.150		1.476	32939	23.457
1.308		1.779	101681	58.440
1.505		0.758	108635	144.893
2.430		0.334	205808	618.677
2.969		0.063	20517	327.158
1.970		0.086	12402	145.354
1.689		0.086	11778	137.941
1.402		0.239	13675	58.535
1.480		0.462	13982	31.706
1.043		2.294	29442	13.829
1.785		2.389	15760	8.352
1.449		2.254	19529	10.086
1.150		1.476	23167	16.837
1.308		1.779	33676	20.221
1.505		0.758	19962	27.854
2.430		0.334	22539	69.937
2.969		0.063	3078	51.626
1.970		0.086	4206	50.596
1.689		0.086	1929	23.991
1.402		0.239	2497	11.826
1.480		0.462	2489	6.842
1.043		2.294	23944	11.433
1.785		2.389	72268	32.004
1.449		2.254	50295	23.736
1.150		1.476	71788	49.774
1.308		1.779	101681	58.440
1.505		0.758	90376	120.792
2.430		0.334	22539	69.937
2.969		0.063	4271	70.480
1.970		0.086	4206	50.596
1.689		0.086	3026	36.687
1.402		0.239	5340	23.704
1.480		0.462	5931	14.289
1.043		2.294	15136	7.594
1.785		2.389	8808	5.442
1.449		2.254	8310	5.109
1.140		1.476	23167	16.820
1.297		1.779	62294	36.279

1.493		0.758	90376	120.780
2.430		0.334	80315	242.929
2.969		0.063	11577	185.912
1.970		0.086	10828	127.163
1.689		0.086	4939	58.823
1.402		0.239	6305	27.739
1.480		0.462	5931	14.289
1.043		2.294	15136	7.594
1.785		2.389	53309	24.069
1.449		2.254	35374	17.116
1.150		1.476	38895	27.491
1.308		1.779	101681	58.440
1.505		0.758	162897	216.513
2.430		0.334	84737	256.169
2.969		0.063	20517	327.158
1.970		0.086	21944	255.682
1.689		0.086	18584	216.686
1.402		0.239	13675	58.535
1.480		0.462	16182	36.466
1.043		2.294	43425	19.923
1.785		2.389	24932	12.191
1.449		2.254	50295	23.736
1.150		1.476	32939	23.457
1.308		1.779	72914	42.273
1.505		0.758	66716	89.564
2.430		0.334	213049	640.356
2.969		0.063	39003	619.220
1.970		0.086	20799	242.442
1.689		0.086	7611	89.737
1.402		0.239	7239	31.639
1.480		0.462	5931	14.289
1.043		2.294	23944	11.433
1.785		2.389	30656	14.587
1.449		2.254	28923	14.254
1.150		1.476	18942	13.975
1.308		1.779	46883	27.644
1.505		0.758	66716	89.564
2.430		0.334	29410	90.511
2.969		0.063	4271	70.480
1.970		0.086	4943	59.111

1.689		0.086	2615	31.927
1.402		0.239	3756	17.084
1.480		0.462	4824	11.893
1.043		2.294	23944	11.433
1.785		2.389	20699	10.419
1.449		2.254	59389	27.770
1.150		1.476	51681	36.153
1.308		1.779	53823	31.544
1.505		0.758	22918	31.754
2.430		0.334	8800	28.801
2.969		0.063	1412	25.309
1.970		0.086	1637	20.892
1.689		0.086	1109	14.510
1.402		0.239	1579	7.987
1.480		0.462	2489	6.842
1.043		2.294	12355	6.382
1.785		2.389	15760	8.352
1.449		2.254	19529	10.086
1.150		1.476	12790	9.807
1.308		1.779	27925	16.989
1.505		0.758	19962	27.854
2.430		0.334	8800	28.801
2.969		0.063	993	18.690
1.970		0.086	749	10.630
1.689		0.086	465	7.062
1.402		0.239	680	4.231
1.480		0.462	877	3.355
1.034		2.294	2272	1.925
1.770		2.389	8808	5.390
1.437		2.254	6404	4.220
1.140		1.476	15405	11.561
1.297		1.779	22832	14.101
1.493		0.758	22918	31.742
2.410		0.334	11693	37.468
2.944		0.063	1412	25.315
1.954		0.086	1110	14.776
1.675		0.086	2277	27.999
1.390		0.239	6305	27.713
1.467		0.462	5931	14.250
1.034		2.294	23944	11.372

1.770		2.389	45216	20.631
1.437		2.254	42659	20.305
1.140		1.476	38895	27.474
1.297		1.779	33676	20.195
1.493		0.758	19962	27.842
2.410		0.334	8800	28.807
2.944		0.063	3078	51.632
1.954		0.086	3028	36.954
1.675		0.086	1636	20.577
1.390		0.239	2073	10.029
1.467		0.462	2489	6.803
1.034		2.294	5753	3.444
1.770		2.389	5990	4.212
1.437		2.254	14869	7.976
1.140		1.476	9738	7.722
1.297		1.779	11738	7.865
1.492		0.758	6564	10.157
2.409		0.334	2203	9.056
2.943		0.063	418	9.599
1.953		0.086	466	7.328
1.674		0.086	246	4.491
1.390		0.239	600	3.872
1.467		0.462	1313	4.258
1.034		2.294	8460	4.621
1.770		2.389	5990	4.211
1.436		2.254	8310	5.064
1.140		1.476	44653	31.374
1.297		1.779	62294	36.279
1.493		0.758	598512	791.470
2.430		0.334	263839	792.429
2.969		0.063	43104	684.017
1.970		0.086	28037	326.128
1.689		0.086	12394	145.066
1.402		0.239	21073	89.449
1.480		0.462	40703	89.516
1.043		2.294	131117	58.142
1.785		2.389	72268	32.004
1.449		2.254	78912	36.431
1.150		1.476	51681	36.153
1.308		1.779	62294	36.305

1.505		0.758	43295	58.650
2.430		0.334	84737	256.169
2.969		0.063	7924	128.192
1.970		0.086	4206	50.596
1.689		0.086	2277	28.026
1.402		0.239	4529	20.316
1.480		0.462	5931	14.289
1.043		2.294	15136	7.594
1.785		2.389	15760	8.352
1.449		2.254	50295	23.736
1.150		1.476	32939	23.457
1.308		1.779	39704	23.609
1.505		0.758	31046	42.483
2.430		0.334	19085	59.597
2.969		0.063	2594	43.973
1.970		0.086	3028	36.975
1.689		0.086	1357	17.372
1.402		0.239	2497	11.826
1.480		0.462	2489	6.842
1.043		2.294	8460	4.685
1.785		2.389	6787	4.596
1.437		2.254	8310	5.066
1.140		1.476	7949	6.510
1.297		1.779	33676	20.195
1.493		0.758	31046	42.471
2.410		0.334	10103	32.707
2.944		0.063	3617	60.147
1.970		0.086	3028	36.975
1.689		0.086	1636	20.604
1.402		0.239	4529	20.316
1.480		0.462	4824	11.893
1.043		2.294	43425	19.923
1.785		2.389	774455	325.917
1.449		2.254	730666	325.584
1.150		1.476	478528	325.305
1.308		1.779	451449	255.011
1.505		0.758	162897	216.513
2.430		0.334	108265	326.615
2.969		0.063	20517	327.158
1.970		0.086	15821	184.882

1.689		0.086	4939	58.823
1.402		0.239	9806	42.368
1.480		0.462	12179	27.805
1.043		2.294	36009	16.692
1.785		2.389	24932	12.191
1.449		2.254	59389	27.770
1.150		1.476	60491	42.121
1.308		1.779	222769	126.492
1.505		0.758	43295	58.650
2.430		0.334	61091	185.369
2.969		0.063	5574	91.054
1.970		0.086	3544	42.944
1.689		0.086	1929	23.991
1.402		0.239	3071	14.222
1.480		0.462	4005	10.121
1.043		2.294	8460	4.685
1.785		2.389	8808	5.442
1.437		2.254	14869	7.976
1.140		1.476	176091	120.412
1.308		1.779	222769	126.492
1.505		0.758	66716	89.564
2.430		0.334	39840	121.739
2.969		0.063	7550	122.282
1.970		0.086	5837	69.450
1.689		0.086	3026	36.687
1.402		0.239	3756	17.084
1.480		0.462	3049	8.054
1.043		2.294	23944	11.433
1.785		2.389	12864	7.140
1.449		2.254	23522	11.858
1.150		1.476	23167	16.837
1.308		1.779	53823	31.544
1.505		0.758	51128	68.990
2.430		0.334	41814	127.649
2.969		0.063	8625	139.259
1.970		0.086	4943	59.111
1.689		0.086	4939	58.823
1.402		0.239	8378	36.400
1.480		0.462	10314	23.771
1.043		2.294	23944	11.433

1.785		2.389	15760	8.352
1.449		2.254	19529	10.086
1.150		1.476	12790	9.807
1.308		1.779	22832	14.127
1.505		0.758	9722	14.337
2.430		0.334	6321	21.378
2.969		0.063	1198	21.921
1.970		0.086	903	12.402
1.689		0.086	319	5.365
1.402		0.239	600	3.898
1.467		0.462	458	2.407
1.034		2.294	2272	1.925
1.770		2.389	2366	2.693
1.436		2.254	4279	3.276
1.140		1.476	7949	6.510
1.297		1.779	15416	9.933
1.493		0.758	7906	11.929
2.410		0.334	5242	18.153
2.944		0.063	993	18.696
1.954		0.086	1110	14.776
1.675		0.086	465	7.036
1.390		0.239	680	4.206
1.467		0.462	877	3.317
1.034		2.294	4356	2.833
1.770		2.389	4535	3.603
1.437		2.254	128805	58.524
1.150		1.476	84357	58.288
1.308		1.779	242460	137.559
1.505		0.758	90376	120.792
2.430		0.334	19085	59.597
2.969		0.063	4271	70.480
1.970		0.086	3028	36.975
1.689		0.086	1357	17.372
1.402		0.239	2073	10.054
1.480		0.462	2489	6.842
1.043		2.294	8460	4.685
1.785		2.389	5990	4.262
1.437		2.254	23522	11.815
1.140		1.476	18942	13.957
1.297		1.779	39704	23.583

1.493		0.758	11890	17.187
2.410		0.334	3485	12.894
2.944		0.063	1668	29.350
1.954		0.086	2616	32.193
1.675		0.086	1929	23.965
1.390		0.239	3756	17.059
1.467		0.462	4005	10.082
1.034		2.294	12355	6.321
1.770		2.389	6787	4.546
1.437		2.254	19529	10.043
1.140		1.476	44653	31.375
1.297		1.779	212253	120.556
1.505		0.758	182193	241.982
2.430		0.334	213049	640.356
2.969		0.063	40375	640.899
1.970		0.086	21944	255.682
1.689		0.086	10821	126.875
1.402		0.239	9806	42.368
1.480		0.462	18941	42.435
1.043		2.294	51198	23.311
1.785		2.389	20699	10.419
1.449		2.254	50295	23.736
1.150		1.476	27938	20.069
1.308		1.779	53823	31.544
1.505		0.758	43295	58.650
2.430		0.334	19085	59.597
2.969		0.063	4271	70.480
1.970		0.086	5837	69.450
1.689		0.086	4203	50.308
1.402		0.239	11637	50.021
1.480		0.462	12179	27.805
1.043		2.294	43425	19.923
1.785		2.389	45216	20.681
1.449		2.254	68182	31.671
1.150		1.476	184815	126.340
1.308		1.779	156687	89.354
1.505		0.758	51128	68.990
2.430		0.334	39840	121.739
2.969		0.063	4271	70.480
1.970		0.086	4206	50.596

1.689		0.086	2277	28.026
1.402		0.239	2497	11.826
1.480		0.462	3049	8.054
1.043		2.294	8460	4.685
1.785		2.389	6787	4.596
1.437		2.254	23522	11.815
1.140		1.476	27938	20.052
1.297		1.779	72914	42.247
1.493		0.758	51128	68.978
2.430		0.334	19085	59.597
2.969		0.063	3078	51.626
1.970		0.086	3028	36.975
1.689		0.086	1636	20.604
1.402		0.239	2073	10.054
1.480		0.462	2489	6.842
1.043		2.294	8460	4.685
1.785		2.389	8808	5.442
1.437		2.254	14869	7.976
1.140		1.476	12790	9.789
1.297		1.779	86531	49.900
1.493		0.758	90376	120.780
2.430		0.334	47889	145.841
2.969		0.063	15221	243.472
1.970		0.086	11786	138.229
1.689		0.086	10821	126.875
1.402		0.239	11637	50.021
1.480		0.462	10314	23.771
1.043		2.294	23944	11.433
1.785		2.389	15760	8.352
1.449		2.254	28923	14.254
1.150		1.476	176091	120.430
1.308		1.779	382574	216.303
1.505		0.758	108635	144.893
2.430		0.334	39840	121.739
2.969		0.063	4271	70.480
1.970		0.086	4206	50.596
1.689		0.086	2277	28.026
1.402		0.239	2497	11.826
1.480		0.462	3049	8.054
1.043		2.294	6519	3.839

1.785		2.389	20699	10.419
1.436		2.254	28923	14.209
1.140		1.476	44653	31.374
1.297		1.779	62294	36.279
1.493		0.758	31046	42.471
2.410		0.334	13686	43.436
2.944		0.063	1668	29.350
1.954		0.086	1930	24.258
1.675		0.086	749	10.315
1.390		0.239	1579	7.962
1.467		0.462	8748	20.344
1.034		2.294	29442	13.768
1.770		2.389	24932	12.141
1.437		2.254	14869	7.976
1.140		1.476	15405	11.561
1.297		1.779	18569	11.705
1.493		0.758	7906	11.929
2.410		0.334	7452	24.772
2.944		0.063	812	15.833
1.953		0.086	749	10.608
1.674		0.086	465	7.035
1.390		0.239	1579	7.961
1.467		0.462	1704	5.104
1.034		2.294	5753	3.442
1.770		2.389	5990	4.211
1.436		2.254	4279	3.276
1.140		1.476	7949	6.510
1.297		1.779	9581	6.653
1.492		0.758	22918	31.742
2.409		0.334	19085	59.604
2.969		0.063	3617	60.140
1.970		0.086	3028	36.975
1.689		0.086	1357	17.372
1.402		0.239	1579	7.987
1.480		0.462	4005	10.121
1.043		2.294	8460	4.685
1.785		2.389	12864	7.140
1.437		2.254	8310	5.066
1.140		1.476	15405	11.561
1.297		1.779	22832	14.101

1.493		0.758	22918	31.742
2.410		0.334	16242	51.089
2.944		0.063	3617	60.147
1.970		0.086	2279	28.314
1.689		0.086	1109	14.510
1.402		0.239	2497	11.826
1.480		0.462	2489	6.842
1.043		2.294	8460	4.685
1.785		2.389	5990	4.262
1.437		2.254	6404	4.220
1.140		1.476	12790	9.790
1.297		1.779	15416	9.933
1.493		0.758	16906	23.807
2.410		0.334	10103	32.707
2.944		0.063	1915	33.251
1.954		0.086	2279	28.293
1.675		0.086	1357	17.345
1.390		0.239	2073	10.029
1.467		0.462	1704	5.105
1.034		2.294	15136	7.533
1.770		2.389	12864	7.090
1.437		2.254	23522	11.815
1.140		1.476	27938	20.052
1.297		1.779	101681	58.414
1.505		0.758	31046	42.483
2.430		0.334	8800	28.801
2.969		0.063	812	15.827
1.970		0.086	1110	14.798
1.689		0.086	465	7.062
1.402		0.239	2073	10.054
1.480		0.462	1704	5.144
1.043		2.294	5753	3.505
1.770		2.389	6787	4.544
1.436		2.254	19529	10.041
1.140		1.476	27938	20.051
1.297		1.779	22832	14.100
1.492		0.758	9722	14.325
2.409		0.334	4286	15.290
2.943		0.063	993	18.696
1.953		0.086	2279	28.292

1.674		0.086	1109	14.482
1.390		0.239	2073	10.028
1.467		0.462	1704	5.104
1.034		2.294	5753	3.442
1.770		2.389	5990	4.211
1.436		2.254	5652	3.885
1.140		1.476	4194	3.966
1.297		1.779	6560	4.955
1.492		0.758	9722	14.325
2.409		0.334	6321	21.385
2.943		0.063	993	18.696
1.953		0.086	903	12.379
1.674		0.086	749	10.314
1.390		0.239	1289	6.749
1.467		0.462	1313	4.258
1.034		2.294	8460	4.621
1.770		2.389	8808	5.390
1.436		2.254	14869	7.974
1.140		1.476	18942	13.957
1.297		1.779	18569	11.704
1.492		0.758	4080	6.878
2.409		0.334	837	4.966
2.943		0.063	63	3.992
1.953		0.086	86	2.934
1.674		0.086	62	2.364
1.390		0.239	118	1.856
1.467		0.462	3049	8.014

Vol_o (Mm^3)	Vol_{poss} (Mm^3)	WL_{poss} (gmsl)	$t_{o.prelim}$ (month)	t_o (month)
1.504	2.909	1.310	0.359	0.359
1.504	3.619	1.480	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000

1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	3.462	1.440	0.287	0.287
1.504	5.390	1.700	0.000	0.000
1.504	6.316	1.740	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	6.512	1.750	0.076	0.076
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000

1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	6.512	1.750	0.110	0.110
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
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1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000

1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	6.512	1.750	0.110	0.110
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	5.015	1.680	0.183	0.183
1.504	4.338	1.630	0.000	0.000

1.504	4.199	1.600	0.000	0.000
1.504	4.781	1.670	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	4.222	1.600	0.225	0.225
1.504	5.105	1.680	0.000	0.000
1.504	5.390	1.700	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	4.980	1.680	0.185	0.185
1.504	5.470	1.700	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000

1.504	5.313	1.690	0.171	0.171
1.504	5.724	1.710	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	5.313	1.690	0.171	0.171
1.504	5.724	1.710	0.000	0.000
1.504	5.137	1.690	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
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1.504	4.948	1.680	0.000	0.000
1.504	5.716	1.710	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
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1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000

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1.504	0.717	0.450	1.000	1.000
1.504	4.222	1.600	0.225	0.225
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1.504	0.717	0.450	1.000	1.000
1.504	5.313	1.690	0.171	0.171
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1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.127	1.730	0.000	0.000
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1.504	5.390	1.700	0.000	0.000
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1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	5.281	1.690	0.000	0.000
1.504	6.050	1.730	0.000	0.000
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1.504	6.512	1.750	0.000	0.000
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1.504	6.512	1.750	0.000	0.000

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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	5.401	1.700	0.168	0.168
1.504	6.050	1.730	0.000	0.000
1.504	6.512	1.750	0.000	0.000
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1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	5.313	1.690	0.171	0.171
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	5.401	1.700	0.168	0.168
1.504	6.512	1.750	0.000	0.000
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1.504	6.512	1.750	0.000	0.000
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1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
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1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
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1.504	6.512	1.750	0.000	0.000
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1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	4.072	1.570	0.235	0.235
1.504	3.428	1.440	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	5.724	1.710	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000

1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	4.948	1.680	0.000	0.000
1.504	5.716	1.710	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	5.995	1.720	0.000	0.000
1.504	5.375	1.700	0.000	0.000
1.504	5.762	1.710	0.000	0.000
1.504	6.125	1.730	0.000	0.000
1.504	5.714	1.710	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000

1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	5.313	1.690	0.171	0.171
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000

1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	6.159	1.730	0.145	0.145
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000

1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	4.614	1.660	0.202	0.202
1.504	3.911	1.540	0.000	0.000
1.504	3.428	1.440	0.000	0.000
1.504	4.197	1.600	0.000	0.000
1.504	4.779	1.670	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	5.710	1.710	0.000	0.000
1.504	4.820	1.670	0.000	0.000
1.504	4.336	1.630	0.000	0.000
1.504	5.107	1.680	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	4.979	1.680	0.185	0.185
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000

1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.050	1.730	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000

1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	5.313	1.690	0.171	0.171
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	6.159	1.730	0.145	0.145
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
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1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000

1.504	6.512	1.750	0.076	0.076
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
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1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	4.945	1.680	0.000	0.000
1.504	5.714	1.710	0.000	0.000
1.504	4.779	1.670	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	6.512	1.750	0.110	0.110
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000

1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	4.979	1.680	0.185	0.185
1.504	5.724	1.710	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
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1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	0.717	0.450	1.000	1.000
1.504	4.222	1.600	0.225	0.225
1.504	6.048	1.730	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000

1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	4.945	1.680	0.000	0.000
1.504	5.714	1.710	0.000	0.000
1.504	5.389	1.700	0.000	0.000
1.504	5.470	1.700	0.000	0.000
1.504	6.459	1.740	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	5.762	1.710	0.000	0.000
1.504	6.125	1.730	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.512	1.750	0.000	0.000
1.504	6.470	1.740	0.000	0.000
1.504	5.496	1.700	0.000	0.000
1.504	4.438	1.650	0.000	0.000
1.504	3.867	1.530	0.000	0.000
1.504	3.360	1.420	0.000	0.000
1.504	6.512	1.750	0.000	0.000

H_{min} (gmsl)	Q_{min} (Mm^3 / month)	H_{max} (gmsl)	H_{check} (m)	Q_{max} (Mm^3 / month)
0.900	0.000	1.310	0.410	35.384
0.900	0.000	1.480	0.580	59.535
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
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0.900	0.000	0.900	0.000	0.000
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.440	0.540	53.484
0.900	0.000	1.700	0.800	96.442
0.900	0.000	1.740	0.840	103.765
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624

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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.680	0.780	92.848
0.900	0.000	1.630	0.730	84.065

0.900	0.000	1.600	0.700	78.937
0.900	0.000	1.670	0.770	91.069
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	1.600	0.700	78.937
0.900	0.000	1.680	0.780	92.848
0.900	0.000	1.700	0.800	96.442
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	1.680	0.780	92.848
0.900	0.000	1.700	0.800	96.442
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000

0.900	0.000	1.690	0.790	94.640
0.900	0.000	1.710	0.810	98.256
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.690	0.790	94.640
0.900	0.000	1.710	0.810	98.256
0.900	0.000	1.690	0.790	94.640
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.680	0.780	92.848
0.900	0.000	1.710	0.810	98.256
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.600	0.700	78.937
0.900	0.000	1.730	0.830	101.918
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.690	0.790	94.640
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.740	0.840	103.765
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.730	0.830	101.918
0.900	0.000	1.710	0.810	98.256
0.900	0.000	1.700	0.800	96.442
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	1.690	0.790	94.640
0.900	0.000	1.730	0.830	101.918
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.720	0.820	100.081
0.900	0.000	1.700	0.800	96.442
0.900	0.000	1.710	0.810	98.256
0.900	0.000	1.730	0.830	101.918
0.900	0.000	1.710	0.810	98.256
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	0.900	0.000	0.000
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.690	0.790	94.640
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.730	0.830	101.918
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	0.900	0.000	0.000
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0.900	0.000	1.540	0.640	69.008
0.900	0.000	1.440	0.540	53.484
0.900	0.000	1.600	0.700	78.937
0.900	0.000	1.670	0.770	91.069
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.710	0.810	98.256
0.900	0.000	1.670	0.770	91.069
0.900	0.000	1.630	0.730	84.065
0.900	0.000	1.680	0.780	92.848
0.900	0.000	1.750	0.850	105.624
0.900	0.000	0.900	0.000	0.000
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.680	0.780	92.848
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624

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0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.730	0.830	101.918
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.690	0.790	94.640
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.730	0.830	101.918
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000

0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.680	0.780	92.848
0.900	0.000	1.710	0.810	98.256
0.900	0.000	1.670	0.770	91.069
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624

0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.680	0.780	92.848
0.900	0.000	1.710	0.810	98.256
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
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0.900	0.000	0.900	0.000	0.000
0.900	0.000	0.900	0.000	0.000
0.900	0.000	1.600	0.700	78.937
0.900	0.000	1.730	0.830	101.918
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624

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0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.680	0.780	92.848
0.900	0.000	1.710	0.810	98.256
0.900	0.000	1.700	0.800	96.442
0.900	0.000	1.700	0.800	96.442
0.900	0.000	1.740	0.840	103.765
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.710	0.810	98.256
0.900	0.000	1.730	0.830	101.918
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.750	0.850	105.624
0.900	0.000	1.740	0.840	103.765
0.900	0.000	1.700	0.800	96.442
0.900	0.000	1.650	0.750	87.544
0.900	0.000	1.530	0.630	67.397
0.900	0.000	1.420	0.520	50.540
0.900	0.000	1.750	0.850	105.624

Q_{ave} (Mm^3 / month)	t_{prem} (month)	t (month)	t_x / t_w (month)	t_x (month)
17.692	0.000	0.000	tx	0.641
29.768	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.301	0.301	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
26.742	0.000	0.000	tx	0.713
48.221	0.000	0.000	tx	1.000
51.883	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.683	0.683	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
52.812	0.000	0.000	tx	0.924
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.137	0.137	tw	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
52.812	0.000	0.000	tx	0.890
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.310	0.310	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
52.812	0.000	0.000	tx	0.890
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.058	0.058	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
46.424	0.000	0.000	tx	0.817
42.033	0.000	0.000	tx	1.000

39.468	0.000	0.000	tx	1.000
45.534	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.067	0.067	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
39.468	0.000	0.000	tx	0.775
46.424	0.000	0.000	tx	1.000
48.221	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.136	0.136	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
46.424	0.000	0.000	tx	0.815
48.221	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.283	0.283	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

47.320	0.000	0.000	tx	0.829
49.128	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.131	0.131	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
47.320	0.000	0.000	tx	0.829
49.128	0.000	0.000	tx	1.000
47.320	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
46.424	0.000	0.000	tx	1.000
49.128	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.292	0.292	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
39.468	0.000	0.000	tx	0.775
50.959	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.737	0.737	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
47.320	0.000	0.000	tx	0.829
52.812	0.000	0.000	tx	1.000
51.883	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000

52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
50.959	0.000	0.000	tx	1.000
49.128	0.000	0.000	tx	1.000
48.221	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
47.320	0.000	0.000	tx	1.000
50.959	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000

52.812	0.136	0.136	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
52.812	0.000	0.000	tx	0.934
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.054	0.054	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
52.812	0.000	0.000	tx	0.890
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.737	0.737	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
48.221	0.000	0.000	tx	0.832
50.959	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.310	0.310	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
47.320	0.000	0.000	tx	0.829
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000

52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.860	0.860	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
48.221	0.000	0.000	tx	0.832
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.292	0.292	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
52.812	0.000	0.000	tx	0.877
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.131	0.131	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
52.812	0.000	0.000	tx	0.890
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
47.320	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.860	0.860	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000

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0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
50.041	0.000	0.000	tx	0.846
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000

52.812	0.074	0.074	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
36.959	0.000	0.000	tx	0.765
26.742	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
49.128	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000

52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
46.424	0.000	0.000	tx	1.000
49.128	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
50.041	0.000	0.000	tx	1.000
48.221	0.000	0.000	tx	1.000
49.128	0.000	0.000	tx	1.000
50.959	0.000	0.000	tx	1.000
49.128	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.007	0.007	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
47.320	0.000	0.000	tx	0.829
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.683	0.683	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
50.959	0.000	0.000	tx	0.855
52.812	0.000	0.000	tx	1.000
52.812	0.074	0.074	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
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0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
44.650	0.000	0.000	tx	0.798
34.504	0.000	0.000	tx	1.000
26.742	0.000	0.000	tx	1.000
39.468	0.000	0.000	tx	1.000
45.534	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
49.128	0.000	0.000	tx	1.000
45.534	0.000	0.000	tx	1.000
42.033	0.000	0.000	tx	1.000
46.424	0.000	0.000	tx	1.000
52.812	0.877	0.877	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
46.424	0.000	0.000	tx	0.815
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000

52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
50.959	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.074	0.074	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
47.320	0.000	0.000	tx	0.829
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.310	0.310	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
50.959	0.000	0.000	tx	0.855
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.074	0.074	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000

52.812	0.000	0.000	tx	0.924
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
46.424	0.000	0.000	tx	1.000
49.128	0.000	0.000	tx	1.000
45.534	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.737	0.737	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
52.812	0.000	0.000	tx	0.890
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000

52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.683	0.683	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
46.424	0.000	0.000	tx	0.815
49.128	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.894	0.894	tw	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
0.000	0.000	0.000	-	0.000
39.468	0.000	0.000	tx	0.775
50.959	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000

52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
46.424	0.000	0.000	tx	1.000
49.128	0.000	0.000	tx	1.000
48.221	0.000	0.000	tx	1.000
48.221	0.000	0.000	tx	1.000
51.883	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
49.128	0.000	0.000	tx	1.000
50.959	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000
51.883	0.000	0.000	tx	1.000
48.221	0.000	0.000	tx	1.000
43.772	0.000	0.000	tx	1.000
33.699	0.000	0.000	tx	1.000
25.270	0.000	0.000	tx	1.000
52.812	0.000	0.000	tx	1.000

t_w (month)	t_{total} (month)	Vol_{acc} (Mm^3)	$Q_{weir\ outflow}$ (Mm^3 / month)	Vol_{res} (Mm^3)
0.000	1.000	2.909	1.405	1.504
0.000	1.000	3.619	2.116	1.504
0.000	1.000	21.699	20.195	1.504
0.000	1.000	33.246	31.742	1.504
0.000	1.000	52.593	51.089	1.504
0.000	1.000	53.136	51.632	1.504
0.699	1.000	22.430	15.918	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717

0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	3.462	1.958	1.504
0.000	1.000	5.390	3.886	1.504
0.000	1.000	6.316	4.812	1.504
0.000	1.000	18.466	16.963	1.504
0.000	1.000	18.691	17.187	1.504
0.000	1.000	34.211	32.707	1.504
0.317	1.000	42.573	36.061	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	11.136	9.632	1.504
0.000	1.000	13.317	11.813	1.504
0.000	1.000	32.878	31.374	1.504
0.863	1.000	13.755	7.243	0.717

0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
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0.000	1.000	0.717	0.000	0.717
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0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	7.856	6.353	1.504
0.000	1.000	9.479	7.976	1.504
0.000	1.000	13.064	11.561	1.504
0.000	1.000	18.467	16.963	1.504
0.000	1.000	21.923	20.419	1.504
0.000	1.000	34.211	32.707	1.504
0.000	1.000	53.136	51.632	1.504
0.000	1.000	29.796	28.293	1.504
0.000	1.000	18.849	17.345	1.504
0.000	1.000	11.533	10.029	1.504
0.000	1.000	11.586	10.082	1.504
0.000	1.000	7.825	6.321	1.504
0.000	1.000	6.896	5.392	1.504
0.000	1.000	15.714	14.211	1.504
0.000	1.000	18.323	16.820	1.504
0.000	1.000	37.782	36.279	1.504
0.690	1.000	22.874	16.362	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717

0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	7.856	6.353	1.504
0.000	1.000	8.267	6.764	1.504
0.000	1.000	9.226	7.722	1.504
0.000	1.000	13.209	11.705	1.504
0.000	1.000	25.311	23.807	1.504
0.000	1.000	22.888	21.384	1.504
0.942	1.000	9.572	3.059	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
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0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	5.015	3.511	1.504
0.000	1.000	4.338	2.835	1.504

0.000	1.000	4.199	2.695	1.504
0.000	1.000	4.781	3.277	1.504
0.000	1.000	8.014	6.510	1.504
0.000	1.000	11.437	9.933	1.504
0.000	1.000	13.433	11.929	1.504
0.933	1.000	10.046	3.534	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
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0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	4.222	2.718	1.504
0.000	1.000	5.105	3.602	1.504
0.000	1.000	5.390	3.886	1.504
0.000	1.000	15.460	13.957	1.504
0.000	1.000	37.782	36.279	1.504
0.864	1.000	13.711	7.199	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
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0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717

0.000	1.000	0.717	0.000	0.717
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0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	4.980	3.476	1.504
0.000	1.000	5.470	3.966	1.504
0.000	1.000	8.158	6.654	1.504
0.000	1.000	21.923	20.419	1.504
0.000	1.000	52.593	51.089	1.504
0.717	1.000	21.478	14.965	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
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0.000	1.000	5.313	3.809	1.504
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0.000	1.000	33.246	31.742	1.504
0.000	1.000	44.940	43.436	1.504
0.869	1.000	13.427	6.915	0.717
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0.000	1.000	8.266	6.762	1.504
0.000	1.000	15.460	13.957	1.504
0.000	1.000	18.466	16.963	1.504
0.000	1.000	51.627	50.123	1.504
0.263	1.000	45.458	38.946	0.717
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0.000	1.000	33.132	31.628	1.504
0.000	1.000	43.607	42.103	1.504
0.000	1.000	33.022	31.518	1.504

0.864	1.000	13.711	7.199	0.717
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0.000	1.000	37.782	36.279	1.504
0.000	1.000	33.246	31.742	1.504
0.263	1.000	45.458	38.946	0.717
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0.000	1.000	51.404	49.900	1.504
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0.000	1.000	24.943	23.439	1.504
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0.140	1.000	51.909	45.397	0.717
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0.000	1.000	7.099	5.595	1.504
0.000	1.000	6.896	5.392	1.504
0.000	1.000	8.267	6.764	1.504
0.000	1.000	11.293	9.790	1.504
0.000	1.000	25.087	23.583	1.504
0.000	1.000	21.923	20.419	1.504
0.000	1.000	19.656	18.153	1.504
0.869	1.000	13.427	6.915	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	7.856	6.353	1.504
0.000	1.000	21.809	20.305	1.504
0.000	1.000	21.555	20.052	1.504
0.000	1.000	25.087	23.583	1.504
0.000	1.000	25.311	23.807	1.504
0.000	1.000	30.310	28.807	1.504
0.000	1.000	23.431	21.928	1.504
0.000	1.000	16.280	14.776	1.504
0.000	1.000	15.986	14.483	1.504
0.000	1.000	9.466	7.962	1.504
0.000	1.000	6.609	5.105	1.504
0.000	1.000	5.281	3.778	1.504
0.000	1.000	6.896	5.392	1.504
0.000	1.000	13.318	11.815	1.504
0.000	1.000	24.943	23.439	1.504
0.000	1.000	25.087	23.583	1.504
0.140	1.000	51.909	45.397	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
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0.000	1.000	5.826	4.322	1.504
0.000	1.000	18.323	16.820	1.504
0.000	1.000	37.782	36.279	1.504

0.926	1.000	10.404	3.892	0.717
0.000	1.000	0.717	0.000	0.717
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0.000	1.000	4.072	2.568	1.504
0.000	1.000	3.428	1.925	1.504
0.000	1.000	6.894	5.390	1.504
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0.000	1.000	15.605	14.101	1.504
0.000	1.000	33.246	31.742	1.504
0.000	1.000	38.972	37.468	1.504
0.000	1.000	26.819	25.315	1.504
0.000	1.000	16.280	14.776	1.504
0.000	1.000	29.503	27.999	1.504
0.000	1.000	29.217	27.713	1.504
0.000	1.000	15.754	14.250	1.504
0.000	1.000	12.876	11.372	1.504

0.000	1.000	22.135	20.631	1.504
0.000	1.000	21.809	20.305	1.504
0.000	1.000	28.978	27.474	1.504
0.000	1.000	21.699	20.195	1.504
0.000	1.000	29.345	27.842	1.504
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0.000	1.000	11.533	10.029	1.504
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0.000	1.000	4.948	3.444	1.504
0.000	1.000	5.716	4.212	1.504
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0.000	1.000	11.661	10.157	1.504
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0.000	1.000	11.102	9.599	1.504
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0.000	1.000	5.714	4.211	1.504
0.000	1.000	6.568	5.064	1.504
0.000	1.000	32.878	31.374	1.504
0.000	1.000	37.782	36.279	1.504
0.993	1.000	6.870	0.358	0.717
0.000	1.000	0.717	0.000	0.717
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0.000	1.000	5.313	3.809	1.504
0.000	1.000	6.570	5.066	1.504
0.000	1.000	8.014	6.510	1.504
0.000	1.000	21.699	20.195	1.504
0.000	1.000	43.975	42.471	1.504
0.000	1.000	34.211	32.707	1.504
0.317	1.000	42.573	36.061	0.717
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0.000	1.000	6.159	4.655	1.504
0.000	1.000	9.479	7.976	1.504
0.926	1.000	10.425	3.913	0.717
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0.000	1.000	4.614	3.111	1.504
0.000	1.000	3.911	2.407	1.504
0.000	1.000	3.428	1.925	1.504
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0.000	1.000	4.779	3.276	1.504
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0.000	1.000	11.437	9.933	1.504
0.000	1.000	13.433	11.929	1.504
0.000	1.000	19.656	18.153	1.504
0.000	1.000	20.199	18.696	1.504
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0.000	1.000	5.710	4.206	1.504
0.000	1.000	4.820	3.317	1.504
0.000	1.000	4.336	2.833	1.504
0.000	1.000	5.107	3.603	1.504
0.123	1.000	52.818	46.306	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
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0.000	1.000	4.979	3.476	1.504
0.000	1.000	13.318	11.815	1.504
0.000	1.000	15.461	13.957	1.504
0.000	1.000	25.087	23.583	1.504

0.000	1.000	18.691	17.187	1.504
0.000	1.000	14.398	12.894	1.504
0.000	1.000	30.854	29.350	1.504
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0.000	1.000	25.468	23.965	1.504
0.000	1.000	18.563	17.059	1.504
0.000	1.000	11.586	10.082	1.504
0.000	1.000	7.825	6.321	1.504
0.000	1.000	6.050	4.546	1.504
0.000	1.000	11.547	10.043	1.504
0.000	1.000	32.878	31.375	1.504
0.926	1.000	10.416	3.904	0.717
0.000	1.000	0.717	0.000	0.717
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0.000	1.000	5.313	3.809	1.504
0.000	1.000	13.318	11.815	1.504
0.000	1.000	21.555	20.052	1.504
0.000	1.000	43.751	42.247	1.504
0.690	1.000	22.874	16.362	0.717
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0.000	1.000	0.717	0.000	0.717
0.000	1.000	6.159	4.655	1.504
0.000	1.000	9.479	7.976	1.504
0.000	1.000	11.293	9.789	1.504
0.000	1.000	51.404	49.900	1.504
0.926	1.000	10.404	3.892	0.717
0.000	1.000	0.717	0.000	0.717
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0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717

0.000	1.000	11.136	9.632	1.504
0.000	1.000	15.713	14.209	1.504
0.000	1.000	32.878	31.374	1.504
0.000	1.000	37.782	36.279	1.504
0.000	1.000	43.975	42.471	1.504
0.000	1.000	44.940	43.436	1.504
0.000	1.000	30.854	29.350	1.504
0.000	1.000	25.762	24.258	1.504
0.000	1.000	11.819	10.315	1.504
0.000	1.000	9.466	7.962	1.504
0.000	1.000	21.848	20.344	1.504
0.000	1.000	15.272	13.768	1.504
0.000	1.000	13.644	12.141	1.504
0.000	1.000	9.479	7.976	1.504
0.000	1.000	13.064	11.561	1.504
0.000	1.000	13.209	11.705	1.504
0.000	1.000	13.433	11.929	1.504
0.000	1.000	26.276	24.772	1.504
0.000	1.000	17.337	15.833	1.504
0.000	1.000	12.111	10.608	1.504
0.000	1.000	8.538	7.035	1.504
0.000	1.000	9.465	7.961	1.504
0.000	1.000	6.607	5.104	1.504
0.000	1.000	4.945	3.442	1.504
0.000	1.000	5.714	4.211	1.504
0.000	1.000	4.779	3.276	1.504
0.000	1.000	8.013	6.510	1.504
0.000	1.000	8.157	6.653	1.504
0.000	1.000	33.246	31.742	1.504
0.263	1.000	45.456	38.944	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	7.856	6.353	1.504
0.000	1.000	6.570	5.066	1.504
0.000	1.000	13.065	11.561	1.504
0.000	1.000	15.605	14.101	1.504

0.000	1.000	33.246	31.742	1.504
0.000	1.000	52.593	51.089	1.504
0.317	1.000	42.573	36.061	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	4.979	3.476	1.504
0.000	1.000	5.724	4.220	1.504
0.000	1.000	11.293	9.790	1.504
0.000	1.000	11.437	9.933	1.504
0.000	1.000	25.311	23.807	1.504
0.000	1.000	34.211	32.707	1.504
0.000	1.000	34.754	33.251	1.504
0.000	1.000	29.796	28.293	1.504
0.000	1.000	18.849	17.345	1.504
0.000	1.000	11.533	10.029	1.504
0.000	1.000	6.609	5.105	1.504
0.000	1.000	9.037	7.533	1.504
0.000	1.000	8.593	7.090	1.504
0.000	1.000	13.318	11.815	1.504
0.000	1.000	21.555	20.052	1.504
0.106	1.000	53.723	47.211	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	0.717	0.000	0.717
0.000	1.000	4.222	2.718	1.504
0.000	1.000	6.048	4.544	1.504
0.000	1.000	11.545	10.041	1.504
0.000	1.000	21.555	20.051	1.504
0.000	1.000	15.604	14.100	1.504
0.000	1.000	15.828	14.325	1.504
0.000	1.000	16.794	15.290	1.504
0.000	1.000	20.200	18.696	1.504
0.000	1.000	29.796	28.292	1.504

0.000	1.000	15.986	14.482	1.504
0.000	1.000	11.532	10.028	1.504
0.000	1.000	6.607	5.104	1.504
0.000	1.000	4.945	3.442	1.504
0.000	1.000	5.714	4.211	1.504
0.000	1.000	5.389	3.885	1.504
0.000	1.000	5.470	3.966	1.504
0.000	1.000	6.459	4.955	1.504
0.000	1.000	15.828	14.325	1.504
0.000	1.000	22.888	21.385	1.504
0.000	1.000	20.200	18.696	1.504
0.000	1.000	13.883	12.379	1.504
0.000	1.000	11.818	10.314	1.504
0.000	1.000	8.252	6.749	1.504
0.000	1.000	5.762	4.258	1.504
0.000	1.000	6.125	4.621	1.504
0.000	1.000	6.894	5.390	1.504
0.000	1.000	9.478	7.974	1.504
0.000	1.000	15.460	13.957	1.504
0.000	1.000	13.208	11.704	1.504
0.000	1.000	8.381	6.878	1.504
0.000	1.000	6.470	4.966	1.504
0.000	1.000	5.496	3.992	1.504
0.000	1.000	4.438	2.934	1.504
0.000	1.000	3.867	2.364	1.504
0.000	1.000	3.360	1.856	1.504
0.000	1.000	9.517	8.014	1.504

Vol_{av} (Mm^3)	WL_{res} (gmsl)	Mouth State 1 = closed 0 = open	Mouth State = closed	Mouth State = opened
1.110	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1

0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.880	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1

0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.880	1	1	0
1.504	0.890	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
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1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1

0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.880	1	1	0
1.504	0.880	1	1	0

1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.890	1	1	0
1.504	0.880	1	1	0
1.504	0.890	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.890	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0

1.110	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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0.717	0.450	1	1	0
1.110	0.880	1	1	0
1.504	0.880	1	1	0
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1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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0.717	0.450	0	0	1
0.717	0.450	0	0	1

0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
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1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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0.717	0.450	0	0	1

0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.880	1	1	0
1.504	0.890	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
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0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0

1.110	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
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1.504	0.880	1	1	0
1.504	0.890	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0

1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.880	1	1	0
1.504	0.880	1	1	0
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1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.504	0.880	1	1	0
1.110	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	0	0	1
0.717	0.450	1	1	0
1.110	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
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1.504	0.890	1	1	0
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1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
1.504	0.890	1	1	0
			402	700
			CLOSED	OPEN
			0.364791289	
			% CLOSED	
			0.364791289	0.635208711

Water channel per decade	Inflow$_{peak}$ (m3/s) - see tab 5.1 -	$t_{r\ inflow}$ (s)	$t_{r\ outflow}$ (month)	$t_{r\ outflow}$ (s)
	0.166	6694643.589	1.732	4563991.112
	0.376	4001661.319	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	103.900	14472.019	1.504	3962385.013
	103.900	14472.019	1.504	3962385.013
	138.960	7989.214	0.021	54888.347
	120.173	5964.156	0.012	32108.891
	57.880	12383.088	0.026	68090.628
	27.545	26020.765	0.050	132184.671
	17.823	40214.657	0.074	195489.247
	12.936	55405.941	0.086	226147.143
	10.051	71312.187	0.105	277481.816
	27.545	26020.765	0.051	135152.828
	34.121	21005.557	0.042	111172.208
	262.671	2728.632	0.002	5799.572
	262.671	2728.632	0.002	5782.755
	258.433	2773.383	0.001	2761.237
	294.315	2435.258	0.003	7387.038
	173.165	4139.004	0.008	21047.502
	103.900	6898.317	0.014	37758.982
	57.880	12383.088	0.026	67927.355
	27.545	26020.765	0.052	136575.539
	21.977	32613.004	0.059	154931.814
	76.358	9386.507	0.020	51843.428
	103.900	6898.317	0.014	37946.455
	173.165	4139.004	0.008	21137.629
	173.165	4139.004	0.008	21088.006
	138.960	5157.816	0.010	27006.304
	236.728	3027.669	0.005	13562.741
	138.960	5157.816	0.010	27195.546
	88.654	8084.588	0.017	44278.617
	41.448	17292.275	0.035	92966.989
	21.977	32613.004	0.060	158814.564
	10.051	71312.187	0.112	295938.970

	17.823	40214.657	0.069	181277.980
	49.016	14622.341	0.030	79573.556
	224.190	3196.985	0.006	14949.615
	244.151	2935.613	0.005	13054.267
	173.165	4139.004	0.008	21088.006
	173.165	4139.004	0.008	20867.358
	138.960	5157.816	0.010	26798.247
	88.654	8084.588	0.017	43981.643
	57.880	12383.088	0.026	67391.873
	27.545	26020.765	0.050	132804.362
	12.936	55405.941	0.089	234516.120
	21.977	32613.004	0.063	165195.508
	10.051	71312.187	0.100	264543.684
	27.545	26020.765	0.050	132507.897
	57.880	12383.088	0.026	68702.708
	76.358	9386.507	0.020	52024.548
	236.728	3027.669	0.005	13709.427
	216.993	3303.022	0.006	15514.573
	138.960	5157.816	0.010	26798.247
	76.358	9386.507	0.019	51080.947
	34.121	21005.557	0.041	108723.599
	12.936	55405.941	0.090	236473.782
	10.051	71312.187	0.105	276068.191
	3.143	228019.507	0.204	538867.979
	0.376	2954558.238	1.556	4101156.178
	3.143	478363.457	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	120.173	9238.196	0.025	66945.800
	76.358	9386.507	0.019	51080.947
	57.880	12383.088	0.026	67391.873
	27.545	26020.765	0.050	132804.362
	10.051	71312.187	0.105	276068.191
	5.985	119754.256	0.153	403185.935
	17.823	62290.611	1.201	3164566.331
	21.977	68419.012	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	173.165	6411.122	0.014	37473.578

	224.190	3196.985	0.006	14906.859
	294.722	2431.892	0.003	7774.834
	1221.945	586.550	0.000	586.005
	430.269	1665.777	0.001	1662.894
	299.779	2390.873	0.001	2385.805
	222.176	3225.963	0.001	3218.321
	294.722	2431.892	0.003	7806.830
	138.960	5157.816	0.010	27580.091
	138.960	5157.816	0.010	27278.388
	138.960	5157.816	0.010	27410.174
	120.173	5964.156	0.012	32403.458
	120.173	5964.156	0.012	32319.116
	120.173	5964.156	0.012	32203.253
	103.900	6898.317	0.014	36973.772
	120.173	5964.156	0.012	31405.395
	66.295	10811.327	0.022	58629.276
	41.448	17292.275	0.035	91669.264
	27.545	26020.765	0.050	132804.362
	10.051	71312.187	0.105	276068.191
	3.948	181529.783	0.187	492043.827
	10.051	110459.220	1.248	3287947.197
	12.936	116236.447	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	103.900	14472.019	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	138.960	7989.214	0.021	55538.273
	138.960	5157.816	0.010	27006.304
	103.900	6898.317	0.014	36584.900
	76.358	9386.507	0.019	51080.947

	57.880	12383.088	0.026	67391.873
	21.977	32613.004	0.061	159709.938
	10.051	71312.187	0.105	276068.191
	5.985	119754.256	0.153	403185.935
662.833	10.051	110459.220	1.248	3287947.197
	10.051	149606.254	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	236.728	4689.716	0.008	22268.835
	138.960	5157.816	0.010	27195.546
	76.358	9386.507	0.020	51481.969
	66.295	10811.327	0.023	59695.949
	41.448	17292.275	0.035	92662.889
	21.977	32613.004	0.063	165195.508
	49.016	14622.341	0.030	78472.959
	76.358	9386.507	0.020	51843.428
	76.358	9386.507	0.020	52243.440
	76.358	9386.507	0.020	52024.548
	290.576	2466.589	0.003	8723.405
	236.728	3027.669	0.005	13615.830
	236.728	3027.669	0.005	13562.741
	138.960	5157.816	0.010	27195.546
	66.295	10811.327	0.022	59158.187
	41.448	17292.275	0.035	92966.989
	21.977	32613.004	0.060	158814.564
	12.936	55405.941	0.094	248701.725
	17.823	40214.657	0.069	181277.980
	12.936	55405.941	0.089	235535.444
	21.977	32613.004	0.062	163118.586
	34.121	21005.557	0.042	111172.208
	41.448	17292.275	0.035	92442.595
	49.016	14622.341	0.029	76262.664
	49.016	14622.341	0.028	74626.538
	27.545	26020.765	0.048	127638.235
	12.936	55405.941	0.087	228254.523
	5.985	119754.256	0.141	372001.246
	3.948	281181.088	1.359	3581248.620
	1.670	900225.434	1.504	3962385.013

	0.376	4001661.319	1.504	3962385.013
	1.670	900225.434	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	224.190	4951.979	0.009	24512.584
	244.151	2935.613	0.005	12902.639
	294.315	2435.258	0.003	7387.038
	294.315	2435.258	0.003	7395.369
	173.165	4139.004	0.008	21115.176
	76.358	9386.507	0.020	51793.877
	34.121	21005.557	0.043	113154.918
	21.977	32613.004	0.059	154931.814
	21.977	32613.004	0.060	159281.373
	34.121	21005.557	0.043	112176.568
	88.654	8084.588	0.017	44679.392
	103.900	6898.317	0.014	37672.186
	120.173	5964.156	0.012	31691.522
	88.654	8084.588	0.016	42951.811
	49.016	14622.341	0.030	77791.276
	21.977	32613.004	0.059	155918.023
	10.051	71312.187	0.106	278785.054
	5.985	119754.256	0.139	367179.496
	3.143	353191.482	1.432	3772525.427
	1.670	900225.434	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	173.165	6411.122	0.014	37351.085
	216.993	3303.022	0.006	15514.573
	173.165	4139.004	0.008	20742.921
	120.173	5964.156	0.012	31952.438
	76.358	9386.507	0.020	51481.969
	57.880	12383.088	0.026	68090.628
	41.448	17292.275	0.035	92662.889
	34.121	21005.557	0.043	113154.918
	17.823	40214.657	0.069	181277.980
	17.823	40214.657	0.071	187261.164
	41.448	17292.275	0.036	94111.762
	120.173	5964.156	0.012	32319.116

	120.173	5964.156	0.012	32203.253
	103.900	6898.317	0.014	36973.772
	103.900	6898.317	0.014	36584.900
	66.295	10811.327	0.022	58629.276
	49.016	14622.341	0.030	78725.171
	34.121	21005.557	0.042	110553.924
	17.823	40214.657	0.071	186616.282
	12.936	55405.941	0.094	248701.725
	5.985	119754.256	0.132	347069.874
	3.948	281181.088	1.361	3587822.957
	3.948	380832.393	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	103.900	14472.019	1.504	3962385.013
	138.960	7989.214	0.020	53431.982
	88.654	8084.588	0.017	43981.643
	120.173	5964.156	0.012	32108.891
	66.295	10811.327	0.023	59695.949
	34.121	21005.557	0.042	110124.152
	12.936	55405.941	0.094	248701.725
	10.051	71312.187	0.100	264543.684
	21.977	32613.004	0.060	159281.373
	88.654	8084.588	0.017	44840.743
	57.880	12383.088	0.026	68324.664
	173.165	4139.004	0.008	21088.006
	276.117	2595.761	0.004	10189.059
	224.190	3196.985	0.006	14733.591
	173.165	4139.004	0.008	20980.163
	66.295	10811.327	0.022	59158.187
	34.121	21005.557	0.042	110553.924
	21.977	32613.004	0.060	158814.564
	12.936	55405.941	0.094	248701.725
	12.936	55405.941	0.086	226147.143
	10.051	71312.187	0.105	277481.816
	17.823	40214.657	0.073	192587.434
	103.900	6898.317	0.014	37830.841
	120.173	5964.156	0.012	32203.253
	173.165	4139.004	0.008	20867.358
	120.173	5964.156	0.012	31405.395
	120.173	5964.156	0.012	31952.438

	57.880	12383.088	0.026	67391.873
	49.016	14622.341	0.030	79680.373
	34.121	21005.557	0.042	110124.152
	21.977	32613.004	0.063	165195.508
286.878	12.936	55405.941	0.086	226147.143
	27.545	26020.765	0.050	132507.897
	27.545	26020.765	0.051	135152.828
	88.654	8084.588	0.017	44679.392
	103.900	6898.317	0.014	37672.186
	294.722	2431.892	0.003	7774.834
	294.315	2435.258	0.003	7357.409
	224.190	3196.985	0.006	14852.889
	173.165	4139.004	0.008	21047.502
	88.654	8084.588	0.017	44579.195
	66.295	10811.327	0.023	59570.416
	34.121	21005.557	0.043	113154.918
	41.448	17292.275	0.035	91327.475
	41.448	17292.275	0.035	92821.611
	120.173	5964.156	0.012	32403.458
	120.173	5964.156	0.012	32319.116
	173.165	4139.004	0.008	21088.006
	103.900	6898.317	0.014	36973.772
	138.960	5157.816	0.010	26798.247
	103.900	6898.317	0.014	37329.403
	173.165	4139.004	0.008	21047.502
	216.993	3303.022	0.006	15651.144
	103.900	6898.317	0.014	37708.719
	57.880	12383.088	0.026	69068.447
	49.016	14622.341	0.030	78472.959
	34.121	21005.557	0.042	110348.402
	88.654	8084.588	0.017	44840.743
	173.165	4139.004	0.008	21137.629
	138.960	5157.816	0.010	27377.028
	103.900	6898.317	0.014	36973.772
	76.358	9386.507	0.019	49697.052
	76.358	9386.507	0.019	51080.947
	34.121	21005.557	0.041	108723.599
	17.823	40214.657	0.071	187853.799
	10.051	71312.187	0.105	276068.191
	3.948	181529.783	0.187	492043.827

	3.948	281181.088	1.340	3529943.638
	3.948	380832.393	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	88.654	16960.705	1.504	3962385.013
	173.165	6411.122	0.014	36550.111
	103.900	6898.317	0.014	37329.403
	66.295	10811.327	0.022	59158.187
	49.016	14622.341	0.030	79680.373
	21.977	32613.004	0.060	158814.564
	17.823	40214.657	0.074	195489.247
	21.977	32613.004	0.059	154931.814
	21.977	32613.004	0.060	159281.373
	57.880	12383.088	0.026	68702.708
	173.165	4139.004	0.008	21137.629
	138.960	5157.816	0.010	27377.028
	173.165	4139.004	0.008	20867.358
	294.315	2435.258	0.003	7357.409
	262.671	2728.632	0.002	5791.385
	290.576	2466.589	0.003	8716.466
	173.165	4139.004	0.008	21115.176
	138.960	5157.816	0.010	27396.317
	138.960	5157.816	0.010	27580.091
	76.358	9386.507	0.019	51373.992
	120.173	5964.156	0.012	32249.125
	173.165	4139.004	0.008	21173.674
	224.190	3196.985	0.006	14931.637
	173.165	4139.004	0.008	21088.006
	290.576	2466.589	0.003	8685.415
	216.993	3303.022	0.006	15445.683
	120.173	5964.156	0.012	31952.438
	49.016	14622.341	0.030	78725.171
	76.358	9386.507	0.020	51888.748
	41.448	17292.275	0.035	92662.889
	21.977	32613.004	0.063	165195.508
	49.016	14622.341	0.030	78472.959
	49.016	14622.341	0.030	79573.556
	66.295	10811.327	0.023	60165.889
	76.358	9386.507	0.020	52024.548

	103.900	6898.317	0.014	37672.186
	138.960	5157.816	0.010	27006.304
	294.722	2431.892	0.003	7757.495
	173.165	4139.004	0.008	20980.163
	88.654	8084.588	0.017	44278.617
	41.448	17292.275	0.035	92966.989
	17.823	40214.657	0.071	186616.282
	5.985	119754.256	0.153	403185.935
	3.948	281181.088	1.340	3529943.638
	3.948	380832.393	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	103.900	14472.019	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	138.960	7989.214	0.021	54168.742
	138.960	5157.816	0.010	26798.247
	103.900	6898.317	0.014	37329.403
	49.016	14622.341	0.030	78725.171
	34.121	21005.557	0.042	110553.924
	21.977	32613.004	0.060	158814.564
	10.051	71312.187	0.112	295938.970
	10.051	71312.187	0.100	264543.684
	12.936	55405.941	0.089	235535.444
	49.016	14622.341	0.031	80519.835
	66.295	10811.327	0.023	59875.759
	66.295	10811.327	0.023	59479.295
	88.654	8084.588	0.017	43488.806
	103.900	6898.317	0.014	36584.900
	88.654	8084.588	0.017	43981.643

	41.448	17292.275	0.035	91669.264
	17.823	40214.657	0.071	187853.799
	5.985	119754.256	0.139	367179.496
	3.143	353191.482	1.432	3772525.427
403.697	3.948	380832.393	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	103.900	14472.019	1.504	3962385.013
	120.173	9238.196	0.025	65936.308
	120.173	5964.156	0.012	31405.395
	224.190	3196.985	0.006	14852.889
	103.900	6898.317	0.014	37543.118
	66.295	10811.327	0.023	59695.949
	27.545	26020.765	0.050	132184.671
	12.936	55405.941	0.094	248701.725
	10.051	71312.187	0.100	264543.684
	27.545	26020.765	0.050	132507.897
	41.448	17292.275	0.036	94111.762
	138.960	5157.816	0.010	27460.720
	138.960	5157.816	0.010	27377.028
	138.960	5157.816	0.010	27006.304
	173.165	4139.004	0.008	20742.921
	103.900	6898.317	0.014	37329.403
	66.295	10811.327	0.022	59158.187
	27.545	26020.765	0.050	132804.362
	12.936	55405.941	0.089	234516.120
	5.985	119754.256	0.153	403185.935
	3.948	281181.088	1.340	3529943.638
	5.985	251233.153	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013

	17.823	84366.565	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	88.654	16960.705	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	3.948	380832.393	1.504	3962385.013
	3.948	380832.393	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	88.654	16960.705	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	88.654	16960.705	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013

	173.165	6411.122	0.014	37351.085
	173.165	4139.004	0.008	20867.358
	276.117	2595.761	0.004	10159.300
	173.165	4139.004	0.008	20980.163
	88.654	8084.588	0.017	44278.617
	41.448	17292.275	0.035	92966.989
	17.823	40214.657	0.071	186616.282
	10.051	71312.187	0.112	295938.970
	5.985	119754.256	0.132	347069.874
	21.977	50516.008	1.189	3133503.382
	57.880	25978.553	1.504	3962385.013
	88.654	16960.705	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	244.151	4547.127	0.008	21176.988
	244.151	2935.613	0.005	12902.639
	120.173	5964.156	0.012	31952.438
	88.654	8084.588	0.017	44278.617
	49.016	14622.341	0.030	79680.373
	21.977	32613.004	0.060	158814.564
	12.936	55405.941	0.094	248701.725
	17.823	40214.657	0.069	181277.980
	49.016	14622.341	0.030	79573.556
	88.654	8084.588	0.017	44840.743
	290.576	2466.589	0.003	8731.885
	294.722	2431.892	0.003	7805.262
	294.315	2435.258	0.003	7373.004
	294.722	2431.892	0.003	7757.495
	294.315	2435.258	0.003	7387.038
	173.165	4139.004	0.008	21047.502
	88.654	8084.588	0.017	44579.195
	88.654	8084.588	0.017	44509.152
	49.016	14622.341	0.031	81022.673
	216.993	3303.022	0.006	15603.985
	262.671	2728.632	0.002	5801.058
	290.576	2466.589	0.003	8738.030
	276.117	2595.761	0.004	10253.071
	262.671	2728.632	0.002	5799.572
	10.705	66955.824	0.001	3895.631
	290.576	2466.589	0.003	8663.782
	290.576	2466.589	0.003	8704.896

	138.960	5157.816	0.010	27308.800
	76.358	9386.507	0.020	51888.748
	34.121	21005.557	0.042	110124.152
	17.823	40214.657	0.074	195489.247
1208.755	17.823	40214.657	0.069	181277.980
	34.121	21005.557	0.042	110348.402
	76.358	9386.507	0.020	52243.440
	103.900	6898.317	0.014	37830.841
	173.165	4139.004	0.008	21088.006
	138.960	5157.816	0.010	27006.304
	88.654	8084.588	0.016	42951.811
	57.880	12383.088	0.025	66706.340
	57.880	12383.088	0.026	67391.873
	21.977	32613.004	0.061	159709.938
	10.051	71312.187	0.105	276068.191
	5.985	119754.256	0.153	403185.935
	10.051	110459.220	1.248	3287947.197
	27.545	54589.115	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	120.173	9238.196	0.025	65936.308
	120.173	5964.156	0.012	31405.395
	138.960	5157.816	0.010	27195.546
	76.358	9386.507	0.020	51481.969
	34.121	21005.557	0.042	110553.924
	17.823	40214.657	0.071	186616.282
	10.051	71312.187	0.112	295938.970
	10.051	71312.187	0.100	264543.684
	17.823	40214.657	0.071	187261.164
	88.654	8084.588	0.017	44840.743
	276.117	2595.761	0.004	10253.071
	276.117	2595.761	0.004	10241.381
	244.151	2935.613	0.005	12950.676
	173.165	4139.004	0.008	20742.921
	173.165	4139.004	0.008	20980.163
	103.900	6898.317	0.014	37543.118
	103.900	6898.317	0.014	37758.982
	57.880	12383.088	0.026	67927.355
	27.545	26020.765	0.052	136575.539

	34.121	21005.557	0.041	108243.140
	41.448	17292.275	0.035	92821.611
	57.880	12383.088	0.026	68702.708
	57.880	12383.088	0.026	68324.664
	66.295	10811.327	0.023	59479.295
	49.016	14622.341	0.029	76262.664
	88.654	8084.588	0.016	42951.811
	88.654	8084.588	0.017	43981.643
	41.448	17292.275	0.035	91669.264
	17.823	40214.657	0.071	187853.799
	5.985	119754.256	0.139	367179.496
	5.985	185493.704	1.334	3516211.523
	3.948	380832.393	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	103.900	14472.019	1.504	3962385.013
	138.960	7989.214	0.021	55538.273
	120.173	5964.156	0.012	31691.522
	138.960	5157.816	0.010	26798.247
	120.173	5964.156	0.012	31952.438
	57.880	12383.088	0.026	67391.873
	76.358	9386.507	0.020	51888.748
	276.117	2595.761	0.004	10244.080
	120.173	5964.156	0.012	32484.589
	57.880	12383.088	0.026	67206.965
	57.880	12383.088	0.026	68012.610
	76.358	9386.507	0.020	52243.440
	76.358	9386.507	0.020	52024.548
	120.173	5964.156	0.012	32203.253
	88.654	8084.588	0.017	43488.806
	66.295	10811.327	0.022	56813.430
	88.654	8084.588	0.017	43981.643
	41.448	17292.275	0.035	91669.264
	21.977	32613.004	0.061	159709.938
	12.936	55405.941	0.089	234516.120
	5.985	119754.256	0.153	403185.935
	3.948	281181.088	1.340	3529943.638
	41.448	36277.564	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013

	57.880	25978.553	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	120.173	9238.196	0.023	61909.020
	138.960	5157.816	0.010	27006.304
	88.654	8084.588	0.016	42951.811
	57.880	12383.088	0.025	66706.340
	34.121	21005.557	0.041	108723.599
	17.823	40214.657	0.071	187853.799
	5.985	119754.256	0.139	367179.496
	5.985	185493.704	1.334	3516211.523
	5.985	251233.153	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	138.960	7989.214	0.021	54168.742
	120.173	5964.156	0.012	31405.395
	173.165	4139.004	0.008	20980.163
	88.654	8084.588	0.017	44278.617
	34.121	21005.557	0.042	110553.924
	21.977	32613.004	0.060	158814.564
	12.936	55405.941	0.094	248701.725
	10.051	71312.187	0.100	264543.684
	21.977	32613.004	0.060	159281.373
	66.295	10811.327	0.023	60165.889
	57.880	12383.088	0.026	68324.664
	66.295	10811.327	0.023	59479.295
	76.358	9386.507	0.019	50417.367
	103.900	6898.317	0.014	36584.900
	57.880	12383.088	0.025	66706.340

	27.545	26020.765	0.049	130171.913
	12.936	55405.941	0.090	236473.782
	5.985	119754.256	0.139	367179.496
	10.051	110459.220	1.266	3337002.782
649.337	5.985	251233.153	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	173.165	6411.122	0.014	36550.111
	138.960	5157.816	0.010	27195.546
	88.654	8084.588	0.017	44278.617
	41.448	17292.275	0.035	92966.989
	21.977	32613.004	0.060	158814.564
	5.985	119754.256	0.153	403185.935
	10.051	110459.220	1.248	3287947.197
	41.448	36277.564	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	3.948	380832.393	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	120.173	9238.196	0.023	61909.020
	88.654	8084.588	0.017	43488.806
	103.900	6898.317	0.014	36584.900
	103.900	6898.317	0.014	37329.403
	216.993	3303.022	0.006	15613.932
	103.900	6898.317	0.014	37758.982
	66.295	10811.327	0.023	59570.416
	27.545	26020.765	0.052	136575.539

	27.545	26020.765	0.049	129483.792
	49.016	14622.341	0.030	79573.556
	49.016	14622.341	0.031	80519.835
	120.173	5964.156	0.012	32319.116
	244.151	2935.613	0.005	13035.324
	233.844	3065.007	0.001	3052.856
	262.671	2728.632	0.002	5773.158
	244.151	2935.613	0.005	12994.037
	236.728	3027.669	0.005	13692.297
	120.173	5964.156	0.012	32266.656
	66.295	10811.327	0.023	59570.416
	27.545	26020.765	0.052	136575.539
	12.936	55405.941	0.086	226147.143
	17.823	40214.657	0.071	187261.164
	34.121	21005.557	0.043	112176.568
	41.448	17292.275	0.035	93403.817
	57.880	12383.088	0.026	67808.899
	138.960	5157.816	0.010	27006.304
	103.900	6898.317	0.014	36584.900
	103.900	6898.317	0.014	37329.403
	49.016	14622.341	0.030	78725.171
	21.977	32613.004	0.061	159709.938
	10.051	71312.187	0.105	276068.191
	21.977	32613.004	0.063	165195.508
	66.295	10811.327	0.022	59015.655
	49.016	14622.341	0.030	79573.556
	103.900	6898.317	0.014	37946.455
	120.173	5964.156	0.012	32319.116
	216.993	3303.022	0.006	15636.212
	138.960	5157.816	0.010	27006.304
	138.960	5157.816	0.010	26798.247
	103.900	6898.317	0.014	37329.403
	76.358	9386.507	0.020	51481.969
	49.016	14622.341	0.030	79680.373
	27.545	26020.765	0.050	132184.671
	12.936	55405.941	0.094	248701.725
	5.985	119754.256	0.132	347069.874
	5.985	185493.704	1.312	3458197.633
	34.121	44067.680	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013

	216.993	5116.225	0.010	26082.193
	294.722	2431.892	0.003	7774.834
	276.117	2595.761	0.004	10159.300
	224.190	3196.985	0.006	14852.889
	120.173	5964.156	0.012	32108.891
	57.880	12383.088	0.026	68090.628
	27.545	26020.765	0.050	132184.671
	12.936	55405.941	0.094	248701.725
	49.016	14622.341	0.030	78472.959
	34.121	21005.557	0.042	110348.402
	57.880	12383.088	0.026	68702.708
	120.173	5964.156	0.012	32319.116
	290.576	2466.589	0.003	8723.405
	294.315	2435.258	0.003	7373.004
	262.671	2728.632	0.002	5773.158
	294.315	2435.258	0.003	7387.038
	290.576	2466.589	0.003	8716.466
	120.173	5964.156	0.012	32266.656
	76.358	9386.507	0.020	51793.877
	41.448	17292.275	0.036	94799.413
	21.977	32613.004	0.059	154931.814
	49.016	14622.341	0.030	79573.556
	49.016	14622.341	0.031	80519.835
	88.654	8084.588	0.017	44679.392
	173.165	4139.004	0.008	21088.006
	242.070	2960.844	0.001	2949.504
	233.844	3065.007	0.001	3050.179
	294.722	2431.892	0.003	7790.441
	173.165	4139.004	0.008	21047.502
	66.295	10811.327	0.023	59695.949
	27.545	26020.765	0.050	132184.671
	21.977	32613.004	0.063	165195.508
	27.545	26020.765	0.049	129483.792
	27.545	26020.765	0.050	132507.897
	27.545	26020.765	0.051	135152.828
	57.880	12383.088	0.026	68324.664
	173.165	4139.004	0.008	21088.006
	173.165	4139.004	0.008	20867.358
	138.960	5157.816	0.010	26798.247
	120.173	5964.156	0.012	31952.438

	66.295	10811.327	0.022	59158.187
	34.121	21005.557	0.042	110553.924
	21.977	32613.004	0.060	158814.564
	21.977	32613.004	0.063	165195.508
447.499	17.823	40214.657	0.069	181277.980
	57.880	12383.088	0.026	68012.610
	76.358	9386.507	0.020	52243.440
	66.295	10811.327	0.023	59875.759
	66.295	10811.327	0.023	59479.295
	57.880	12383.088	0.025	65579.175
	49.016	14622.341	0.028	74626.538
	41.448	17292.275	0.034	90405.482
	27.545	26020.765	0.049	130171.913
	12.936	55405.941	0.090	236473.782
	10.051	71312.187	0.105	276068.191
	10.051	71312.187	0.112	295938.970
	12.936	55405.941	0.086	226147.143
	17.823	40214.657	0.071	187261.164
	17.823	40214.657	0.073	192587.434
	34.121	21005.557	0.042	111172.208
	57.880	12383.088	0.026	67808.899
	57.880	12383.088	0.025	65579.175
	34.121	21005.557	0.038	101058.320
	17.823	40214.657	0.067	177681.167
	10.051	71312.187	0.101	267431.989
	3.948	181529.783	0.169	446377.344
	1.670	664666.062	1.450	3821913.963
	0.376	4001661.319	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	3.948	380832.393	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013

	41.448	36277.564	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	103.900	14472.019	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	3.948	380832.393	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	3.948	380832.393	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	299.779	3703.349	0.001	3721.584
	299.779	2390.873	0.001	2383.473
	258.433	2773.383	0.001	2761.237
	262.671	2728.632	0.002	5791.385
	244.151	2935.613	0.005	13019.836
	173.165	4139.004	0.008	21115.176
	173.165	4139.004	0.008	21099.449
	120.173	5964.156	0.012	32484.589
	66.295	10811.327	0.022	59015.655
	76.358	9386.507	0.020	51843.428
	76.358	9386.507	0.020	52243.440
	76.358	9386.507	0.020	52024.548

	120.173	5964.156	0.012	32203.253
	294.315	2435.258	0.003	7373.004
	224.190	3196.985	0.006	14733.591
	103.900	6898.317	0.014	37329.403
	57.880	12383.088	0.026	67391.873
	41.448	17292.275	0.035	92966.989
	27.545	26020.765	0.050	132184.671
	12.936	55405.941	0.094	248701.725
	12.936	55405.941	0.086	226147.143
	49.016	14622.341	0.030	79573.556
	49.016	14622.341	0.031	80519.835
	49.016	14622.341	0.030	80001.047
	88.654	8084.588	0.017	44458.263
	120.173	5964.156	0.012	31691.522
	88.654	8084.588	0.016	42951.811
	76.358	9386.507	0.019	51080.947
	34.121	21005.557	0.041	108723.599
	21.977	32613.004	0.061	159709.938
	10.051	71312.187	0.105	276068.191
	5.985	119754.256	0.153	403185.935
	3.948	281181.088	1.340	3529943.638
	5.985	251233.153	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	88.654	16960.705	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	120.173	9238.196	0.025	66945.800
	76.358	9386.507	0.019	51080.947
	41.448	17292.275	0.035	91669.264
	41.448	17292.275	0.035	92966.989
	21.977	32613.004	0.060	158814.564
	41.448	17292.275	0.036	94799.413
	262.671	2728.632	0.002	5795.133
	262.671	2728.632	0.002	5801.058
	262.671	2728.632	0.002	5806.032
	294.315	2435.258	0.003	7406.465
	290.576	2466.589	0.003	8723.405
	262.671	2728.632	0.002	5782.755
	262.671	2728.632	0.002	5773.158
	276.117	2595.761	0.004	10215.879

	120.173	5964.156	0.012	32108.891
	88.654	8084.588	0.017	44579.195
	57.880	12383.088	0.026	67927.355
	34.121	21005.557	0.043	113154.918
810.358	21.977	32613.004	0.059	154931.814
	57.880	12383.088	0.026	68012.610
	88.654	8084.588	0.017	44840.743
	224.190	3196.985	0.006	14931.637
	120.173	5964.156	0.012	32203.253
	276.117	2595.761	0.004	10189.059
	173.165	4139.004	0.008	20742.921
	88.654	8084.588	0.017	43981.643
	49.016	14622.341	0.030	78725.171
	27.545	26020.765	0.050	132804.362
	17.823	40214.657	0.071	186616.282
	5.985	119754.256	0.153	403185.935
	5.985	185493.704	1.298	3420106.860
	12.936	116236.447	1.504	3962385.013
	216.993	5116.225	0.010	26172.363
	224.190	3196.985	0.006	14931.637
	173.165	4139.004	0.008	21088.006
	216.993	3303.022	0.006	15514.573
	216.993	3303.022	0.006	15445.683
	138.960	5157.816	0.010	27195.546
	76.358	9386.507	0.020	51481.969
	34.121	21005.557	0.042	110553.924
	12.936	55405.941	0.089	234516.120
	21.977	32613.004	0.063	165195.508
	10.051	71312.187	0.100	264543.684
	21.977	32613.004	0.060	159281.373
	34.121	21005.557	0.043	112176.568
	66.295	10811.327	0.023	59875.759
	138.960	5157.816	0.010	27377.028
	224.190	3196.985	0.006	14796.263
	236.728	3027.669	0.005	13562.741
	120.173	5964.156	0.012	31952.438
	120.173	5964.156	0.012	32108.891
	76.358	9386.507	0.020	51888.748
	49.016	14622.341	0.030	79456.880
	21.977	32613.004	0.063	165195.508

	12.936	55405.941	0.086	226147.143
	17.823	40214.657	0.071	187261.164
	17.823	40214.657	0.073	192587.434
	27.545	26020.765	0.051	133697.571
	27.545	26020.765	0.050	131736.842
	41.448	17292.275	0.034	88347.491
	41.448	17292.275	0.033	86159.190
	21.977	32613.004	0.058	152296.920
	5.985	119754.256	0.134	352058.302
	3.143	353191.482	1.391	3665606.037
	0.376	4001661.319	1.504	3962385.013
	0.376	4001661.319	1.504	3962385.013
	0.376	4001661.319	1.504	3962385.013
	1.670	900225.434	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	3.948	380832.393	1.504	3962385.013
	1.670	900225.434	1.504	3962385.013
	1.670	900225.434	1.504	3962385.013
	1.670	900225.434	1.504	3962385.013
	120.173	9238.196	0.023	61190.254
	120.173	5964.156	0.012	32403.458
	236.728	3027.669	0.005	13730.382
	216.993	3303.022	0.006	15636.212
	120.173	5964.156	0.012	31691.522
	138.960	5157.816	0.010	26798.247
	76.358	9386.507	0.019	51080.947
	34.121	21005.557	0.041	108723.599
	17.823	40214.657	0.071	187853.799
	10.051	71312.187	0.105	276068.191
	5.985	119754.256	0.153	403185.935
	3.143	353191.482	1.362	3587946.371
	21.977	68419.012	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013

	34.121	44067.680	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	3.948	380832.393	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	216.993	5116.225	0.010	26136.933
	294.722	2431.892	0.003	7805.262
	242.070	2960.844	0.001	2949.504
	242.070	2960.844	0.001	2947.005
	294.315	2435.258	0.003	7387.038
	224.190	3196.985	0.006	14886.607
	88.654	8084.588	0.017	44579.195
	88.654	8084.588	0.017	44509.152
	49.016	14622.341	0.031	81022.673
	17.823	40214.657	0.069	181277.980
	49.016	14622.341	0.030	79573.556
	41.448	17292.275	0.036	94111.762
	66.295	10811.327	0.023	59875.759
	120.173	5964.156	0.012	32203.253
	120.173	5964.156	0.012	31691.522
	138.960	5157.816	0.010	26798.247
	138.960	5157.816	0.010	27195.546
	103.900	6898.317	0.014	37543.118
	103.900	6898.317	0.014	37758.982
	57.880	12383.088	0.026	67927.355
	41.448	17292.275	0.036	94799.413
	41.448	17292.275	0.035	91327.475
	66.295	10811.327	0.023	59635.974
	224.190	3196.985	0.006	14949.615
	173.165	4139.004	0.008	21137.629
	138.960	5157.816	0.010	27377.028
	216.993	3303.022	0.006	15514.573
	138.960	5157.816	0.010	26798.247
	103.900	6898.317	0.014	37329.403

	57.880	12383.088	0.026	67391.873
	21.977	32613.004	0.061	159709.938
	12.936	55405.941	0.089	234516.120
	5.985	119754.256	0.153	403185.935
432.813	3.948	281181.088	1.340	3529943.638
	21.977	68419.012	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	88.654	16960.705	1.504	3962385.013
	138.960	7989.214	0.021	55538.273
	120.173	5964.156	0.012	31691.522
	103.900	6898.317	0.014	36584.900
	76.358	9386.507	0.019	51080.947
	41.448	17292.275	0.035	91669.264
	17.823	40214.657	0.071	187853.799
	10.051	71312.187	0.105	276068.191
	5.985	119754.256	0.153	403185.935
	5.985	185493.704	1.298	3420106.860
	12.936	116236.447	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	103.900	14472.019	1.504	3962385.013
	216.993	5116.225	0.010	26082.193
	244.151	2935.613	0.005	12950.676
	294.722	2431.892	0.003	7757.495
	236.728	3027.669	0.005	13663.767
	224.190	3196.985	0.006	14886.607
	103.900	6898.317	0.014	37758.982
	49.016	14622.341	0.030	79456.880
	21.977	32613.004	0.063	165195.508
	12.936	55405.941	0.086	226147.143
	27.545	26020.765	0.050	132507.897
	216.993	3303.022	0.006	15683.261
	290.576	2466.589	0.003	8731.885
	244.151	2935.613	0.005	13035.324
	216.993	3303.022	0.006	15514.573
	138.960	5157.816	0.010	26798.247
	103.900	6898.317	0.014	37329.403
	57.880	12383.088	0.026	67391.873
	21.977	32613.004	0.061	159709.938
	12.936	55405.941	0.089	234516.120
	3.948	181529.783	0.187	492043.827

	17.823	62290.611	1.201	3164566.331
	27.545	54589.115	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	76.358	19692.007	1.504	3962385.013
	88.654	16960.705	1.504	3962385.013
	88.654	16960.705	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	1.670	900225.434	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	120.173	9238.196	0.025	65936.852
	120.173	5964.156	0.012	31405.395
	76.358	9386.507	0.019	51080.947
	34.121	21005.557	0.041	108723.599
	12.936	55405.941	0.090	236473.782
	17.823	40214.657	0.071	186616.282
	5.985	119754.256	0.153	403185.935
	10.051	110459.220	1.248	3287947.197
	5.985	251233.153	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013

	66.295	22681.145	1.504	3962385.013
	103.900	14472.019	1.504	3962385.013
	120.173	9238.196	0.025	66945.800
	57.880	12383.088	0.025	66706.340
	27.545	26020.765	0.049	130171.913
	21.977	32613.004	0.061	159709.938
	10.051	71312.187	0.105	276068.191
	5.985	119754.256	0.153	403185.935
	3.143	353191.482	1.362	3587946.371
	3.948	380832.393	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	49.016	30676.294	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	66.295	22681.145	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	120.173	9238.196	0.023	60446.375
	88.654	8084.588	0.017	44458.263
	57.880	12383.088	0.025	65579.175
	27.545	26020.765	0.045	119334.734
	27.545	26020.765	0.048	127638.235
	10.051	71312.187	0.101	267431.989
	17.823	40214.657	0.071	187853.799
	5.985	119754.256	0.139	367179.496
	3.143	353191.482	1.432	3772525.427
	3.948	380832.393	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	57.880	25978.553	1.504	3962385.013

	27.545	54589.115	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
1264.442	3.143	478363.457	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	3.948	380832.393	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	41.448	36277.564	1.504	3962385.013
	34.121	44067.680	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	17.823	84366.565	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	3.948	380832.393	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	5.985	251233.153	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
	27.545	54589.115	1.504	3962385.013
	21.977	68419.012	1.504	3962385.013
	10.051	149606.254	1.504	3962385.013
	3.143	478363.457	1.504	3962385.013
	0.376	4001661.319	1.504	3962385.013
	0.376	4001661.319	1.504	3962385.013
	0.271	5552727.941	1.504	3962385.013
	0.187	8048417.870	1.504	3962385.013
	12.936	116236.447	1.504	3962385.013
649.34				
MEDIAN				
685.18				
AVERAGE				
350.92				
std dev				

my method

$M_{s\ total}$ (ton)	WL_{av} (gmsl)	C_d (ton/m)	v_s (m/s) (Maine 2011)	d_s (m)
985	0.710	1387	0.002504469	16766.525
1462	0.880	1661	0.000598755	2396.014
33676	0.880	38268	0.001132437	41.082
22918	0.880	26043	0.000070817	1.606
16242	0.880	18457	0.000035547	0.514
9825	0.880	11165	0.000040541	0.587
9111	0.710	12833	0.000040428	0.323
9906	0.450	22013	0.000040428	0.241
10903	0.450	24229	0.000037444	0.464
5931	0.450	13180	0.000036141	0.940
19879	0.450	44176	0.002656782	106.842
15760	0.450	35023	0.003037164	168.277
12137	0.450	26971	0.002504469	178.599
18942	0.450	42093	0.000598755	15.580
27925	0.450	62056	0.001132437	23.787
245596	0.450	545769	0.000070817	0.193
248399	0.450	551999	0.000035547	0.097
237963	0.450	528806	0.000040541	0.112
200451	0.450	445446	0.000040428	0.098
164207	0.450	364905	0.000040428	0.167
114784	0.450	255076	0.000037444	0.258
61076	0.450	135725	0.000036141	0.448
29777	0.450	66171	0.002656782	69.131
24932	0.450	55405	0.003037164	99.051
78912	0.450	175359	0.002504469	23.508
71788	0.450	159530	0.000598755	4.130
156687	0.450	348194	0.001132437	4.687
66716	0.450	148258	0.000070817	0.293
45798	0.450	101774	0.000035547	0.183
35763	0.450	79474	0.000040541	0.123
31845	0.450	70767	0.000040428	0.209
20631	0.450	45846	0.000040428	0.327
10175	0.450	22611	0.000037444	0.647
4824	0.450	10719	0.000036141	1.179
12355	0.450	27455	0.002656782	189.461

20699	0.450	45998	0.003037164	122.138
50295	0.450	111767	0.002504469	36.621
184815	0.450	410701	0.000598755	1.914
255137	0.450	566971	0.001132437	3.324
66716	0.450	148258	0.000070817	0.293
52670	0.450	117044	0.000035547	0.147
39721	0.450	88268	0.000040541	0.209
24808	0.450	55129	0.000040428	0.327
9067	0.450	20149	0.000040428	0.501
3071	0.450	6824	0.000037444	0.974
3049	0.450	6776	0.000036141	2.002
23944	0.450	53210	0.002656782	86.646
12864	0.450	28587	0.003037164	216.587
28923	0.450	64273	0.002504469	65.168
38895	0.450	86434	0.000598755	7.414
62294	0.450	138431	0.001132437	10.630
103238	0.450	229417	0.000070817	0.214
93888	0.450	208640	0.000035547	0.117
73662	0.450	163694	0.000040541	0.209
42462	0.450	94359	0.000040428	0.379
8011	0.450	17803	0.000040428	0.849
1579	0.450	3508	0.000037444	2.075
2489	0.450	5531	0.000036141	2.577
5753	0.450	12785	0.002656782	605.798
2366	0.710	3332	0.003037164	8973.477
5652	0.880	6422	0.002504469	1198.046
5443	0.890	6115	0.000598755	150.427
27925	0.890	31376	0.001132437	49.904
11890	0.880	13512	0.000070817	3.121
10103	0.880	11480	0.000035547	0.806
4464	0.710	6287	0.000040541	0.375
5137	0.450	11416	0.000040428	0.379
3083	0.450	6850	0.000040428	0.501
3071	0.450	6824	0.000037444	0.974
2489	0.450	5531	0.000036141	2.577
8460	0.450	18799	0.002656782	318.161
20699	0.710	29154	0.003037164	189.187
23522	0.890	26430	0.002504469	171.353
44653	0.890	50172	0.000598755	13.580
156687	0.710	220686	0.001132437	7.260

94853	0.450	210785	0.000070817	0.226
127446	0.450	283214	0.000035547	0.086
306773	0.450	681718	0.000040541	0.024
388631	0.450	863624	0.000040428	0.067
398753	0.450	886117	0.000040428	0.097
453208	0.450	1007128	0.000037444	0.121
442707	0.450	983792	0.000036141	0.088
511081	0.450	1135736	0.002656782	13.703
161226	0.450	358281	0.003037164	15.665
152110	0.450	338023	0.002504469	12.918
84357	0.450	187460	0.000598755	3.571
101681	0.450	225957	0.001132437	6.754
43295	0.450	96211	0.000070817	0.422
18901	0.450	42001	0.000035547	0.245
12218	0.450	27151	0.000040541	0.242
8269	0.450	18377	0.000040428	0.437
1873	0.450	4163	0.000040428	0.699
3071	0.450	6824	0.000037444	0.974
2489	0.450	5531	0.000036141	2.577
6519	0.450	14486	0.002656782	482.285
12864	0.710	18119	0.003037164	335.483
14869	0.890	16707	0.002504469	291.111
15405	0.890	17309	0.000598755	40.966
27925	0.880	31733	0.001132437	49.904
14339	0.880	16294	0.000070817	2.569
10103	0.880	11480	0.000035547	0.806
3925	0.880	4460	0.000040541	0.587
3587	0.880	4076	0.000040428	1.050
1357	0.880	1541	0.000040428	1.782
2073	0.880	2356	0.000037444	3.159
4005	0.880	4551	0.000036141	3.049
12355	0.880	14040	0.002656782	397.471
8808	0.880	10010	0.003037164	763.036
28923	0.880	32867	0.002504469	136.717
23167	0.880	26327	0.000598755	26.386
62294	0.880	70789	0.001132437	22.300
51128	0.710	72012	0.000070817	0.566
32924	0.450	73165	0.000035547	0.183
22588	0.450	50196	0.000040541	0.280
11578	0.450	25729	0.000040428	0.379

4092	0.450	9093	0.000040428	0.501
2497	0.450	5550	0.000037444	1.221
2489	0.450	5531	0.000036141	2.577
8460	0.450	18799	0.002656782	318.161
12864	0.710	18119	0.003037164	335.483
12137	0.880	13792	0.002504469	374.684
9738	0.880	11066	0.000598755	69.597
18569	0.880	21101	0.001132437	77.480
16906	0.880	19211	0.000070817	2.172
6321	0.880	7183	0.000035547	1.290
8625	0.710	12147	0.000040541	0.190
12152	0.450	27004	0.000040428	0.209
9547	0.450	21216	0.000040428	0.379
8735	0.450	19411	0.000037444	0.405
9625	0.450	21389	0.000036141	0.625
23944	0.450	53210	0.002656782	86.646
53309	0.450	118465	0.003037164	44.410
78912	0.450	175359	0.002504469	23.508
51681	0.450	114846	0.000598755	5.620
62294	0.450	138431	0.001132437	10.630
162897	0.450	361993	0.000070817	0.175
145175	0.450	322610	0.000035547	0.108
119079	0.450	264619	0.000040541	0.123
92435	0.450	205411	0.000040428	0.209
52217	0.450	116039	0.000040428	0.437
6028	0.450	13395	0.000037444	0.647
4824	0.450	10719	0.000036141	1.179
15136	0.450	33636	0.002656782	147.201
20699	0.450	45998	0.003037164	122.138
14869	0.450	33043	0.002504469	138.762
15405	0.450	34234	0.000598755	19.527
27925	0.450	62056	0.001132437	23.787
14339	0.450	31864	0.000070817	1.225
7452	0.450	16561	0.000035547	0.520
1412	0.450	3138	0.000040541	0.593
1110	0.450	2466	0.000040428	1.052
570	0.450	1267	0.000040428	2.240
882	0.450	1961	0.000037444	4.484
1313	0.710	1850	0.000036141	10.162
4356	0.880	4949	0.002656782	2391.702

2366	0.880	2688	0.003037164	12153.700
4279	0.880	4862	0.002504469	2254.586
7949	0.880	9033	0.000598755	89.577
15416	0.880	17518	0.001132437	95.540
7906	0.880	8985	0.000070817	4.845
41814	0.710	58892	0.000035547	0.176
40522	0.450	90050	0.000040541	0.119
51750	0.450	115000	0.000040428	0.098
62358	0.450	138573	0.000040428	0.098
69787	0.450	155083	0.000037444	0.155
61935	0.450	137632	0.000036141	0.339
51254	0.450	113899	0.002656782	55.807
24932	0.450	55405	0.003037164	99.051
23522	0.450	52272	0.002504469	81.678
23167	0.450	51483	0.000598755	12.577
72914	0.450	162030	0.001132437	9.155
36844	0.450	81876	0.000070817	0.489
19085	0.450	42412	0.000035547	0.212
12687	0.450	28194	0.000040541	0.328
5377	0.450	11948	0.000040428	0.591
902	0.450	2004	0.000040428	1.318
1289	0.450	2863	0.000037444	2.670
1704	0.450	3787	0.000036141	4.328
5753	0.710	8103	0.002656782	938.353
4535	0.880	5154	0.003037164	2734.132
5652	0.880	6422	0.002504469	1198.046
18942	0.880	21525	0.000598755	32.685
62294	0.880	70789	0.001132437	22.300
66716	0.710	93967	0.000070817	0.454
63893	0.450	141985	0.000035547	0.117
52796	0.450	117325	0.000040541	0.168
38052	0.450	84560	0.000040428	0.241
20689	0.450	45976	0.000040428	0.379
9547	0.450	21216	0.000037444	0.464
8748	0.450	19440	0.000036141	0.625
36009	0.450	80021	0.002656782	55.807
20699	0.450	45998	0.003037164	122.138
19529	0.450	43397	0.002504469	100.716
27938	0.450	62085	0.000598755	10.354
101681	0.450	225957	0.001132437	6.754

43295	0.450	96211	0.000070817	0.422
18901	0.450	42001	0.000035547	0.245
11679	0.450	25954	0.000040541	0.280
7037	0.450	15638	0.000040428	0.437
2131	0.450	4735	0.000040428	0.591
3756	0.450	8346	0.000037444	0.787
4005	0.450	8899	0.000036141	1.453
15136	0.450	33636	0.002656782	147.201
8808	0.450	19574	0.003037164	363.713
6404	0.710	9019	0.002504469	704.209
4194	0.880	4766	0.000598755	228.025
9581	0.880	10888	0.001132437	169.420
14339	0.880	16294	0.000070817	2.569
16242	0.880	18457	0.000035547	0.514
11018	0.710	15519	0.000040541	0.324
9536	0.450	21192	0.000040428	0.327
7549	0.450	16776	0.000040428	0.241
10743	0.450	23873	0.000037444	0.405
8333	0.450	18517	0.000036141	0.759
15136	0.450	33636	0.002656782	147.201
12864	0.450	28587	0.003037164	216.587
23522	0.450	52272	0.002504469	81.678
60491	0.450	134425	0.000598755	4.841
46883	0.450	104184	0.001132437	14.023
66716	0.450	148258	0.000070817	0.293
84351	0.450	187446	0.000035547	0.092
74979	0.450	166620	0.000040541	0.130
61000	0.450	135556	0.000040428	0.167
40932	0.450	90960	0.000040428	0.437
4931	0.450	10957	0.000037444	0.787
4824	0.450	10719	0.000036141	1.179
15136	0.450	33636	0.002656782	147.201
15760	0.450	35023	0.003037164	168.277
12137	0.450	26971	0.002504469	178.599
12790	0.450	28422	0.000598755	24.079
86531	0.450	192290	0.001132437	7.812
43295	0.450	96211	0.000070817	0.422
32069	0.450	71264	0.000035547	0.147
25201	0.450	56002	0.000040541	0.242
16603	0.450	36895	0.000040428	0.241

9984	0.450	22187	0.000040428	0.501
5340	0.450	11866	0.000037444	0.548
7254	0.450	16120	0.000036141	0.759
23944	0.450	53210	0.002656782	86.646
15760	0.450	35023	0.003037164	168.277
28923	0.450	64273	0.002504469	65.168
18942	0.450	42093	0.000598755	15.580
72914	0.450	162030	0.001132437	9.155
36844	0.450	81876	0.000070817	0.489
80315	0.450	178478	0.000035547	0.086
80945	0.450	179878	0.000040541	0.099
74015	0.450	164477	0.000040428	0.129
60368	0.450	134151	0.000040428	0.167
47726	0.450	106058	0.000037444	0.303
29602	0.450	65782	0.000036141	0.391
39908	0.450	88685	0.002656782	55.807
45216	0.450	100480	0.003037164	52.519
42659	0.450	94798	0.002504469	43.308
84357	0.450	187460	0.000598755	3.571
101681	0.450	225957	0.001132437	6.754
66716	0.450	148258	0.000070817	0.293
39502	0.450	87781	0.000035547	0.245
22248	0.450	49439	0.000040541	0.209
16116	0.450	35813	0.000040428	0.279
13740	0.450	30532	0.000040428	0.167
37176	0.450	82613	0.000037444	0.124
49437	0.450	109859	0.000036141	0.249
82503	0.450	183340	0.002656782	32.899
53309	0.450	118465	0.003037164	44.410
35374	0.450	78610	0.002504469	52.608
60491	0.450	134425	0.000598755	4.841
156687	0.450	348194	0.001132437	4.687
51128	0.450	113618	0.000070817	0.365
25869	0.450	57488	0.000035547	0.245
13989	0.450	31086	0.000040541	0.381
5187	0.450	11527	0.000040428	0.379
2169	0.450	4821	0.000040428	0.849
2073	0.450	4607	0.000037444	1.506
2489	0.450	5531	0.000036141	2.577
6519	0.450	14486	0.002656782	482.285

6787	0.710	9560	0.003037164	853.993
6404	0.880	7277	0.002504469	953.783
12790	0.880	14534	0.000598755	50.515
15416	0.880	17518	0.001132437	95.540
22918	0.880	26043	0.000070817	1.606
13686	0.880	15552	0.000035547	0.603
9883	0.710	13920	0.000040541	0.260
10471	0.450	23269	0.000040428	0.279
6596	0.450	14659	0.000040428	0.437
5529	0.450	12287	0.000037444	0.548
4824	0.450	10719	0.000036141	1.179
19879	0.450	44176	0.002656782	106.842
24932	0.450	55405	0.003037164	99.051
23522	0.450	52272	0.002504469	81.678
38895	0.450	86434	0.000598755	7.414
156687	0.450	348194	0.001132437	4.687
51128	0.450	113618	0.000070817	0.365
39038	0.450	86751	0.000035547	0.147
42333	0.450	94073	0.000040541	0.099
61083	0.450	135739	0.000040428	0.110
64693	0.450	143763	0.000040428	0.100
71430	0.450	158733	0.000037444	0.155
78022	0.450	173382	0.000036141	0.186
200542	0.450	445650	0.002656782	13.703
83641	0.450	185869	0.003037164	28.508
128805	0.450	286234	0.002504469	14.937
129992	0.450	288872	0.000598755	2.478
222769	0.450	495041	0.001132437	3.620
66716	0.450	148258	0.000070817	0.293
95069	0.450	211264	0.000035547	0.088
84095	0.450	186878	0.000040541	0.134
64014	0.450	142252	0.000040428	0.241
31643	0.450	70317	0.000040428	0.591
8378	0.450	18617	0.000037444	0.351
10582	0.450	23516	0.000036141	0.625
23944	0.450	53210	0.002656782	86.646
53309	0.450	118465	0.003037164	44.410
50295	0.450	111767	0.002504469	36.621
44653	0.450	99230	0.000598755	6.473
62294	0.450	138431	0.001132437	10.630

36844	0.450	81876	0.000070817	0.489
22539	0.450	50086	0.000035547	0.183
28576	0.450	63503	0.000040541	0.099
29932	0.450	66515	0.000040428	0.167
22344	0.450	49653	0.000040428	0.327
10644	0.450	23653	0.000037444	0.647
4005	0.450	8899	0.000036141	1.453
8460	0.450	18799	0.002656782	318.161
6787	0.710	9560	0.003037164	853.993
6404	0.880	7277	0.002504469	953.783
3701	0.880	4206	0.000598755	286.422
9581	0.880	10888	0.001132437	169.420
26524	0.880	30141	0.000070817	1.395
10103	0.880	11480	0.000035547	0.806
3925	0.880	4460	0.000040541	0.587
3924	0.880	4459	0.000040428	0.917
1109	0.880	1260	0.000040428	2.207
1579	0.880	1794	0.000037444	4.352
1704	0.880	1937	0.000036141	9.080
5753	0.880	6538	0.002656782	1270.907
5990	0.880	6807	0.003037164	1452.868
12137	0.880	13792	0.002504469	374.684
12790	0.880	14534	0.000598755	50.515
33676	0.880	38268	0.001132437	41.082
19962	0.880	22684	0.000070817	1.840
22539	0.710	31744	0.000035547	0.284
17795	0.450	39544	0.000040541	0.209
13732	0.450	30516	0.000040428	0.279
7150	0.450	15890	0.000040428	0.591
3756	0.450	8346	0.000037444	0.787
4824	0.450	10719	0.000036141	1.179
12355	0.450	27455	0.002656782	189.461
12864	0.450	28587	0.003037164	216.587
14869	0.450	33043	0.002504469	138.762
32939	0.450	73198	0.000598755	8.755
53823	0.450	119608	0.001132437	12.243
22918	0.450	50928	0.000070817	0.766
13686	0.450	30413	0.000035547	0.287
8024	0.450	17830	0.000040541	0.280
6581	0.450	14625	0.000040428	0.327

3437	0.450	7638	0.000040428	0.699
2073	0.450	4607	0.000037444	1.506
1704	0.450	3787	0.000036141	4.328
5753	0.710	8103	0.002656782	938.353
6787	0.890	7626	0.003037164	1156.650
12137	0.890	13637	0.002504469	374.684
18942	0.890	21283	0.000598755	32.685
27925	0.890	31376	0.001132437	49.904
36844	0.890	41398	0.000070817	1.025
19085	0.710	26881	0.000035547	0.328
13875	0.450	30833	0.000040541	0.242
17248	0.450	38329	0.000040428	0.129
16498	0.450	36661	0.000040428	0.279
13512	0.450	30026	0.000037444	0.405
7288	0.450	16195	0.000036141	0.940
15136	0.450	33636	0.002656782	147.201
12864	0.450	28587	0.003037164	216.587
28923	0.450	64273	0.002504469	65.168
27938	0.450	62085	0.000598755	10.354
120078	0.450	266840	0.001132437	5.841
51128	0.450	113618	0.000070817	0.365
32166	0.450	71481	0.000035547	0.183
24634	0.450	54743	0.000040541	0.168
19655	0.450	43677	0.000040428	0.279
10088	0.450	22419	0.000040428	0.437
3360	0.450	7467	0.000037444	0.974
3049	0.450	6776	0.000036141	2.002
8460	0.450	18799	0.002656782	318.161
6787	0.710	9560	0.003037164	853.993
8310	0.880	9444	0.002504469	629.206
5443	0.880	6185	0.000598755	150.427
33676	0.880	38268	0.001132437	41.082
16906	0.880	19211	0.000070817	2.172
5242	0.880	5956	0.000035547	1.566
1915	0.880	2176	0.000040541	0.920
2279	0.880	2590	0.000040428	1.050
1109	0.880	1260	0.000040428	2.207
2073	0.880	2356	0.000037444	3.159
1704	0.880	1937	0.000036141	9.080
29442	0.880	33457	0.002656782	145.031

20699	0.880	23522	0.003037164	256.235
35374	0.880	40198	0.002504469	110.366
12790	0.880	14534	0.000598755	50.515
46883	0.880	53276	0.001132437	29.419
19962	0.880	22684	0.000070817	1.840
8800	0.880	10000	0.000035547	0.923
1412	0.880	1605	0.000040541	1.244
1110	0.880	1261	0.000040428	2.207
902	0.880	1025	0.000040428	2.766
1579	0.880	1794	0.000037444	4.352
3049	0.880	3465	0.000036141	4.201
8460	0.880	9613	0.002656782	667.472
5990	0.880	6807	0.003037164	1452.868
5652	0.880	6422	0.002504469	1198.046
15405	0.880	17506	0.000598755	40.966
53823	0.880	61163	0.001132437	25.685
22918	0.880	26043	0.000070817	1.606
13686	0.880	15552	0.000035547	0.603
6525	0.880	7415	0.000040541	0.798
2885	0.880	3278	0.000040428	1.050
1109	0.880	1260	0.000040428	2.207
1579	0.880	1794	0.000037444	4.352
1704	0.880	1937	0.000036141	9.080
6519	0.880	7407	0.002656782	1011.788
6787	0.880	7713	0.003037164	1156.650
8310	0.880	9444	0.002504469	629.206
18942	0.880	21525	0.000598755	32.685
27925	0.880	31733	0.001132437	49.904
14339	0.880	16294	0.000070817	2.569
13686	0.880	15552	0.000035547	0.603
6525	0.880	7415	0.000040541	0.798
3634	0.880	4129	0.000040428	0.796
3372	0.880	3832	0.000040428	0.796
4850	0.880	5512	0.000037444	1.358
4005	0.880	4551	0.000036141	3.049
12355	0.880	14040	0.002656782	397.471
20699	0.880	23522	0.003037164	256.235
68182	0.880	77479	0.002504469	56.804
60491	0.880	68740	0.000598755	10.155
53823	0.880	61163	0.001132437	25.685

66716	0.710	93967	0.000070817	0.454
53464	0.450	118809	0.000035547	0.147
47561	0.450	105691	0.000040541	0.105
44055	0.450	97900	0.000040428	0.167
31215	0.450	69367	0.000040428	0.327
13072	0.450	29049	0.000037444	0.647
4005	0.450	8899	0.000036141	1.453
12355	0.450	27455	0.002656782	189.461
8808	0.450	19574	0.003037164	363.713
23522	0.710	33130	0.002504469	126.516
38895	0.890	43703	0.000598755	15.555
72914	0.880	82856	0.001132437	19.207
16906	0.880	19211	0.000070817	2.172
47889	0.710	67449	0.000035547	0.162
46062	0.450	102361	0.000040541	0.119
38823	0.450	86273	0.000040428	0.241
21563	0.450	47917	0.000040428	0.327
11241	0.450	24980	0.000037444	0.548
4824	0.450	10719	0.000036141	1.179
15136	0.450	33636	0.002656782	147.201
20699	0.450	45998	0.003037164	122.138
50295	0.450	111767	0.002504469	36.621
60491	0.450	134425	0.000598755	4.841
382574	0.450	850164	0.001132437	2.793
182193	0.450	404873	0.000070817	0.172
197203	0.450	438228	0.000035547	0.087
174488	0.450	387750	0.000040541	0.099
158203	0.450	351563	0.000040428	0.098
131203	0.450	291561	0.000040428	0.167
92221	0.450	204935	0.000037444	0.303
49124	0.450	109164	0.000036141	0.292
68426	0.450	152057	0.002656782	38.848
284988	0.450	633306	0.003037164	10.032
730666	0.450	1623702	0.002504469	6.834
317394	0.450	705321	0.000598755	1.477
325472	0.450	723270	0.001132437	2.940
245596	0.450	545769	0.000070817	0.193
301242	0.450	669426	0.000035547	2.380
13609	0.450	30241	0.000040541	0.100
29181	0.450	64847	0.000040428	0.100

28548	0.450	63439	0.000040428	0.209
23697	0.450	52660	0.000037444	0.351
12443	0.450	27650	0.000036141	0.759
19879	0.450	44176	0.002656782	106.842
20699	0.450	45998	0.003037164	122.138
35374	0.450	78610	0.002504469	52.608
51681	0.450	114846	0.000598755	5.620
86531	0.450	192290	0.001132437	7.812
66716	0.450	148258	0.000070817	0.293
45798	0.450	101774	0.000035547	0.183
29732	0.450	66072	0.000040541	0.328
10356	0.450	23013	0.000040428	0.501
2277	0.450	5061	0.000040428	0.501
2497	0.450	5550	0.000037444	1.221
2489	0.450	5531	0.000036141	2.577
8460	0.450	18799	0.002656782	318.161
12864	0.710	18119	0.003037164	335.483
28923	0.880	32867	0.002504469	136.717
23167	0.880	26327	0.000598755	26.386
62294	0.880	70789	0.001132437	22.300
22918	0.880	26043	0.000070817	1.606
19085	0.710	26881	0.000035547	0.328
13875	0.450	30833	0.000040541	0.242
12257	0.450	27237	0.000040428	0.209
9603	0.450	21340	0.000040428	0.379
5261	0.450	11690	0.000037444	0.787
4005	0.450	8899	0.000036141	1.453
12355	0.450	27455	0.002656782	189.461
12864	0.450	28587	0.003037164	216.587
19529	0.450	43397	0.002504469	100.716
60491	0.450	134425	0.000598755	4.841
325472	0.450	723270	0.001132437	2.940
138583	0.450	307963	0.000070817	0.184
129861	0.450	288581	0.000035547	0.104
105321	0.450	234046	0.000040541	0.168
73665	0.450	163699	0.000040428	0.167
50476	0.450	112169	0.000040428	0.279
30831	0.450	68513	0.000037444	0.258
25313	0.450	56250	0.000036141	0.448
29581	0.450	65735	0.002656782	69.131

37495	0.450	83321	0.003037164	63.797
42659	0.450	94798	0.002504469	43.308
38895	0.450	86434	0.000598755	7.414
46883	0.450	104184	0.001132437	14.023
22918	0.450	50928	0.000070817	0.766
7452	0.450	16561	0.000035547	0.520
2594	0.450	5764	0.000040541	0.328
4249	0.450	9442	0.000040428	0.327
2799	0.450	6219	0.000040428	0.699
2073	0.450	4607	0.000037444	1.506
1704	0.450	3787	0.000036141	4.328
8460	0.710	11915	0.002656782	492.816
6787	0.880	7713	0.003037164	1156.650
14869	0.890	16707	0.002504469	291.111
32939	0.890	37010	0.000598755	18.368
86531	0.880	98330	0.001132437	16.389
51128	0.710	72012	0.000070817	0.566
29471	0.450	65492	0.000035547	0.212
19858	0.450	44129	0.000040541	0.209
15573	0.450	34607	0.000040428	0.241
9506	0.450	21125	0.000040428	0.501
8378	0.450	18617	0.000037444	0.351
86382	0.450	191960	0.000036141	0.094
199491	0.450	443312	0.002656782	15.845
62949	0.450	139886	0.003037164	37.609
59389	0.450	131976	0.002504469	31.013
51681	0.450	114846	0.000598755	5.620
62294	0.450	138431	0.001132437	10.630
43295	0.450	96211	0.000070817	0.422
16345	0.450	36321	0.000035547	0.287
7821	0.450	17380	0.000040541	0.438
3748	0.450	8328	0.000040428	0.327
2662	0.450	5914	0.000040428	0.699
2497	0.450	5550	0.000037444	1.221
3049	0.450	6776	0.000036141	2.002
8460	0.450	18799	0.002656782	318.161
6787	0.710	9560	0.003037164	853.993
42659	0.880	48476	0.002504469	90.856
32939	0.880	37431	0.000598755	18.368
62294	0.880	70789	0.001132437	22.300

19962	0.880	22684	0.000070817	1.840
7452	0.880	8469	0.000035547	1.090
812	0.890	913	0.000040541	2.213
903	0.890	1014	0.000040428	2.766
570	0.890	641	0.000040428	4.699
1579	0.890	1774	0.000037444	4.352
1704	0.890	1915	0.000036141	9.080
15136	0.890	17007	0.002656782	308.815
15760	0.890	17708	0.003037164	353.029
28923	0.880	32867	0.002504469	136.717
27938	0.880	31748	0.000598755	21.721
33676	0.880	38268	0.001132437	41.082
43295	0.710	60979	0.000070817	0.654
25940	0.450	57644	0.000035547	0.183
17965	0.450	39921	0.000040541	0.328
7159	0.450	15909	0.000040428	0.501
1357	0.450	3014	0.000040428	0.849
2073	0.450	4607	0.000037444	1.506
1704	0.450	3787	0.000036141	4.328
8460	0.710	11915	0.002656782	492.816
8808	0.880	10010	0.003037164	763.036
8310	0.880	9444	0.002504469	629.206
9738	0.880	11066	0.000598755	69.597
27925	0.880	31733	0.001132437	49.904
22918	0.880	26043	0.000070817	1.606
22539	0.710	31744	0.000035547	0.284
17140	0.450	38090	0.000040541	0.242
15547	0.450	34549	0.000040428	0.167
13308	0.450	29573	0.000040428	0.327
7398	0.450	16439	0.000037444	0.787
4824	0.450	10719	0.000036141	1.179
15136	0.450	33636	0.002656782	147.201
12864	0.450	28587	0.003037164	216.587
23522	0.450	52272	0.002504469	81.678
44653	0.450	99230	0.000598755	6.473
46883	0.450	104184	0.001132437	14.023
22918	0.450	50928	0.000070817	0.766
11693	0.450	25983	0.000035547	0.334
6101	0.450	13557	0.000040541	0.280
4588	0.450	10196	0.000040428	0.501

1109	0.450	2465	0.000040428	1.052
1579	0.450	3508	0.000037444	2.075
1704	0.450	3787	0.000036141	4.328
12355	0.710	17401	0.002656782	293.466
8808	0.880	10010	0.003037164	763.036
12137	0.880	13792	0.002504469	374.684
12790	0.880	14534	0.000598755	50.515
39704	0.880	45118	0.001132437	34.739
14339	0.880	16294	0.000070817	2.569
5242	0.880	5956	0.000035547	1.566
5574	0.710	7850	0.000040541	0.260
9370	0.450	20822	0.000040428	0.209
8570	0.450	19045	0.000040428	0.327
6874	0.450	15277	0.000037444	0.647
4824	0.450	10719	0.000036141	1.179
8460	0.450	18799	0.002656782	318.161
12864	0.710	18119	0.003037164	335.483
42659	0.880	48476	0.002504469	90.856
27938	0.880	31748	0.000598755	21.721
39704	0.880	45118	0.001132437	34.739
16906	0.880	19211	0.000070817	2.172
8800	0.880	10000	0.000035547	0.923
1198	0.880	1361	0.000040541	1.471
1110	0.880	1261	0.000040428	2.207
1109	0.880	1260	0.000040428	2.207
1579	0.880	1794	0.000037444	4.352
1704	0.880	1937	0.000036141	9.080
6519	0.880	7407	0.002656782	1011.788
8808	0.880	10010	0.003037164	763.036
23522	0.880	26730	0.002504469	171.353
32939	0.880	37431	0.000598755	18.368
39704	0.880	45118	0.001132437	34.739
43295	0.710	60979	0.000070817	0.654
17087	0.450	37971	0.000035547	0.287
9253	0.450	20562	0.000040541	0.280
7709	0.450	17130	0.000040428	0.279
13242	0.450	29426	0.000040428	0.134
20950	0.450	46555	0.000037444	0.258
22906	0.450	50903	0.000036141	0.391
32459	0.450	72131	0.002656782	69.131

30656	0.450	68125	0.003037164	79.029
50295	0.450	111767	0.002504469	36.621
32939	0.450	73198	0.000598755	8.755
101681	0.450	225957	0.001132437	6.754
108635	0.450	241412	0.000070817	0.208
264256	0.450	587236	0.000035547	0.109
220793	0.450	490652	0.000040541	0.111
178919	0.450	397598	0.000040428	0.119
143510	0.450	318911	0.000040428	0.122
118149	0.450	262553	0.000037444	0.223
73497	0.450	163326	0.000036141	0.391
39123	0.450	86939	0.002656782	69.131
15760	0.450	35023	0.003037164	168.277
19529	0.450	43397	0.002504469	100.716
23167	0.450	51483	0.000598755	12.577
33676	0.450	74835	0.001132437	19.582
19962	0.450	44361	0.000070817	0.877
22539	0.450	50086	0.000035547	0.183
16434	0.450	36519	0.000040541	0.280
10427	0.450	23170	0.000040428	0.279
5894	0.450	13097	0.000040428	0.591
2497	0.450	5550	0.000037444	1.221
2489	0.450	5531	0.000036141	2.577
23944	0.450	53210	0.002656782	86.646
72268	0.450	160595	0.003037164	32.836
50295	0.450	111767	0.002504469	36.621
71788	0.450	159530	0.000598755	4.130
101681	0.450	225957	0.001132437	6.754
90376	0.450	200835	0.000070817	0.234
65937	0.450	146526	0.000035547	0.183
43343	0.450	96318	0.000040541	0.209
27409	0.450	60909	0.000040428	0.279
13449	0.450	29886	0.000040428	0.379
7447	0.450	16549	0.000037444	0.548
5931	0.450	13180	0.000036141	0.940
15136	0.450	33636	0.002656782	147.201
8808	0.450	19574	0.003037164	363.713
8310	0.710	11705	0.002504469	464.563
23167	0.880	26327	0.000598755	26.386
62294	0.880	70789	0.001132437	22.300

90376	0.710	127290	0.000070817	0.362
124571	0.450	276825	0.000035547	0.086
112218	0.450	249374	0.000040541	0.105
96804	0.450	215120	0.000040428	0.129
73940	0.450	164311	0.000040428	0.241
40626	0.450	90281	0.000037444	0.464
5931	0.450	13180	0.000036141	0.940
15136	0.450	33636	0.002656782	147.201
53309	0.450	118465	0.003037164	44.410
35374	0.450	78610	0.002504469	52.608
38895	0.450	86434	0.000598755	7.414
101681	0.450	225957	0.001132437	6.754
162897	0.450	361993	0.000070817	0.175
184402	0.450	409782	0.000035547	0.087
169446	0.450	376547	0.000040541	0.111
149737	0.450	332748	0.000040428	0.098
135561	0.450	301247	0.000040428	0.100
119196	0.450	264879	0.000037444	0.223
76224	0.450	169387	0.000036141	0.339
62187	0.450	138194	0.002656782	45.942
24932	0.450	55405	0.003037164	99.051
50295	0.450	111767	0.002504469	36.621
32939	0.450	73198	0.000598755	8.755
72914	0.450	162030	0.001132437	9.155
66716	0.450	148258	0.000070817	0.293
236309	0.450	525130	0.000035547	0.105
220042	0.450	488983	0.000040541	0.124
180082	0.450	400182	0.000040428	0.098
148349	0.450	329664	0.000040428	0.167
100424	0.450	223164	0.000037444	0.405
16014	0.450	35586	0.000036141	0.940
23944	0.450	53210	0.002656782	86.646
30656	0.450	68125	0.003037164	79.029
28923	0.450	64273	0.002504469	65.168
18942	0.450	42093	0.000598755	15.580
46883	0.450	104184	0.001132437	14.023
66716	0.450	148258	0.000070817	0.293
52670	0.450	117044	0.000035547	0.147
39721	0.450	88268	0.000040541	0.209
26206	0.450	58236	0.000040428	0.241

14779	0.450	32842	0.000040428	0.437
4180	0.450	9289	0.000037444	0.787
4824	0.450	10719	0.000036141	1.179
23944	0.450	53210	0.002656782	86.646
20699	0.450	45998	0.003037164	122.138
59389	0.450	131976	0.002504469	31.013
51681	0.450	114846	0.000598755	5.620
53823	0.450	119608	0.001132437	12.243
22918	0.450	50928	0.000070817	0.766
8800	0.450	19555	0.000035547	0.440
1604	0.450	3565	0.000040541	0.593
1637	0.450	3638	0.000040428	0.699
1109	0.450	2465	0.000040428	1.052
1579	0.450	3508	0.000037444	2.075
2489	0.450	5531	0.000036141	2.577
12355	0.450	27455	0.002656782	189.461
15760	0.450	35023	0.003037164	168.277
19529	0.450	43397	0.002504469	100.716
12790	0.450	28422	0.000598755	24.079
27925	0.450	62056	0.001132437	23.787
19962	0.450	44361	0.000070817	0.877
8800	0.450	19555	0.000035547	0.440
1185	0.450	2634	0.000040541	0.852
749	0.450	1665	0.000040428	1.626
465	0.450	1034	0.000040428	2.883
680	0.450	1511	0.000037444	6.797
877	0.710	1236	0.000036141	24.021
2272	0.890	2553	0.002656782	10631.540
8808	0.880	10010	0.003037164	763.036
6404	0.880	7277	0.002504469	953.783
15405	0.880	17506	0.000598755	40.966
22832	0.880	25945	0.001132437	61.819
22918	0.880	26043	0.000070817	1.606
11693	0.880	13287	0.000035547	0.700
3804	0.880	4323	0.000040541	1.244
1110	0.880	1261	0.000040428	2.207
2277	0.880	2588	0.000040428	1.050
6305	0.880	7165	0.000037444	0.973
5931	0.880	6740	0.000036141	1.973
23944	0.880	27210	0.002656782	181.774

45216	0.880	51382	0.003037164	110.181
42659	0.880	48476	0.002504469	90.856
38895	0.880	44199	0.000598755	15.555
33676	0.880	38268	0.001132437	41.082
19962	0.880	22684	0.000070817	1.840
8800	0.880	10000	0.000035547	0.923
3078	0.880	3498	0.000040541	0.587
4054	0.880	4607	0.000040428	0.796
2022	0.880	2298	0.000040428	1.467
2073	0.880	2356	0.000037444	3.159
2489	0.880	2828	0.000036141	5.407
5753	0.880	6538	0.002656782	1270.907
5990	0.880	6807	0.003037164	1452.868
14869	0.890	16707	0.002504469	291.111
9738	0.890	10942	0.000598755	69.597
11738	0.890	13189	0.001132437	131.630
6564	0.890	7375	0.000070817	5.975
2203	0.890	2476	0.000035547	4.132
418	0.890	469	0.000040541	4.712
466	0.890	523	0.000040428	6.048
246	0.890	276	0.000040428	15.396
600	0.890	674	0.000037444	17.912
1313	0.890	1475	0.000036141	13.763
8460	0.890	9505	0.002656782	667.472
5990	0.890	6731	0.003037164	1452.868
8310	0.890	9338	0.002504469	629.206
44653	0.890	50172	0.000598755	13.580
62294	0.880	70789	0.001132437	22.300
598512	0.710	842975	0.000070817	0.262
641271	0.450	1425047	0.000035547	0.085
563263	0.450	1251696	0.000040541	0.112
450566	0.450	1001258	0.000040428	0.110
352509	0.450	783353	0.000040428	0.119
280612	0.450	623582	0.000037444	0.155
224671	0.450	499269	0.000036141	0.150
281104	0.450	624676	0.002656782	15.845
72268	0.450	160595	0.003037164	32.836
78912	0.450	175359	0.002504469	23.508
51681	0.450	114846	0.000598755	5.620
62294	0.450	138431	0.001132437	10.630

43295	0.450	96211	0.000070817	0.422
87396	0.450	194212	0.000035547	0.087
78508	0.450	174461	0.000040541	0.130
60102	0.450	133560	0.000040428	0.279
25132	0.450	55848	0.000040428	0.501
4529	0.450	10064	0.000037444	0.647
5931	0.450	13180	0.000036141	0.940
15136	0.450	33636	0.002656782	147.201
15760	0.450	35023	0.003037164	168.277
50295	0.450	111767	0.002504469	36.621
32939	0.450	73198	0.000598755	8.755
39704	0.450	88230	0.001132437	16.559
31046	0.450	68991	0.000070817	0.573
19085	0.450	42412	0.000035547	0.212
12687	0.450	28194	0.000040541	0.328
6475	0.450	14388	0.000040428	0.379
2371	0.450	5269	0.000040428	0.849
2497	0.450	5550	0.000037444	1.221
2489	0.450	5531	0.000036141	2.577
8460	0.450	18799	0.002656782	318.161
6787	0.710	9560	0.003037164	853.993
8310	0.880	9444	0.002504469	629.206
7949	0.880	9033	0.000598755	89.577
33676	0.880	38268	0.001132437	41.082
31046	0.880	35280	0.000070817	1.201
10103	0.880	11480	0.000035547	0.806
4464	0.710	6287	0.000040541	0.375
5137	0.450	11416	0.000040428	0.379
2441	0.450	5424	0.000040428	0.699
4529	0.450	10064	0.000037444	0.647
4824	0.450	10719	0.000036141	1.179
43425	0.450	96500	0.002656782	45.942
774455	0.450	1721012	0.003037164	8.287
730666	0.450	1623702	0.002504469	6.834
478528	0.450	1063395	0.000598755	1.634
451449	0.450	1003221	0.001132437	2.758
162897	0.450	361993	0.000070817	0.175
207930	0.450	462066	0.000035547	0.097
183629	0.450	408065	0.000040541	0.111
154310	0.450	342910	0.000040428	0.105

123264	0.450	273919	0.000040428	0.241
67022	0.450	148938	0.000037444	0.303
34114	0.450	75810	0.000036141	0.448
36196	0.450	80437	0.002656782	55.807
24932	0.450	55405	0.003037164	99.051
59389	0.450	131976	0.002504469	31.013
60491	0.450	134425	0.000598755	4.841
222769	0.450	495041	0.001132437	3.620
43295	0.450	96211	0.000070817	0.422
63750	0.450	141666	0.000035547	0.092
56251	0.450	125003	0.000040541	0.168
38820	0.450	86268	0.000040428	0.327
12553	0.450	27896	0.000040428	0.591
3071	0.450	6824	0.000037444	0.974
4005	0.450	8899	0.000036141	1.453
8460	0.450	18799	0.002656782	318.161
8808	0.710	12406	0.003037164	563.375
14869	0.890	16707	0.002504469	291.111
176091	0.710	248015	0.000598755	3.063
222769	0.450	495041	0.001132437	3.620
66716	0.450	148258	0.000070817	0.293
63100	0.450	140221	0.000035547	0.117
54186	0.450	120413	0.000040541	0.134
43899	0.450	97552	0.000040428	0.209
26583	0.450	59074	0.000040428	0.379
7921	0.450	17603	0.000037444	0.787
3049	0.450	6776	0.000036141	2.002
23944	0.450	53210	0.002656782	86.646
12864	0.450	28587	0.003037164	216.587
23522	0.450	52272	0.002504469	81.678
23167	0.450	51483	0.000598755	12.577
53823	0.450	119608	0.001132437	12.243
51128	0.450	113618	0.000070817	0.365
51441	0.450	114314	0.000035547	0.114
47075	0.450	104611	0.000040541	0.123
39177	0.450	87060	0.000040428	0.241
23125	0.450	51388	0.000040428	0.241
19112	0.450	42471	0.000037444	0.351
14498	0.450	32219	0.000036141	0.528
23944	0.450	53210	0.002656782	86.646

15760	0.450	35023	0.003037164	168.277
19529	0.450	43397	0.002504469	100.716
12790	0.450	28422	0.000598755	24.079
22832	0.450	50738	0.001132437	29.467
9722	0.450	21604	0.000070817	1.843
6321	0.450	14046	0.000035547	0.615
1198	0.450	2662	0.000040541	0.701
903	0.450	2006	0.000040428	1.318
319	0.450	708	0.000040428	4.841
600	0.710	845	0.000037444	13.225
458	0.890	514	0.000036141	144.622
2272	0.890	2553	0.002656782	10631.540
2366	0.890	2658	0.003037164	12153.700
4279	0.880	4862	0.002504469	2254.586
7949	0.880	9033	0.000598755	89.577
15416	0.880	17518	0.001132437	95.540
7906	0.880	8985	0.000070817	4.845
5242	0.880	5956	0.000035547	1.566
993	0.880	1129	0.000040541	1.787
1110	0.880	1261	0.000040428	2.207
465	0.880	529	0.000040428	6.048
680	0.880	773	0.000037444	14.260
877	0.880	997	0.000036141	32.535
4356	0.880	4949	0.002656782	2391.702
4535	0.880	5154	0.003037164	2734.132
128805	0.710	181416	0.002504469	23.137
84357	0.450	187460	0.000598755	3.571
242460	0.450	538800	0.001132437	3.429
90376	0.450	200835	0.000070817	0.234
62484	0.450	138852	0.000035547	0.212
37317	0.450	82927	0.000040541	0.209
23005	0.450	51122	0.000040428	0.379
4962	0.450	11026	0.000040428	0.849
2073	0.450	4607	0.000037444	1.506
2489	0.450	5531	0.000036141	2.577
8460	0.450	18799	0.002656782	318.161
5990	0.710	8437	0.003037164	1072.700
23522	0.880	26730	0.002504469	171.353
18942	0.880	21525	0.000598755	32.685
39704	0.880	45118	0.001132437	34.739

11890	0.880	13512	0.000070817	3.121
3485	0.880	3961	0.000035547	2.432
1668	0.880	1895	0.000040541	1.053
2616	0.880	2973	0.000040428	0.917
1929	0.880	2192	0.000040428	1.240
3756	0.880	4268	0.000037444	1.650
4005	0.880	4551	0.000036141	3.049
12355	0.880	14040	0.002656782	397.471
6787	0.880	7713	0.003037164	1156.650
19529	0.880	22192	0.002504469	211.293
44653	0.880	50743	0.000598755	13.580
212253	0.710	298947	0.001132437	5.794
182193	0.450	404873	0.000070817	0.172
325515	0.450	723366	0.000035547	0.105
289756	0.450	643903	0.000040541	0.120
234410	0.450	520911	0.000040428	0.098
193947	0.450	430992	0.000040428	0.129
148048	0.450	328995	0.000037444	0.303
67395	0.450	149767	0.000036141	0.292
74834	0.450	166297	0.002656782	38.848
20699	0.450	45998	0.003037164	122.138
50295	0.450	111767	0.002504469	36.621
27938	0.450	62085	0.000598755	10.354
53823	0.450	119608	0.001132437	12.243
43295	0.450	96211	0.000070817	0.422
21744	0.450	48320	0.000035547	0.212
15771	0.450	35047	0.000040541	0.209
14280	0.450	31732	0.000040428	0.209
11866	0.450	26369	0.000040428	0.279
16149	0.450	35888	0.000037444	0.258
19058	0.450	42352	0.000036141	0.448
43529	0.450	96732	0.002656782	45.942
45216	0.450	100480	0.003037164	52.519
68182	0.450	151514	0.002504469	27.077
184815	0.450	410701	0.000598755	1.914
156687	0.450	348194	0.001132437	4.687
51128	0.450	113618	0.000070817	0.365
49467	0.450	109928	0.000035547	0.117
40832	0.450	90738	0.000040541	0.209
26065	0.450	57921	0.000040428	0.279

12189	0.450	27086	0.000040428	0.501
2497	0.450	5550	0.000037444	1.221
3049	0.450	6776	0.000036141	2.002
8460	0.450	18799	0.002656782	318.161
6787	0.710	9560	0.003037164	853.993
23522	0.880	26730	0.002504469	171.353
27938	0.880	31748	0.000598755	21.721
72914	0.880	82856	0.001132437	19.207
51128	0.710	72012	0.000070817	0.566
29471	0.450	65492	0.000035547	0.212
18665	0.450	41477	0.000040541	0.280
10093	0.450	22429	0.000040428	0.379
3218	0.450	7150	0.000040428	0.699
2073	0.450	4607	0.000037444	1.506
2489	0.450	5531	0.000036141	2.577
8460	0.450	18799	0.002656782	318.161
8808	0.710	12406	0.003037164	563.375
14869	0.890	16707	0.002504469	291.111
12790	0.890	14371	0.000598755	50.515
86531	0.880	98330	0.001132437	16.389
90376	0.710	127290	0.000070817	0.362
92146	0.450	204768	0.000035547	0.104
85998	0.450	191107	0.000040541	0.099
78942	0.450	175428	0.000040428	0.122
68291	0.450	151758	0.000040428	0.129
60314	0.450	134031	0.000037444	0.258
36007	0.450	80016	0.000036141	0.528
23944	0.450	53210	0.002656782	86.646
15760	0.450	35023	0.003037164	168.277
28923	0.450	64273	0.002504469	65.168
176091	0.450	391313	0.000598755	1.978
382574	0.450	850164	0.001132437	2.793
108635	0.450	241412	0.000070817	0.208
98287	0.450	218417	0.000035547	0.117
76914	0.450	170920	0.000040541	0.209
45380	0.450	100846	0.000040428	0.279
19534	0.450	43408	0.000040428	0.501
2497	0.450	5550	0.000037444	1.221
3049	0.450	6776	0.000036141	2.002
6519	0.450	14486	0.002656782	482.285

20699	0.710	29154	0.003037164	189.187
28923	0.890	32497	0.002504469	136.717
44653	0.890	50172	0.000598755	13.580
62294	0.880	70789	0.001132437	22.300
31046	0.880	35280	0.000070817	1.201
13686	0.880	15552	0.000035547	0.603
5977	0.880	6792	0.000040541	1.053
1930	0.880	2193	0.000040428	1.240
749	0.880	851	0.000040428	3.411
1579	0.880	1794	0.000037444	4.352
8748	0.880	9941	0.000036141	1.311
29442	0.880	33457	0.002656782	145.031
24932	0.880	28332	0.003037164	207.800
14869	0.890	16707	0.002504469	291.111
15405	0.890	17309	0.000598755	40.966
18569	0.880	21101	0.001132437	77.480
7906	0.880	8985	0.000070817	4.845
7452	0.880	8469	0.000035547	1.090
812	0.890	913	0.000040541	2.213
749	0.890	842	0.000040428	3.411
465	0.890	523	0.000040428	6.048
1579	0.890	1774	0.000037444	4.352
1704	0.890	1915	0.000036141	9.080
5753	0.890	6464	0.002656782	1270.907
5990	0.890	6731	0.003037164	1452.868
4279	0.890	4808	0.002504469	2254.586
7949	0.890	8931	0.000598755	89.577
9581	0.890	10765	0.001132437	169.420
22918	0.890	25750	0.000070817	1.606
19085	0.710	26881	0.000035547	0.328
13875	0.450	30833	0.000040541	0.242
9448	0.450	20995	0.000040428	0.379
2837	0.450	6305	0.000040428	0.849
1579	0.450	3508	0.000037444	2.075
4005	0.450	8899	0.000036141	1.453
8460	0.450	18799	0.002656782	318.161
12864	0.710	18119	0.003037164	335.483
8310	0.880	9444	0.002504469	629.206
15405	0.880	17506	0.000598755	40.966
22832	0.880	25945	0.001132437	61.819

22918	0.880	26043	0.000070817	1.606
16242	0.880	18457	0.000035547	0.514
10364	0.710	14597	0.000040541	0.375
7176	0.450	15946	0.000040428	0.501
1109	0.450	2465	0.000040428	1.052
2497	0.450	5550	0.000037444	1.221
2489	0.450	5531	0.000036141	2.577
8460	0.450	18799	0.002656782	318.161
5990	0.710	8437	0.003037164	1072.700
6404	0.880	7277	0.002504469	953.783
12790	0.880	14534	0.000598755	50.515
15416	0.880	17518	0.001132437	95.540
16906	0.880	19211	0.000070817	2.172
10103	0.880	11480	0.000035547	0.806
2761	0.880	3138	0.000040541	0.920
2279	0.880	2590	0.000040428	1.050
1357	0.880	1541	0.000040428	1.782
2073	0.880	2356	0.000037444	3.159
1704	0.880	1937	0.000036141	9.080
15136	0.880	17200	0.002656782	308.815
12864	0.880	14619	0.003037164	454.379
23522	0.880	26730	0.002504469	171.353
27938	0.880	31748	0.000598755	21.721
101681	0.710	143212	0.001132437	10.462
31046	0.450	68991	0.000070817	0.573
8800	0.450	19555	0.000035547	0.440
1004	0.450	2232	0.000040541	1.055
1110	0.450	2466	0.000040428	1.052
465	0.450	1034	0.000040428	2.883
2073	0.450	4607	0.000037444	1.506
1704	0.450	3787	0.000036141	4.328
5753	0.710	8103	0.002656782	938.353
6787	0.890	7626	0.003037164	1156.650
19529	0.890	21942	0.002504469	211.293
27938	0.890	31391	0.000598755	21.721
22832	0.890	25654	0.001132437	61.819
9722	0.890	10923	0.000070817	3.866
4286	0.890	4815	0.000035547	1.940
993	0.890	1116	0.000040541	1.787
2279	0.890	2561	0.000040428	1.050

1109	0.890	1246	0.000040428	2.207
2073	0.890	2330	0.000037444	3.159
1704	0.890	1915	0.000036141	9.080
5753	0.890	6464	0.002656782	1270.907
5990	0.890	6731	0.003037164	1452.868
5652	0.890	6350	0.002504469	1198.046
4194	0.890	4712	0.000598755	228.025
6560	0.890	7371	0.001132437	284.506
9722	0.890	10923	0.000070817	3.866
6321	0.890	7102	0.000035547	1.290
993	0.890	1116	0.000040541	1.787
903	0.890	1014	0.000040428	2.766
749	0.890	841	0.000040428	3.411
1289	0.890	1448	0.000037444	5.602
1313	0.890	1475	0.000036141	13.763
8460	0.890	9505	0.002656782	667.472
8808	0.890	9897	0.003037164	763.036
14869	0.890	16707	0.002504469	291.111
18942	0.890	21283	0.000598755	32.685
18569	0.890	20864	0.001132437	77.480
4080	0.890	4584	0.000070817	10.595
837	0.890	941	0.000035547	17.004
63	0.890	70	0.000040541	162.230
86	0.890	96	0.000040428	161.778
62	0.890	69	0.000040428	224.487
118	0.890	132	0.000037444	301.366
3049	0.890	3426	0.000036141	4.201

d_s / WL_{av} (unitless)	Ms st lucia (ton)	$M_{s\ sea}$ (ton)	$M_{s\ scour}$ (ton)	$M_{s\ balance}$ (ton)
23614.82	0	0	0.000	985.004
2722.74	0	0	0	2447
46.68	0	0	0	36122
1.83	0	0	0	59040
0.58	7088	0	0	68194
0.67	1089	0	0	76930
0.45	750	6365	78925	0
0.54	0	9906	0	0
1.03	0	10903	0	0
2.09	0	5931	0	0
237.43	0	19879	0	0
373.95	0	15760	0	0
396.89	0	12137	0	0
34.62	0	18942	0	0
52.86	0	27925	0	0
0.43	0	245596	0	0
0.22	0	248399	0	0
0.25	0	237963	0	0
0.22	0	200451	0	0
0.37	0	164207	0	0
0.57	0	114784	0	0
0.99	0	61076	0	0
153.63	0	29777	0	0
220.11	0	24932	0	0
52.24	0	78912	0	0
9.18	0	71788	0	0
10.42	0	156687	0	0
0.65	0	66716	0	0
0.41	0	45798	0	0
0.27	0	35763	0	0
0.46	0	31845	0	0
0.73	0	20631	0	0
1.44	0	10175	0	0
2.62	0	4824	0	0
421.02	0	12355	0	0

271.42	0	20699	0	0
81.38	0	50295	0	0
4.25	0	184815	0	0
7.39	0	255137	0	0
0.65	0	66716	0	0
0.33	0	52670	0	0
0.46	0	39721	0	0
0.73	0	24808	0	0
1.11	0	9067	0	0
2.17	0	3071	0	0
4.45	0	3049	0	0
192.55	0	23944	0	0
481.30	0	12864	0	0
144.82	0	28923	0	0
16.48	0	38895	0	0
23.62	0	62294	0	0
0.48	0	103238	0	0
0.26	0	93888	0	0
0.46	0	73662	0	0
0.84	0	42462	0	0
1.89	0	8011	0	0
4.61	0	1579	0	0
5.73	0	2489	0	0
1346.22	0	5753	0	0
12638.70	0	0	0	2366
1361.42	0	0	0	8017
169.02	0	0	0	13460
56.07	0	0	0	41385
3.55	0	0	0	53275
0.92	916	0	0	62463
0.53	1078	1416	64432	0
0.84	0	5137	0	0
1.11	0	3083	0	0
2.17	0	3071	0	0
5.73	0	2489	0	0
707.02	0	8460	0	0
266.46	0	0	0	20699
192.53	0	0	0	44221
15.26	0	0	0	88875
10.23	0	135197	110365	0

0.50	0	94853	0	0
0.19	0	127446	0	0
0.05	0	306773	0	0
0.15	0	388631	0	0
0.21	0	398753	0	0
0.27	0	453208	0	0
0.20	0	442707	0	0
30.45	0	511081	0	0
34.81	0	161226	0	0
28.71	0	152110	0	0
7.94	0	84357	0	0
15.01	0	101681	0	0
0.94	0	43295	0	0
0.54	0	18901	0	0
0.54	0	12218	0	0
0.97	0	8269	0	0
1.55	0	1873	0	0
2.17	0	3071	0	0
5.73	0	2489	0	0
1071.74	0	6519	0	0
472.51	0	0	0	12864
327.09	0	0	0	27734
46.03	0	0	0	43139
56.71	0	0	0	71064
2.92	0	0	0	85403
0.92	916	0	0	94590
0.67	1089	0	0	97425
1.19	0	0	0	101012
2.02	0	0	0	102369
3.59	0	0	0	104442
3.46	0	0	0	108447
451.67	0	0	0	120802
867.09	0	0	0	129610
155.36	0	0	0	158533
29.98	0	0	0	181700
25.34	0	0	0	243994
0.80	2518	35288	257316	0
0.41	0	32924	0	0
0.62	0	22588	0	0
0.84	0	11578	0	0

1.11	0	4092	0	0
2.71	0	2497	0	0
5.73	0	2489	0	0
707.02	0	8460	0	0
472.51	0	0	0	12864
425.78	0	0	0	25001
79.09	0	0	0	34739
88.05	0	0	0	53308
2.47	0	0	0	70214
1.47	0	0	0	76535
0.27	142	8125	76893	0
0.46	0	12152	0	0
0.84	0	9547	0	0
0.90	0	8735	0	0
1.39	0	9625	0	0
192.55	0	23944	0	0
98.69	0	53309	0	0
52.24	0	78912	0	0
12.49	0	51681	0	0
23.62	0	62294	0	0
0.39	0	162897	0	0
0.24	0	145175	0	0
0.27	0	119079	0	0
0.46	0	92435	0	0
0.97	0	52217	0	0
1.44	0	6028	0	0
2.62	0	4824	0	0
327.11	0	15136	0	0
271.42	0	20699	0	0
308.36	0	14869	0	0
43.39	0	15405	0	0
52.86	0	27925	0	0
2.72	0	14339	0	0
1.16	0	7452	0	0
1.32	0	1412	0	0
2.34	0	1110	0	0
4.98	0	570	0	0
9.96	0	882	0	0
14.31	0	0	0	1313
2717.84	0	0	0	5669

13811.02	0	0	0	8034
2562.03	0	0	0	12313
101.79	0	0	0	20262
108.57	0	0	0	35678
5.51	0	0	0	43585
0.25	888	39015	45495	0
0.26	0	40522	0	0
0.22	0	51750	0	0
0.22	0	62358	0	0
0.34	0	69787	0	0
0.75	0	61935	0	0
124.02	0	51254	0	0
220.11	0	24932	0	0
181.51	0	23522	0	0
27.95	0	23167	0	0
20.35	0	72914	0	0
1.09	0	36844	0	0
0.47	0	19085	0	0
0.73	0	12687	0	0
1.31	0	5377	0	0
2.93	0	902	0	0
5.93	0	1289	0	0
9.62	0	1704	0	0
1321.62	0	0	0	5753
3106.97	0	0	0	10288
1361.42	0	0	0	15940
37.14	0	0	0	34882
25.34	0	0	0	97176
0.64	1967	57622	104304	0
0.26	0	63893	0	0
0.37	0	52796	0	0
0.54	0	38052	0	0
0.84	0	20689	0	0
1.03	0	9547	0	0
1.39	0	8748	0	0
124.02	0	36009	0	0
271.42	0	20699	0	0
223.81	0	19529	0	0
23.01	0	27938	0	0
15.01	0	101681	0	0

0.94	0	43295	0	0
0.54	0	18901	0	0
0.62	0	11679	0	0
0.97	0	7037	0	0
1.31	0	2131	0	0
1.75	0	3756	0	0
3.23	0	4005	0	0
327.11	0	15136	0	0
808.25	0	8808	0	0
991.84	0	0	0	6404
259.12	0	0	0	10597
192.52	0	0	0	20179
2.92	0	0	0	34517
0.58	7088	0	0	43671
0.46	515	7896	46278	0
0.73	0	9536	0	0
0.54	0	7549	0	0
0.90	0	10743	0	0
1.69	0	8333	0	0
327.11	0	15136	0	0
481.30	0	12864	0	0
181.51	0	23522	0	0
10.76	0	60491	0	0
31.16	0	46883	0	0
0.65	0	66716	0	0
0.21	0	84351	0	0
0.29	0	74979	0	0
0.37	0	61000	0	0
0.97	0	40932	0	0
1.75	0	4931	0	0
2.62	0	4824	0	0
327.11	0	15136	0	0
373.95	0	15760	0	0
396.89	0	12137	0	0
53.51	0	12790	0	0
17.36	0	86531	0	0
0.94	0	43295	0	0
0.33	0	32069	0	0
0.54	0	25201	0	0
0.54	0	16603	0	0

1.11	0	9984	0	0
1.22	0	5340	0	0
1.69	0	7254	0	0
192.55	0	23944	0	0
373.95	0	15760	0	0
144.82	0	28923	0	0
34.62	0	18942	0	0
20.35	0	72914	0	0
1.09	0	36844	0	0
0.19	0	80315	0	0
0.22	0	80945	0	0
0.29	0	74015	0	0
0.37	0	60368	0	0
0.67	0	47726	0	0
0.87	0	29602	0	0
124.02	0	39908	0	0
116.71	0	45216	0	0
96.24	0	42659	0	0
7.94	0	84357	0	0
15.01	0	101681	0	0
0.65	0	66716	0	0
0.54	0	39502	0	0
0.46	0	22248	0	0
0.62	0	16116	0	0
0.37	0	13740	0	0
0.27	0	37176	0	0
0.55	0	49437	0	0
73.11	0	82503	0	0
98.69	0	53309	0	0
116.91	0	35374	0	0
10.76	0	60491	0	0
10.42	0	156687	0	0
0.81	0	51128	0	0
0.54	0	25869	0	0
0.85	0	13989	0	0
0.84	0	5187	0	0
1.89	0	2169	0	0
3.35	0	2073	0	0
5.73	0	2489	0	0
1071.74	0	6519	0	0

1202.81	0	0	0	6787
1083.84	0	0	0	13191
57.40	0	0	0	25981
108.57	0	0	0	41397
1.83	0	0	0	64315
0.69	4568	0	0	73432
0.37	277	8589	74449	0
0.62	0	10471	0	0
0.97	0	6596	0	0
1.22	0	5529	0	0
2.62	0	4824	0	0
237.43	0	19879	0	0
220.11	0	24932	0	0
181.51	0	23522	0	0
16.48	0	38895	0	0
10.42	0	156687	0	0
0.81	0	51128	0	0
0.33	0	39038	0	0
0.22	0	42333	0	0
0.25	0	61083	0	0
0.22	0	64693	0	0
0.34	0	71430	0	0
0.41	0	78022	0	0
30.45	0	200542	0	0
63.35	0	83641	0	0
33.19	0	128805	0	0
5.51	0	129992	0	0
8.05	0	222769	0	0
0.65	0	66716	0	0
0.19	0	95069	0	0
0.30	0	84095	0	0
0.54	0	64014	0	0
1.31	0	31643	0	0
0.78	0	8378	0	0
1.39	0	10582	0	0
192.55	0	23944	0	0
98.69	0	53309	0	0
81.38	0	50295	0	0
14.39	0	44653	0	0
23.62	0	62294	0	0

1.09	0	36844	0	0
0.41	0	22539	0	0
0.22	0	28576	0	0
0.37	0	29932	0	0
0.73	0	22344	0	0
1.44	0	10644	0	0
3.23	0	4005	0	0
707.02	0	8460	0	0
1202.81	0	0	0	6787
1083.84	0	0	0	13191
325.48	0	0	0	16892
192.52	0	0	0	26474
1.58	0	0	0	52998
0.92	916	0	0	62185
0.67	1089	0	0	65020
1.04	0	0	0	68945
2.51	0	0	0	70054
4.95	0	0	0	71632
10.32	0	0	0	73337
1444.21	0	0	0	79090
1650.99	0	0	0	85080
425.78	0	0	0	97217
57.40	0	0	0	110007
46.68	0	0	0	143683
2.09	0	0	0	163645
0.40	3094	15949	167140	0
0.46	0	17795	0	0
0.62	0	13732	0	0
1.31	0	7150	0	0
1.75	0	3756	0	0
2.62	0	4824	0	0
421.02	0	12355	0	0
481.30	0	12864	0	0
308.36	0	14869	0	0
19.46	0	32939	0	0
27.21	0	53823	0	0
1.70	0	22918	0	0
0.64	0	13686	0	0
0.62	0	8024	0	0
0.73	0	6581	0	0

1.55	0	3437	0	0
3.35	0	2073	0	0
9.62	0	1704	0	0
1321.62	0	0	0	5753
1299.61	0	0	0	12541
420.99	0	0	0	24678
36.73	0	0	0	43620
56.07	0	0	0	71545
1.15	0	0	0	108389
0.46	6991	5011	115472	0
0.54	0	13875	0	0
0.29	0	17248	0	0
0.62	0	16498	0	0
0.90	0	13512	0	0
2.09	0	7288	0	0
327.11	0	15136	0	0
481.30	0	12864	0	0
144.82	0	28923	0	0
23.01	0	27938	0	0
12.98	0	120078	0	0
0.81	0	51128	0	0
0.41	0	32166	0	0
0.37	0	24634	0	0
0.62	0	19655	0	0
0.97	0	10088	0	0
2.17	0	3360	0	0
4.45	0	3049	0	0
707.02	0	8460	0	0
1202.81	0	0	0	6787
715.01	0	0	0	15098
170.94	0	0	0	20540
46.68	0	0	0	54216
2.47	0	0	0	71122
1.78	0	0	0	76363
1.04	0	0	0	78278
1.19	0	0	0	80557
2.51	0	0	0	81666
3.59	0	0	0	83739
10.32	0	0	0	85443
164.81	0	0	0	114885

291.18	0	0	0	135584
125.42	0	0	0	170959
57.40	0	0	0	183748
33.43	0	0	0	230631
2.09	0	0	0	250593
1.05	0	0	0	259393
1.41	0	0	0	260806
2.51	0	0	0	261915
3.14	0	0	0	262818
4.95	0	0	0	264396
4.77	0	0	0	267445
758.49	0	0	0	275905
1650.99	0	0	0	281895
1361.42	0	0	0	287547
46.55	0	0	0	302952
29.19	0	0	0	356776
1.83	0	0	0	379693
0.69	4568	0	0	388811
0.91	223	0	0	395113
1.19	0	0	0	397998
2.51	0	0	0	399107
4.95	0	0	0	400686
10.32	0	0	0	402390
1149.76	0	0	0	408908
1314.38	0	0	0	415696
715.01	0	0	0	424006
37.14	0	0	0	442948
56.71	0	0	0	470873
2.92	0	0	0	485212
0.69	4568	0	0	494330
0.91	223	0	0	500632
0.90	305	0	0	503961
0.90	302	0	0	507031
1.54	0	0	0	511882
3.46	0	0	0	515886
451.67	0	0	0	528241
291.18	0	0	0	548940
64.55	0	0	0	617122
11.54	0	0	0	677613
29.19	0	0	0	731437

0.64	1967	57622	738565	0
0.33	0	53464	0	0
0.23	0	47561	0	0
0.37	0	44055	0	0
0.73	0	31215	0	0
1.44	0	13072	0	0
3.23	0	4005	0	0
421.02	0	12355	0	0
808.25	0	8808	0	0
178.19	0	0	0	23522
17.48	0	0	0	62418
21.83	0	0	0	135331
2.47	0	0	0	152237
0.23	733	45311	154081	0
0.26	0	46062	0	0
0.54	0	38823	0	0
0.73	0	21563	0	0
1.22	0	11241	0	0
2.62	0	4824	0	0
327.11	0	15136	0	0
271.42	0	20699	0	0
81.38	0	50295	0	0
10.76	0	60491	0	0
6.21	0	382574	0	0
0.38	0	182193	0	0
0.19	0	197203	0	0
0.22	0	174488	0	0
0.22	0	158203	0	0
0.37	0	131203	0	0
0.67	0	92221	0	0
0.65	0	49124	0	0
86.33	0	68426	0	0
22.29	0	284988	0	0
15.19	0	730666	0	0
3.28	0	317394	0	0
6.53	0	325472	0	0
0.43	0	245596	0	0
5.29	0	301242	0	0
0.22	0	13609	0	0
0.22	0	29181	0	0

0.46	0	28548	0	0
0.78	0	23697	0	0
1.69	0	12443	0	0
237.43	0	19879	0	0
271.42	0	20699	0	0
116.91	0	35374	0	0
12.49	0	51681	0	0
17.36	0	86531	0	0
0.65	0	66716	0	0
0.41	0	45798	0	0
0.73	0	29732	0	0
1.11	0	10356	0	0
1.11	0	2277	0	0
2.71	0	2497	0	0
5.73	0	2489	0	0
707.02	0	8460	0	0
472.51	0	0	0	12864
155.36	0	0	0	41787
29.98	0	0	0	64955
25.34	0	0	0	127248
1.83	0	0	0	150166
0.46	6991	5011	157249	0
0.54	0	13875	0	0
0.46	0	12257	0	0
0.84	0	9603	0	0
1.75	0	5261	0	0
3.23	0	4005	0	0
421.02	0	12355	0	0
481.30	0	12864	0	0
223.81	0	19529	0	0
10.76	0	60491	0	0
6.53	0	325472	0	0
0.41	0	138583	0	0
0.23	0	129861	0	0
0.37	0	105321	0	0
0.37	0	73665	0	0
0.62	0	50476	0	0
0.57	0	30831	0	0
0.99	0	25313	0	0
153.63	0	29581	0	0

141.77	0	37495	0	0
96.24	0	42659	0	0
16.48	0	38895	0	0
31.16	0	46883	0	0
1.70	0	22918	0	0
1.16	0	7452	0	0
0.73	0	2594	0	0
0.73	0	4249	0	0
1.55	0	2799	0	0
3.35	0	2073	0	0
9.62	0	1704	0	0
694.11	0	0	0	8460
1314.38	0	0	0	15247
327.09	0	0	0	30116
20.64	0	0	0	63056
18.62	0	0	0	149586
0.80	2518	35288	162908	0
0.47	0	29471	0	0
0.46	0	19858	0	0
0.54	0	15573	0	0
1.11	0	9506	0	0
0.78	0	8378	0	0
0.21	0	86382	0	0
35.21	0	199491	0	0
83.58	0	62949	0	0
68.92	0	59389	0	0
12.49	0	51681	0	0
23.62	0	62294	0	0
0.94	0	43295	0	0
0.64	0	16345	0	0
0.97	0	7821	0	0
0.73	0	3748	0	0
1.55	0	2662	0	0
2.71	0	2497	0	0
4.45	0	3049	0	0
707.02	0	8460	0	0
1202.81	0	0	0	6787
103.25	0	0	0	49447
20.87	0	0	0	82386
25.34	0	0	0	144680

2.09	0	0	0	164642
1.24	0	0	0	172094
2.49	0	0	0	172907
3.11	0	0	0	173809
5.28	0	0	0	174379
4.89	0	0	0	175958
10.20	0	0	0	177662
346.98	0	0	0	192798
396.66	0	0	0	208559
155.36	0	0	0	237481
24.68	0	0	0	265420
46.68	0	0	0	299096
0.92	2702	6079	333610	0
0.41	0	25940	0	0
0.73	0	17965	0	0
1.11	0	7159	0	0
1.89	0	1357	0	0
3.35	0	2073	0	0
9.62	0	1704	0	0
694.11	0	0	0	8460
867.09	0	0	0	17268
715.01	0	0	0	25578
79.09	0	0	0	35317
56.71	0	0	0	63242
1.83	0	0	0	86159
0.40	3094	15949	89655	0
0.54	0	17140	0	0
0.37	0	15547	0	0
0.73	0	13308	0	0
1.75	0	7398	0	0
2.62	0	4824	0	0
327.11	0	15136	0	0
481.30	0	12864	0	0
181.51	0	23522	0	0
14.39	0	44653	0	0
31.16	0	46883	0	0
1.70	0	22918	0	0
0.74	0	11693	0	0
0.62	0	6101	0	0
1.11	0	4588	0	0

2.34	0	1109	0	0
4.61	0	1579	0	0
9.62	0	1704	0	0
413.33	0	0	0	12355
867.09	0	0	0	21163
425.78	0	0	0	33300
57.40	0	0	0	46090
39.48	0	0	0	85794
2.92	0	0	0	100133
1.78	0	0	0	105374
0.37	277	4844	105826	0
0.46	0	9370	0	0
0.73	0	8570	0	0
1.44	0	6874	0	0
2.62	0	4824	0	0
707.02	0	8460	0	0
472.51	0	0	0	12864
103.25	0	0	0	55524
24.68	0	0	0	83462
39.48	0	0	0	123166
2.47	0	0	0	140071
1.05	0	0	0	148871
1.67	0	0	0	150069
2.51	0	0	0	151179
2.51	0	0	0	152288
4.95	0	0	0	153866
10.32	0	0	0	155571
1149.76	0	0	0	162089
867.09	0	0	0	170898
194.72	0	0	0	194420
20.87	0	0	0	227359
39.48	0	0	0	267063
0.92	2702	6079	301577	0
0.64	0	17087	0	0
0.62	0	9253	0	0
0.62	0	7709	0	0
0.30	0	13242	0	0
0.57	0	20950	0	0
0.87	0	22906	0	0
153.63	0	32459	0	0

175.62	0	30656	0	0
81.38	0	50295	0	0
19.46	0	32939	0	0
15.01	0	101681	0	0
0.46	0	108635	0	0
0.24	0	264256	0	0
0.25	0	220793	0	0
0.26	0	178919	0	0
0.27	0	143510	0	0
0.50	0	118149	0	0
0.87	0	73497	0	0
153.63	0	39123	0	0
373.95	0	15760	0	0
223.81	0	19529	0	0
27.95	0	23167	0	0
43.52	0	33676	0	0
1.95	0	19962	0	0
0.41	0	22539	0	0
0.62	0	16434	0	0
0.62	0	10427	0	0
1.31	0	5894	0	0
2.71	0	2497	0	0
5.73	0	2489	0	0
192.55	0	23944	0	0
72.97	0	72268	0	0
81.38	0	50295	0	0
9.18	0	71788	0	0
15.01	0	101681	0	0
0.52	0	90376	0	0
0.41	0	65937	0	0
0.46	0	43343	0	0
0.62	0	27409	0	0
0.84	0	13449	0	0
1.22	0	7447	0	0
2.09	0	5931	0	0
327.11	0	15136	0	0
808.25	0	8808	0	0
654.31	0	0	0	8310
29.98	0	0	0	31478
25.34	0	0	0	93772

0.51	1444	83716	98988	0
0.19	0	124571	0	0
0.23	0	112218	0	0
0.29	0	96804	0	0
0.54	0	73940	0	0
1.03	0	40626	0	0
2.09	0	5931	0	0
327.11	0	15136	0	0
98.69	0	53309	0	0
116.91	0	35374	0	0
16.48	0	38895	0	0
15.01	0	101681	0	0
0.39	0	162897	0	0
0.19	0	184402	0	0
0.25	0	169446	0	0
0.22	0	149737	0	0
0.22	0	135561	0	0
0.50	0	119196	0	0
0.75	0	76224	0	0
102.09	0	62187	0	0
220.11	0	24932	0	0
81.38	0	50295	0	0
19.46	0	32939	0	0
20.35	0	72914	0	0
0.65	0	66716	0	0
0.23	0	236309	0	0
0.28	0	220042	0	0
0.22	0	180082	0	0
0.37	0	148349	0	0
0.90	0	100424	0	0
2.09	0	16014	0	0
192.55	0	23944	0	0
175.62	0	30656	0	0
144.82	0	28923	0	0
34.62	0	18942	0	0
31.16	0	46883	0	0
0.65	0	66716	0	0
0.33	0	52670	0	0
0.46	0	39721	0	0
0.54	0	26206	0	0

0.97	0	14779	0	0
1.75	0	4180	0	0
2.62	0	4824	0	0
192.55	0	23944	0	0
271.42	0	20699	0	0
68.92	0	59389	0	0
12.49	0	51681	0	0
27.21	0	53823	0	0
1.70	0	22918	0	0
0.98	0	8800	0	0
1.32	0	1604	0	0
1.55	0	1637	0	0
2.34	0	1109	0	0
4.61	0	1579	0	0
5.73	0	2489	0	0
421.02	0	12355	0	0
373.95	0	15760	0	0
223.81	0	19529	0	0
53.51	0	12790	0	0
52.86	0	27925	0	0
1.95	0	19962	0	0
0.98	0	8800	0	0
1.89	0	1185	0	0
3.61	0	749	0	0
6.41	0	465	0	0
15.10	0	680	0	0
33.83	0	0	0	877
11945.55	0	0	0	3149
867.09	0	0	0	11958
1083.84	0	0	0	18361
46.55	0	0	0	33767
70.25	0	0	0	56599
1.83	0	0	0	79516
0.80	2560	0	0	88649
1.41	0	0	0	92453
2.51	0	0	0	93563
1.19	0	0	0	95840
1.11	0	0	0	102146
2.24	0	0	0	108077
206.56	0	0	0	132021

125.21	0	0	0	177237
103.25	0	0	0	219896
17.68	0	0	0	258791
46.68	0	0	0	292467
2.09	0	0	0	312429
1.05	0	0	0	321229
0.67	1089	0	0	323218
0.90	305	0	0	326967
1.67	0	0	0	328990
3.59	0	0	0	331063
6.14	0	0	0	333552
1444.21	0	0	0	339305
1650.99	0	0	0	345295
327.09	0	0	0	360165
78.20	0	0	0	369903
147.90	0	0	0	381641
6.71	0	0	0	388205
4.64	0	0	0	390408
5.29	0	0	0	390826
6.80	0	0	0	391292
17.30	0	0	0	391537
20.13	0	0	0	392137
15.46	0	0	0	393450
749.97	0	0	0	401910
1632.44	0	0	0	407900
706.97	0	0	0	416211
15.26	0	0	0	460864
25.34	0	0	0	523158
0.37	171	594454	527045	0
0.19	0	641271	0	0
0.25	0	563263	0	0
0.25	0	450566	0	0
0.26	0	352509	0	0
0.34	0	280612	0	0
0.33	0	224671	0	0
35.21	0	281104	0	0
72.97	0	72268	0	0
52.24	0	78912	0	0
12.49	0	51681	0	0
23.62	0	62294	0	0

0.94	0	43295	0	0
0.19	0	87396	0	0
0.29	0	78508	0	0
0.62	0	60102	0	0
1.11	0	25132	0	0
1.44	0	4529	0	0
2.09	0	5931	0	0
327.11	0	15136	0	0
373.95	0	15760	0	0
81.38	0	50295	0	0
19.46	0	32939	0	0
36.80	0	39704	0	0
1.27	0	31046	0	0
0.47	0	19085	0	0
0.73	0	12687	0	0
0.84	0	6475	0	0
1.89	0	2371	0	0
2.71	0	2497	0	0
5.73	0	2489	0	0
707.02	0	8460	0	0
1202.81	0	0	0	6787
715.01	0	0	0	15098
101.79	0	0	0	23047
46.68	0	0	0	56722
1.36	0	0	0	87768
0.92	916	0	0	96955
0.53	1078	1416	98925	0
0.84	0	5137	0	0
1.55	0	2441	0	0
1.44	0	4529	0	0
2.62	0	4824	0	0
102.09	0	43425	0	0
18.42	0	774455	0	0
15.19	0	730666	0	0
3.63	0	478528	0	0
6.13	0	451449	0	0
0.39	0	162897	0	0
0.22	0	207930	0	0
0.25	0	183629	0	0
0.23	0	154310	0	0

0.54	0	123264	0	0
0.67	0	67022	0	0
0.99	0	34114	0	0
124.02	0	36196	0	0
220.11	0	24932	0	0
68.92	0	59389	0	0
10.76	0	60491	0	0
8.05	0	222769	0	0
0.94	0	43295	0	0
0.21	0	63750	0	0
0.37	0	56251	0	0
0.73	0	38820	0	0
1.31	0	12553	0	0
2.17	0	3071	0	0
3.23	0	4005	0	0
707.02	0	8460	0	0
793.49	0	0	0	8808
327.09	0	0	0	23678
4.31	0	163045	36724	0
8.05	0	222769	0	0
0.65	0	66716	0	0
0.26	0	63100	0	0
0.30	0	54186	0	0
0.46	0	43899	0	0
0.84	0	26583	0	0
1.75	0	7921	0	0
4.45	0	3049	0	0
192.55	0	23944	0	0
481.30	0	12864	0	0
181.51	0	23522	0	0
27.95	0	23167	0	0
27.21	0	53823	0	0
0.81	0	51128	0	0
0.25	0	51441	0	0
0.27	0	47075	0	0
0.54	0	39177	0	0
0.54	0	23125	0	0
0.78	0	19112	0	0
1.17	0	14498	0	0
192.55	0	23944	0	0

373.95	0	15760	0	0
223.81	0	19529	0	0
53.51	0	12790	0	0
65.48	0	22832	0	0
4.09	0	9722	0	0
1.37	0	6321	0	0
1.56	0	1198	0	0
2.93	0	903	0	0
10.76	0	319	0	0
18.63	0	0	0	600
162.50	0	0	0	1058
11945.55	0	0	0	3330
13655.84	0	0	0	5695
2562.03	0	0	0	9974
101.79	0	0	0	17923
108.57	0	0	0	33339
5.51	0	0	0	41246
1.78	0	0	0	46487
2.03	0	0	0	47480
2.51	0	0	0	48590
6.87	0	0	0	49056
16.20	0	0	0	49736
36.97	0	0	0	50613
2717.84	0	0	0	54968
3106.97	0	0	0	59504
32.59	0	15868	172441	0
7.94	0	84357	0	0
7.62	0	242460	0	0
0.52	0	90376	0	0
0.47	0	62484	0	0
0.46	0	37317	0	0
0.84	0	23005	0	0
1.89	0	4962	0	0
3.35	0	2073	0	0
5.73	0	2489	0	0
707.02	0	8460	0	0
1510.85	0	0	0	5990
194.72	0	0	0	29513
37.14	0	0	0	48455
39.48	0	0	0	88159

3.55	0	0	0	100049
2.76	0	0	0	103534
1.20	0	0	0	105202
1.04	0	0	0	107818
1.41	0	0	0	109747
1.88	0	0	0	113502
3.46	0	0	0	117507
451.67	0	0	0	129862
1314.38	0	0	0	136649
240.11	0	0	0	156178
15.43	0	0	0	200831
8.16	0	196560	216524	0
0.38	0	182193	0	0
0.23	0	325515	0	0
0.27	0	289756	0	0
0.22	0	234410	0	0
0.29	0	193947	0	0
0.67	0	148048	0	0
0.65	0	67395	0	0
86.33	0	74834	0	0
271.42	0	20699	0	0
81.38	0	50295	0	0
23.01	0	27938	0	0
27.21	0	53823	0	0
0.94	0	43295	0	0
0.47	0	21744	0	0
0.46	0	15771	0	0
0.46	0	14280	0	0
0.62	0	11866	0	0
0.57	0	16149	0	0
0.99	0	19058	0	0
102.09	0	43529	0	0
116.71	0	45216	0	0
60.17	0	68182	0	0
4.25	0	184815	0	0
10.42	0	156687	0	0
0.81	0	51128	0	0
0.26	0	49467	0	0
0.46	0	40832	0	0
0.62	0	26065	0	0

1.11	0	12189	0	0
2.71	0	2497	0	0
4.45	0	3049	0	0
707.02	0	8460	0	0
1202.81	0	0	0	6787
194.72	0	0	0	30310
24.68	0	0	0	58248
21.83	0	0	0	131162
0.80	2518	35288	144484	0
0.47	0	29471	0	0
0.62	0	18665	0	0
0.84	0	10093	0	0
1.55	0	3218	0	0
3.35	0	2073	0	0
5.73	0	2489	0	0
707.02	0	8460	0	0
793.49	0	0	0	8808
327.09	0	0	0	23678
56.76	0	0	0	36468
18.62	0	0	0	122998
0.51	1444	83716	128214	0
0.23	0	92146	0	0
0.22	0	85998	0	0
0.27	0	78942	0	0
0.29	0	68291	0	0
0.57	0	60314	0	0
1.17	0	36007	0	0
192.55	0	23944	0	0
373.95	0	15760	0	0
144.82	0	28923	0	0
4.39	0	176091	0	0
6.21	0	382574	0	0
0.46	0	108635	0	0
0.26	0	98287	0	0
0.46	0	76914	0	0
0.62	0	45380	0	0
1.11	0	19534	0	0
2.71	0	2497	0	0
4.45	0	3049	0	0
1071.74	0	6519	0	0

266.46	0	0	0	20699
153.61	0	0	0	49622
15.26	0	0	0	94275
25.34	0	0	0	156569
1.36	0	0	0	187615
0.69	4568	0	0	196733
1.20	0	0	0	202710
1.41	0	0	0	204640
3.88	0	0	0	205389
4.95	0	0	0	206968
1.49	0	0	0	215716
164.81	0	0	0	245157
236.14	0	0	0	270089
327.09	0	0	0	284959
46.03	0	0	0	300364
88.05	0	0	0	318933
5.51	0	0	0	326839
1.24	0	0	0	334292
2.49	0	0	0	335104
3.83	0	0	0	335853
6.80	0	0	0	336319
4.89	0	0	0	337897
10.20	0	0	0	339601
1427.99	0	0	0	345355
1632.44	0	0	0	351345
2533.24	0	0	0	355624
100.65	0	0	0	363573
190.36	0	0	0	373154
1.80	0	0	0	396071
0.46	6991	5011	403154	0
0.54	0	13875	0	0
0.84	0	9448	0	0
1.89	0	2837	0	0
4.61	0	1579	0	0
3.23	0	4005	0	0
707.02	0	8460	0	0
472.51	0	0	0	12864
715.01	0	0	0	21175
46.55	0	0	0	36580
70.25	0	0	0	59412

1.83	0	0	0	82330
0.58	7088	0	0	91483
0.53	1078	3287	97481	0
1.11	0	7176	0	0
2.34	0	1109	0	0
2.71	0	2497	0	0
5.73	0	2489	0	0
707.02	0	8460	0	0
1510.85	0	0	0	5990
1083.84	0	0	0	12394
57.40	0	0	0	25184
108.57	0	0	0	40600
2.47	0	0	0	57506
0.92	916	0	0	66693
1.04	0	0	0	69454
1.19	0	0	0	71733
2.02	0	0	0	73089
3.59	0	0	0	75163
10.32	0	0	0	76867
350.93	0	0	0	92003
516.34	0	0	0	104867
194.72	0	0	0	128390
24.68	0	0	0	156328
14.73	0	10783	247226	0
1.27	0	31046	0	0
0.98	0	8800	0	0
2.34	0	1004	0	0
2.34	0	1110	0	0
6.41	0	465	0	0
3.35	0	2073	0	0
9.62	0	1704	0	0
1321.62	0	0	0	5753
1299.61	0	0	0	12541
237.41	0	0	0	32069
24.41	0	0	0	60008
69.46	0	0	0	82840
4.34	0	0	0	92561
2.18	0	0	0	96847
2.01	0	0	0	97840
1.18	0	0	0	100119

2.48	0	0	0	101228
3.55	0	0	0	103302
10.20	0	0	0	105006
1427.99	0	0	0	110759
1632.44	0	0	0	116749
1346.12	0	0	0	122401
256.21	0	0	0	126595
319.67	0	0	0	133155
4.34	0	0	0	142877
1.45	0	0	0	149198
2.01	0	0	0	150191
3.11	0	0	0	151094
3.83	0	0	0	151843
6.29	0	0	0	153131
15.46	0	0	0	154445
749.97	0	0	0	162904
857.34	0	0	0	171713
327.09	0	0	0	186582
36.73	0	0	0	205524
87.06	0	0	0	224093
11.90	0	0	0	228172
19.11	0	0	0	229010
182.28	0	0	0	229072
181.77	0	0	0	229158
252.23	0	0	0	229220
338.61	0	0	0	229338
4.72	0	0	0	232387

			churchill(1948)	
$TE_{my\ method}$ (%)	Vol_{av} (ft^3)	X-$Area_{av}$ (ft^2)	Resultant Inflow (ft^3/s)	S.I.
100	39175707	60680	29	2759110042
100	53059679	75209	28	4971083679
100	53059679	75209	270	54565168
100	53059679	75209	425	22087168
58	53059679	75209	684	8526356
67	53059679	75209	691	8347853
45	39175707	60680	930	2750227
	25291735	38459	788	1567731
	25291735	38459	371	7050103
	25291735	38459	191	26569476
	25291735	38459	129	58112098
	25291735	38459	112	77768374
	25291735	38459	91	117081927
	25291735	38459	187	27776088
	25291735	38459	228	18793742
	25291735	38459	4361	51146
	25291735	38459	4374	50850
	25291735	38459	9160	11594
	25291735	38459	3424	82978
	25291735	38459	1202	673631
	25291735	38459	670	2168010
	25291735	38459	372	7016333
	25291735	38459	185	28363946
	25291735	38459	163	36500769
	25291735	38459	488	4087034
	25291735	38459	667	2189592
	25291735	38459	1197	679412
	25291735	38459	1199	676226
	25291735	38459	937	1109050
	25291735	38459	1865	279715
	25291735	38459	930	1124647
	25291735	38459	571	2981322
	25291735	38459	272	13142511
	25291735	38459	159	38353188
	25291735	38459	85	133175741

	25291735	38459	140	49970180
	25291735	38459	318	9628493
	25291735	38459	1692	339845
	25291735	38459	1937	259135
	25291735	38459	1199	676226
	25291735	38459	1212	662149
	25291735	38459	944	1092028
	25291735	38459	575	2941465
	25291735	38459	375	6906148
	25291735	38459	190	26819180
	25291735	38459	108	83630792
	25291735	38459	153	41497055
	25291735	38459	96	106418125
	25291735	38459	191	26699574
	25291735	38459	368	7177423
	25291735	38459	486	4115641
	25291735	38459	1845	285798
	25291735	38459	1630	366016
	25291735	38459	944	1092028
	25291735	38459	495	3967699
	25291735	38459	233	17974981
	25291735	38459	107	85032863
	25291735	38459	92	115892024
	25291735	38459	47	441555769
100	39175707	60680	37	1759163077
100	53059679	75209	52	1473377377
100	53059679	76064	64	972024968
100	53059679	76064	227	78224805
100	53059679	75209	230	75335157
92	53059679	75209	438	20802946
53	39175707	60680	805	3664566
	25291735	38459	495	3967699
	25291735	38459	375	6906148
	25291735	38459	190	26819180
	25291735	38459	92	115892024
	25291735	38459	63	247190373
100	39175707	60680	140	122122297
100	53059679	76064	158	161283154
100	53059679	76064	420	22865796
100	39175707	60680	1196	1661377

	25291735	38459	1697	337904
	25291735	38459	3253	91919
	25291735	38459	43160	522
	25291735	38459	15209	4205
	25291735	38459	10601	8655
	25291735	38459	7859	15750
	25291735	38459	3240	92677
	25291735	38459	917	1156677
	25291735	38459	927	1131510
	25291735	38459	923	1142469
	25291735	38459	781	1596627
	25291735	38459	783	1588326
	25291735	38459	785	1576959
	25291735	38459	684	2078779
	25291735	38459	805	1499786
	25291735	38459	431	5226968
	25291735	38459	276	12778159
	25291735	38459	190	26819180
	25291735	38459	92	115892024
	25291735	38459	51	368153034
100	39175707	60680	96	260075628
100	53059679	76064	107	353814694
100	53059679	76064	155	168403505
100	53059679	75209	227	77337457
100	53059679	75209	273	53374818
92	53059679	75209	438	20802946
67	53059679	75209	691	8347853
100	53059679	75209	379	27801549
100	53059679	75209	232	73970751
100	53059679	75209	134	221257160
100	53059679	75209	135	218927984
100	53059679	75209	85	556963407
100	53059679	75209	72	765458223
100	53059679	75209	190	110202061
100	53059679	75209	225	78665435
100	53059679	75209	486	16908741
80	39175707	60680	924	2786314
	25291735	38459	937	1109050
	25291735	38459	691	2035282
	25291735	38459	495	3967699

	25291735	38459	375	6906148
	25291735	38459	158	38786866
	25291735	38459	92	115892024
	25291735	38459	63	247190373
100	39175707	60680	96	260075628
100	53059679	75209	91	486475509
100	53059679	75209	103	373170331
100	53059679	75209	157	162427871
100	53059679	75209	319	39265289
100	53059679	75209	286	48665817
27	39175707	60680	1865	683535
	25291735	38459	930	1124647
	25291735	38459	491	4030242
	25291735	38459	424	5418892
	25291735	38459	273	13056672
	25291735	38459	153	41497055
	25291735	38459	322	9363988
	25291735	38459	488	4087034
	25291735	38459	484	4150346
	25291735	38459	486	4115641
	25291735	38459	2899	115716
	25291735	38459	1858	281909
	25291735	38459	1865	279715
	25291735	38459	930	1124647
	25291735	38459	428	5321702
	25291735	38459	272	13142511
	25291735	38459	159	38353188
	25291735	38459	102	94054246
	25291735	38459	140	49970180
	25291735	38459	107	84359374
	25291735	38459	155	40460170
	25291735	38459	228	18793742
	25291735	38459	274	12994664
	25291735	38459	332	8843919
	25291735	38459	339	8468518
	25291735	38459	198	24773216
	25291735	38459	111	79224515
	25291735	38459	68	210430941
100	39175707	60680	58	717677242
100	53059679	75209	38	2769251576

100	53059679	75209	36	3063592008
100	53059679	75209	44	2071979547
100	53059679	75209	87	525075554
100	53059679	75209	133	225537100
100	53059679	75209	160	156386391
25	39175707	60680	1709	813521
	25291735	38459	1960	253150
	25291735	38459	3424	82978
	25291735	38459	3420	83165
	25291735	38459	1198	677970
	25291735	38459	488	4079225
	25291735	38459	224	19470077
	25291735	38459	163	36500769
	25291735	38459	159	38578984
	25291735	38459	225	19134852
	25291735	38459	566	3035536
	25291735	38459	671	2158055
	25291735	38459	798	1527239
	25291735	38459	589	2805329
	25291735	38459	325	9202008
	25291735	38459	162	36966935
	25291735	38459	91	118184298
	25291735	38459	69	205011230
100	39175707	60680	47	1079119688
100	53059679	75209	48	1715706805
100	53059679	75209	52	1473377377
100	53059679	75209	187	114249384
100	53059679	75209	486	16908741
64	39175707	60680	1199	1653078
	25291735	38459	1630	366016
	25291735	38459	1219	654275
	25291735	38459	792	1552490
	25291735	38459	491	4030242
	25291735	38459	371	7050103
	25291735	38459	273	13056672
	25291735	38459	224	19470077
	25291735	38459	140	49970180
	25291735	38459	135	53323205
	25291735	38459	269	13468171
	25291735	38459	783	1588326

	25291735	38459	785	1576959
	25291735	38459	684	2078779
	25291735	38459	691	2035282
	25291735	38459	431	5226968
	25291735	38459	321	9424277
	25291735	38459	229	18585281
	25291735	38459	136	52956573
	25291735	38459	102	94054246
	25291735	38459	73	183170126
100	39175707	60680	57	729460426
100	53059679	75209	53	1414852184
100	53059679	75209	89	502627262
100	53059679	75209	273	53374818
58	53059679	75209	684	8526356
46	39175707	60680	944	2668333
	25291735	38459	575	2941465
	25291735	38459	788	1567731
	25291735	38459	424	5418892
	25291735	38459	230	18441063
	25291735	38459	102	94054246
	25291735	38459	96	106418125
	25291735	38459	159	38578984
	25291735	38459	564	3057500
	25291735	38459	370	7098651
	25291735	38459	1199	676226
	25291735	38459	2482	157866
	25291735	38459	1717	330094
	25291735	38459	1206	669327
	25291735	38459	428	5321702
	25291735	38459	229	18585281
	25291735	38459	159	38353188
	25291735	38459	102	94054246
	25291735	38459	112	77768374
	25291735	38459	91	117081927
	25291735	38459	131	56399688
	25291735	38459	669	2176270
	25291735	38459	785	1576959
	25291735	38459	1212	662149
	25291735	38459	805	1499786
	25291735	38459	792	1552490

	25291735	38459	375	6906148
	25291735	38459	317	9654361
	25291735	38459	230	18441063
	25291735	38459	153	41497055
	25291735	38459	112	77768374
	25291735	38459	191	26699574
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	25291735	38459	671	2158055
	25291735	38459	3253	91919
	25291735	38459	3438	82313
	25291735	38459	1703	335462
	25291735	38459	1202	673631
	25291735	38459	567	3021936
	25291735	38459	425	5396126
	25291735	38459	224	19470077
	25291735	38459	277	12683050
	25291735	38459	272	13101439
	25291735	38459	781	1596627
	25291735	38459	783	1588326
	25291735	38459	1199	676226
	25291735	38459	684	2078779
	25291735	38459	944	1092028
	25291735	38459	678	2118961
	25291735	38459	1202	673631
	25291735	38459	1616	372489
	25291735	38459	671	2162242
	25291735	38459	366	7254044
	25291735	38459	322	9363988
	25291735	38459	229	18516244
	25291735	38459	564	3057500
	25291735	38459	1197	679412
	25291735	38459	924	1139707
	25291735	38459	684	2078779
	25291735	38459	509	3755624
	25291735	38459	495	3967699
	25291735	38459	233	17974981
	25291735	38459	135	53661249
	25291735	38459	92	115892024
	25291735	38459	51	368153034

100	39175707	60680	62	627614206
100	53059679	75209	57	1249672313
100	53059679	75209	131	232211219
100	53059679	75209	133	225537100
100	53059679	75209	425	22087168
69	53059679	75209	582	11795411
37	39175707	60680	1219	1598765
	25291735	38459	678	2118961
	25291735	38459	428	5321702
	25291735	38459	317	9654361
	25291735	38459	159	38353188
	25291735	38459	129	58112098
	25291735	38459	163	36500769
	25291735	38459	159	38578984
	25291735	38459	368	7177423
	25291735	38459	1197	679412
	25291735	38459	924	1139707
	25291735	38459	1212	662149
	25291735	38459	3438	82313
	25291735	38459	4367	51002
	25291735	38459	2902	115532
	25291735	38459	1198	677970
	25291735	38459	923	1141314
	25291735	38459	917	1156677
	25291735	38459	492	4013354
	25291735	38459	784	1581454
	25291735	38459	1194	681731
	25291735	38459	1694	339028
	25291735	38459	1199	676226
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	25291735	38459	1637	362773
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	25291735	38459	321	9424277
	25291735	38459	487	4094182
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	25291735	38459	153	41497055
	25291735	38459	322	9363988
	25291735	38459	318	9628493
	25291735	38459	420	5504546
	25291735	38459	486	4115641

	25291735	38459	671	2158055
	25291735	38459	937	1109050
	25291735	38459	3260	91509
	25291735	38459	1206	669327
	25291735	38459	571	2981322
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	25291735	38459	136	52956573
	25291735	38459	63	247190373
100	39175707	60680	62	627614206
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100	53059679	75209	49	1686033774
100	53059679	75209	89	502627262
100	53059679	75209	489	16701899
92	53059679	75209	438	20802946
67	53059679	75209	691	8347853
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100	53059679	75209	194	106098844
100	53059679	75209	107	351065847
100	53059679	75209	68	853863833
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100	53059679	75209	56	1254141040
100	53059679	75209	91	486475509
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100	53059679	75209	373	28709672
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	25291735	38459	944	1092028
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	25291735	38459	321	9424277
	25291735	38459	229	18585281
	25291735	38459	159	38353188
	25291735	38459	85	133175741
	25291735	38459	96	106418125
	25291735	38459	107	84359374
	25291735	38459	314	9858857
	25291735	38459	422	5451586
	25291735	38459	425	5379630
	25291735	38459	582	2875913
	25291735	38459	691	2035282
	25291735	38459	575	2941465

	25291735	38459	276	12778159
	25291735	38459	135	53661249
	25291735	38459	69	205011230
100	39175707	60680	47	1079119688
100	53059679	76064	61	1089951022
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100	53059679	76064	187	115547673
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46	39175707	60680	798	3731681
	25291735	38459	805	1499786
	25291735	38459	1703	335462
	25291735	38459	674	2143293
	25291735	38459	424	5418892
	25291735	38459	191	26569476
	25291735	38459	102	94054246
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	25291735	38459	191	26699574
	25291735	38459	269	13468171
	25291735	38459	921	1146686
	25291735	38459	924	1139707
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	25291735	38459	1219	654275
	25291735	38459	678	2118961
	25291735	38459	428	5321702
	25291735	38459	190	26819180
	25291735	38459	108	83630792
	25291735	38459	63	247190373
100	39175707	60680	62	627614206
100	53059679	75209	68	867150560
100	53059679	75209	64	960853507
100	53059679	75209	270	54565168
100	53059679	75209	319	39265289
100	53059679	75209	243	67537540
100	53059679	75209	445	20128646
100	53059679	75209	379	27801549
100	53059679	75209	194	106098844
100	53059679	75209	134	221257160
100	53059679	75209	68	853863833
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100	53059679	75209	139	206986447
100	53059679	75209	229	76348066
100	53059679	75209	131	232211219
100	53059679	75209	370	29177177
100	53059679	75209	373	28709672
100	53059679	75209	386	26818203
100	53059679	75209	339	34725426
100	53059679	75209	198	101928972
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100	53059679	75209	107	346420181
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100	53059679	75209	56	1254141040
100	53059679	75209	52	1473377377
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100	53059679	75209	422	22402163
100	53059679	75209	425	22087168
69	53059679	75209	582	11795411
91	53059679	75209	509	15402613
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100	53059679	75209	194	106098844
100	53059679	75209	107	351065847
100	53059679	75209	68	853863833
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100	53059679	75209	68	867150560
100	53059679	75209	187	114239143
100	53059679	75209	227	77337457
100	53059679	75209	273	53374818
69	53059679	75209	582	11795411
91	53059679	75209	509	15402613
90	53059679	75209	495	16296657
90	53059679	75209	491	16558437
100	53059679	75209	272	54052137
100	53059679	75209	135	218927984
100	53059679	75209	85	556963407
100	53059679	75209	139	206986447
100	53059679	75209	424	22247228
100	53059679	75209	564	12554033
100	53059679	75209	422	22402163

64	39175707	60680	1199	1653078
	25291735	38459	1212	662149
	25291735	38459	2490	156945
	25291735	38459	1206	669327
	25291735	38459	571	2981322
	25291735	38459	272	13142511
	25291735	38459	136	52956573
	25291735	38459	85	133175741
	25291735	38459	73	183170126
100	39175707	60680	159	94283314
100	53059679	76064	368	29819786
100	53059679	75209	566	12468721
100	53059679	75209	319	39265289
23	39175707	60680	1953	623239
	25291735	38459	1960	253150
	25291735	38459	792	1552490
	25291735	38459	571	2981322
	25291735	38459	317	9654361
	25291735	38459	159	38353188
	25291735	38459	102	94054246
	25291735	38459	140	49970180
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	25291735	38459	678	2118961

	25291735	38459	375	6906148
	25291735	38459	158	38786866
	25291735	38459	108	83630792
	25291735	38459	63	247190373
100	39175707	60680	62	627614206
100	53059679	75209	158	159429389
100	53059679	75209	269	55350562
100	53059679	75209	566	12468721
80	39175707	60680	924	2786314
	25291735	38459	798	1527239
	25291735	38459	691	2035282
	25291735	38459	495	3967699
	25291735	38459	276	12778159
	25291735	38459	135	53661249
	25291735	38459	92	115892024
	25291735	38459	63	247190373
100	39175707	60680	73	447650112
100	53059679	76064	107	353814694
100	53059679	76064	131	234879999
100	53059679	75209	668	8937542
51	39175707	60680	1617	908772
	25291735	38459	1953	255038
	25291735	38459	3260	91509
	25291735	38459	1851	283898
	25291735	38459	1699	336986
	25291735	38459	670	2168010
	25291735	38459	318	9600278
	25291735	38459	153	41497055
	25291735	38459	112	77768374
	25291735	38459	191	26699574
	25291735	38459	1613	374019
	25291735	38459	2896	115941
	25291735	38459	1940	258383
	25291735	38459	1630	366016
	25291735	38459	944	1092028
	25291735	38459	678	2118961
	25291735	38459	375	6906148
	25291735	38459	158	38786866
	25291735	38459	108	83630792
	25291735	38459	51	368153034

100	39175707	60680	140	122122297
100	53059679	76064	190	111478531
100	53059679	76064	420	22865796
100	53059679	75209	486	16908741
100	53059679	75209	569	12337571
69	53059679	75209	582	11795411
100	53059679	75209	393	25834475
100	53059679	75209	325	37818641
100	53059679	75209	138	209152748
100	53059679	75209	107	351065847
100	53059679	75209	272	53769769
100	53059679	75209	184	117398955
100	53059679	75209	163	150981945
100	53059679	76064	107	353814694
100	53059679	76064	155	168403505
100	53059679	75209	157	162427871
100	53059679	75209	160	156386391
100	53059679	75209	332	36265405
100	53059679	76064	212	89778576
100	53059679	76064	142	200024468
100	53059679	76064	94	454796757
100	53059679	76064	107	355135658
100	53059679	76064	68	864034971
100	53059679	76064	46	1900010810
100	53059679	76064	56	1269469406
100	53059679	76064	44	2097496678
100	53059679	76064	87	531144387
100	53059679	76064	89	508480005
100	53059679	76064	425	22338768
46	39175707	60680	798	3731654
	25291735	38459	805	1499786
	25291735	38459	495	3967699
	25291735	38459	233	17974981
	25291735	38459	107	85032863
	25291735	38459	136	52956573
	25291735	38459	63	247190373
100	39175707	60680	96	260075628
100	53059679	75209	68	867150560
100	53059679	75209	155	166493313
100	53059679	75209	189	111921174

100	53059679	75209	425	22087168
58	53059679	75209	684	8526356
53	39175707	60680	805	3664566
	25291735	38459	379	6766359
	25291735	38459	194	25766497
	25291735	38459	158	38786866
	25291735	38459	92	115892024
	25291735	38459	63	247190373
100	39175707	60680	57	729682124
100	53059679	75209	57	1249672313
100	53059679	75209	131	232211219
100	53059679	75209	133	225537100
100	53059679	75209	319	39265289
92	53059679	75209	438	20802946
100	53059679	75209	445	20128646
100	53059679	75209	379	27801549
100	53059679	75209	232	73970751
100	53059679	75209	134	221257160
100	53059679	75209	68	853863833
100	53059679	75209	101	392141204
100	53059679	75209	95	442762636
100	53059679	75209	158	159429389
100	53059679	75209	269	55350562
100	39175707	60680	782	3885147
	25291735	38459	569	3005563
	25291735	38459	386	6539623
	25291735	38459	212	21654819
	25291735	38459	198	24773216
	25291735	38459	95	108754570
	25291735	38459	135	53661249
	25291735	38459	69	205011230
100	39175707	60680	47	1079119688
100	53059679	76064	61	1089951022
100	53059679	76064	134	223218914
100	53059679	76064	268	55983038
100	53059679	76064	189	113207827
100	53059679	76064	192	109688055
100	53059679	76064	205	96269754
100	53059679	76064	250	64391054
100	53059679	76064	379	28118999

100	53059679	76064	194	107318659
100	53059679	76064	134	223811685
100	53059679	76064	68	864034971
100	53059679	76064	46	1900010810
100	53059679	76064	56	1269469406
100	53059679	76064	52	1491302613
100	53059679	76064	53	1430930050
100	53059679	76064	66	916546551
100	53059679	76064	192	109688055
100	53059679	76064	286	49217859
100	53059679	76064	250	64391054
100	53059679	76064	166	146866550
100	53059679	76064	138	211568639
100	53059679	76064	90	494170833
100	53059679	76064	57	1241485360
100	53059679	76064	62	1053888874
100	53059679	76064	72	774669972
100	53059679	76064	107	353951445
100	53059679	76064	187	115547673
100	53059679	76064	157	164299555
100	53059679	76064	92	475833932
100	53059679	76064	67	912612892
100	53059679	76064	53	1412185057
100	53059679	76064	39	2614804511
100	53059679	76064	32	4028030171
100	53059679	76064	25	6530459078
100	53059679	76064	107	350477732

% Sediment passing	$TE_{churchill}$ (%)	Q_{max} (m^3/s)	Area (m^2)	
-2	100	13.427	1398074.200	
-3	100	22.592	1940812.800	
11	89	40.082	1940812.800	
15	85	40.082	1940812.800	
21	79	40.082	1940812.800	
21	79	40.082	1940812.800	
29	71	40.082	1398074.200	
34		0.000	899155.000	
22		0.000	899155.000	
14		0.000	899155.000	
10		0.000	899155.000	
9		0.000	899155.000	
7		0.000	899155.000	
14		0.000	899155.000	
16		0.000	899155.000	
79		0.000	899155.000	
80		0.000	899155.000	
111		0.000	899155.000	
71		0.000	899155.000	
43		0.000	899155.000	
31		0.000	899155.000	
22		0.000	899155.000	
14		0.000	899155.000	
13		0.000	899155.000	
26		0.000	899155.000	
31		0.000	899155.000	
43		0.000	899155.000	
43		0.000	899155.000	
37		0.000	899155.000	
53		0.000	899155.000	
37		0.000	899155.000	
29		0.000	899155.000	
18		0.000	899155.000	
12		0.000	899155.000	
7		0.000	899155.000	

11		0.000	899155.000	
20		0.000	899155.000	
51		0.000	899155.000	
54		0.000	899155.000	
43		0.000	899155.000	
43		0.000	899155.000	
38		0.000	899155.000	
29		0.000	899155.000	
22		0.000	899155.000	
14		0.000	899155.000	
9		0.000	899155.000	
12		0.000	899155.000	
8		0.000	899155.000	
14		0.000	899155.000	
22		0.000	899155.000	
26		0.000	899155.000	
53		0.000	899155.000	
50		0.000	899155.000	
38		0.000	899155.000	
26		0.000	899155.000	
16		0.000	899155.000	
9		0.000	899155.000	
8		0.000	899155.000	
3		0.000	899155.000	
-1	100	20.296	1398074.200	
0	100	36.598	1940812.800	
1	99	39.377	1978070.200	
9	91	40.082	1978070.200	
9	91	40.082	1940812.800	
16	84	40.082	1940812.800	
27	73	40.082	1398074.200	
26		0.000	899155.000	
22		0.000	899155.000	
14		0.000	899155.000	
8		0.000	899155.000	
5		0.000	899155.000	
7	93	40.082	1398074.200	
6	94	40.082	1978070.200	
15	85	40.082	1978070.200	
34	66	40.082	1398074.200	

51		0.000	899155.000	
69		0.000	899155.000	
217		0.000	899155.000	
139		0.000	899155.000	
119		0.000	899155.000	
104		0.000	899155.000	
69		0.000	899155.000	
37		0.000	899155.000	
37		0.000	899155.000	
37		0.000	899155.000	
34		0.000	899155.000	
34		0.000	899155.000	
34		0.000	899155.000	
32		0.000	899155.000	
35		0.000	899155.000	
24		0.000	899155.000	
18		0.000	899155.000	
14		0.000	899155.000	
8		0.000	899155.000	
3		0.000	899155.000	
5	95	40.082	1398074.200	
4	96	40.082	1978070.200	
6	94	40.082	1978070.200	
9	91	40.082	1940812.800	
11	89	40.082	1940812.800	
16	84	40.082	1940812.800	
21	79	40.082	1940812.800	
14	86	40.082	1940812.800	
9	91	40.082	1940812.800	
5	95	40.082	1940812.800	
5	95	40.082	1940812.800	
2	98	40.082	1940812.800	
1	99	40.082	1940812.800	
8	92	40.082	1940812.800	
9	91	40.082	1940812.800	
17	83	40.082	1940812.800	
29	71	40.082	1398074.200	
37		0.000	899155.000	
32		0.000	899155.000	
26		0.000	899155.000	

22		0.000	899155.000	
12		0.000	899155.000	
8		0.000	899155.000	
5		0.000	899155.000	
5	95	40.082	1398074.200	1928
3	97	40.082	1940812.800	
3	97	40.082	1940812.800	
6	94	40.082	1940812.800	
12	88	40.082	1940812.800	
11	89	40.082	1940812.800	
42	58	40.082	1398074.200	
37		0.000	899155.000	
26		0.000	899155.000	
24		0.000	899155.000	
18		0.000	899155.000	
12		0.000	899155.000	
20		0.000	899155.000	
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26		0.000	899155.000	
26		0.000	899155.000	
66		0.000	899155.000	
53		0.000	899155.000	
53		0.000	899155.000	
37		0.000	899155.000	
24		0.000	899155.000	
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8		0.000	899155.000	
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21		0.000	899155.000	
21		0.000	899155.000	
15		0.000	899155.000	
9		0.000	899155.000	
5		0.000	899155.000	
2	98	35.234	1398074.200	
-2	100	31.901	1940812.800	

-2	100	29.955	1940812.800	
-1	100	34.558	1940812.800	
2	98	40.082	1940812.800	
5	95	40.082	1940812.800	
6	94	40.082	1940812.800	
41	59	40.082	1398074.200	
54		0.000	899155.000	
71		0.000	899155.000	
71		0.000	899155.000	
43		0.000	899155.000	
26		0.000	899155.000	
16		0.000	899155.000	
13		0.000	899155.000	
12		0.000	899155.000	
16		0.000	899155.000	
28		0.000	899155.000	
31		0.000	899155.000	
34		0.000	899155.000	
29		0.000	899155.000	
20		0.000	899155.000	
13		0.000	899155.000	
7		0.000	899155.000	
5		0.000	899155.000	
0	100	29.955	1398074.200	
-1	100	35.234	1940812.800	
0	100	36.598	1940812.800	
8	92	40.082	1940812.800	
17	83	40.082	1940812.800	
34	66	40.082	1398074.200	
50		0.000	899155.000	
43		0.000	899155.000	
34		0.000	899155.000	
26		0.000	899155.000	
22		0.000	899155.000	
18		0.000	899155.000	
16		0.000	899155.000	
11		0.000	899155.000	
11		0.000	899155.000	
18		0.000	899155.000	
34		0.000	899155.000	

34		0.000	899155.000	
32		0.000	899155.000	
32		0.000	899155.000	
24		0.000	899155.000	
20		0.000	899155.000	
16		0.000	899155.000	
11		0.000	899155.000	
8		0.000	899155.000	
6		0.000	899155.000	
2	98	35.234	1398074.200	
0	100	36.598	1940812.800	
3	97	40.082	1940812.800	
11	89	40.082	1940812.800	
21	79	40.082	1940812.800	
29	71	40.082	1398074.200	
29		0.000	899155.000	
34		0.000	899155.000	
24		0.000	899155.000	
16		0.000	899155.000	
8		0.000	899155.000	
8		0.000	899155.000	
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28		0.000	899155.000	
22		0.000	899155.000	
43		0.000	899155.000	
61		0.000	899155.000	
51		0.000	899155.000	
43		0.000	899155.000	
24		0.000	899155.000	
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7		0.000	899155.000	
11		0.000	899155.000	
31		0.000	899155.000	
34		0.000	899155.000	
43		0.000	899155.000	
35		0.000	899155.000	
34		0.000	899155.000	

22		0.000	899155.000	
20		0.000	899155.000	
16		0.000	899155.000	
12		0.000	899155.000	
9		0.000	899155.000	1938
14		0.000	899155.000	
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16		0.000	899155.000	
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32		0.000	899155.000	
38		0.000	899155.000	
31		0.000	899155.000	
43		0.000	899155.000	
49		0.000	899155.000	
31		0.000	899155.000	
22		0.000	899155.000	
20		0.000	899155.000	
16		0.000	899155.000	
28		0.000	899155.000	
43		0.000	899155.000	
37		0.000	899155.000	
32		0.000	899155.000	
27		0.000	899155.000	
26		0.000	899155.000	
16		0.000	899155.000	
11		0.000	899155.000	
8		0.000	899155.000	
3		0.000	899155.000	

2	98	35.914	1398074.200	
0	100	37.286	1940812.800	
5	95	40.082	1940812.800	
5	95	40.082	1940812.800	
15	85	40.082	1940812.800	
19	81	40.082	1940812.800	
34	66	40.082	1398074.200	
31		0.000	899155.000	
24		0.000	899155.000	
20		0.000	899155.000	
12		0.000	899155.000	
10		0.000	899155.000	
13		0.000	899155.000	
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22		0.000	899155.000	
43		0.000	899155.000	
37		0.000	899155.000	
43		0.000	899155.000	
71		0.000	899155.000	
80		0.000	899155.000	
66		0.000	899155.000	
43		0.000	899155.000	
37		0.000	899155.000	
37		0.000	899155.000	
26		0.000	899155.000	
34		0.000	899155.000	
42		0.000	899155.000	
51		0.000	899155.000	
43		0.000	899155.000	
66		0.000	899155.000	
50		0.000	899155.000	
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20		0.000	899155.000	
26		0.000	899155.000	
18		0.000	899155.000	
12		0.000	899155.000	
20		0.000	899155.000	
20		0.000	899155.000	
24		0.000	899155.000	
26		0.000	899155.000	

31		0.000	899155.000	
37		0.000	899155.000	
69		0.000	899155.000	
43		0.000	899155.000	
29		0.000	899155.000	
18		0.000	899155.000	
11		0.000	899155.000	
5		0.000	899155.000	
2	98	35.914	1398074.200	
0	100	37.286	1940812.800	
-1	100	35.914	1940812.800	
3	97	40.082	1940812.800	
17	83	40.082	1940812.800	
16	84	40.082	1940812.800	
21	79	40.082	1940812.800	
15	85	40.082	1940812.800	
8	92	40.082	1940812.800	
4	96	40.082	1940812.800	
1	99	40.082	1940812.800	
-1	100	35.234	1940812.800	
0	100	37.286	1940812.800	
3	97	40.082	1940812.800	
5	95	40.082	1940812.800	
11	89	40.082	1940812.800	
14	86	40.082	1940812.800	
29	71	40.082	1398074.200	
38		0.000	899155.000	
31		0.000	899155.000	
20		0.000	899155.000	
16		0.000	899155.000	
12		0.000	899155.000	
7		0.000	899155.000	
8		0.000	899155.000	
9		0.000	899155.000	
20		0.000	899155.000	
24		0.000	899155.000	
24		0.000	899155.000	
29		0.000	899155.000	
32		0.000	899155.000	
29		0.000	899155.000	

18		0.000	899155.000	
11		0.000	899155.000	
5		0.000	899155.000	
0	100	29.955	1398074.200	
0	100	38.675	1978070.200	1948
3	97	40.082	1978070.200	
8	92	40.082	1978070.200	
9	91	40.082	1978070.200	
21	79	40.082	1978070.200	
27	73	40.082	1398074.200	
35		0.000	899155.000	
51		0.000	899155.000	
31		0.000	899155.000	
24		0.000	899155.000	
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14		0.000	899155.000	
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5		0.000	899155.000	
2	98	35.914	1398074.200	
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1	99	39.377	1940812.800	
11	89	40.082	1940812.800	
12	88	40.082	1940812.800	
10	90	40.082	1940812.800	
16	84	40.082	1940812.800	
14	86	40.082	1940812.800	
8	92	40.082	1940812.800	
5	95	40.082	1940812.800	
1	99	40.082	1940812.800	
7	93	40.082	1940812.800	

5	95	40.082	1940812.800	
9	91	40.082	1940812.800	
5	95	40.082	1940812.800	
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14	86	40.082	1940812.800	
13	87	40.082	1940812.800	
8	92	40.082	1940812.800	
6	94	40.082	1940812.800	
4	96	40.082	1940812.800	
4	96	40.082	1940812.800	
1	99	38.675	1940812.800	
0	100	37.286	1940812.800	
0	100	36.598	1940812.800	
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15	85	40.082	1940812.800	
15	85	40.082	1940812.800	
19	81	40.082	1940812.800	
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14	86	40.082	1940812.800	
8	92	40.082	1940812.800	
4	96	40.082	1940812.800	
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19	81	40.082	1940812.800	
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17	83	40.082	1940812.800	
17	83	40.082	1940812.800	
11	89	40.082	1940812.800	
5	95	40.082	1940812.800	
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15	85	40.082	1940812.800	
18	82	40.082	1940812.800	
15	85	40.082	1940812.800	

34	66	40.082	1398074.200	
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11		0.000	899155.000	
7		0.000	899155.000	
6		0.000	899155.000	
8	92	40.082	1398074.200	
14	86	40.082	1978070.200	
18	82	40.082	1940812.800	
12	88	40.082	1940812.800	
43	57	40.082	1398074.200	
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66		0.000	899155.000	
66		0.000	899155.000	

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12		0.000	899155.000	
8		0.000	899155.000	
5		0.000	899155.000	
5	95	40.082	1398074.200	
8	92	40.082	1940812.800	
9	91	40.082	1940812.800	
17	83	40.082	1940812.800	
15	85	40.082	1940812.800	
27	73	40.082	1398074.200	
35		0.000	899155.000	
37		0.000	899155.000	
26		0.000	899155.000	
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18		0.000	899155.000	
11		0.000	899155.000	
5		0.000	899155.000	
2	98	36.598	1398074.200	
0	100	38.675	1940812.800	
4	96	40.082	1978070.200	
12	88	40.082	1978070.200	
21	79	40.082	1940812.800	
29	71	40.082	1398074.200	
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12		0.000	899155.000	
9		0.000	899155.000	
5		0.000	899155.000	
2	98	35.914	1398074.200	
11	89	40.082	1940812.800	
12	88	40.082	1940812.800	
17	83	40.082	1940812.800	

14	86	40.082	1940812.800	
13	87	40.082	1940812.800	
9	91	40.082	1978070.200	
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3	97	40.082	1978070.200	
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11	89	40.082	1940812.800	
11	89	40.082	1940812.800	
27	73	40.082	1398074.200	
37		0.000	899155.000	
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22		0.000	899155.000	
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5		0.000	899155.000	
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9	91	40.082	1940812.800	
15	85	40.082	1940812.800	
29	71	40.082	1398074.200	
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29		0.000	899155.000	
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22		0.000	899155.000	

14		0.000	899155.000	
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5		0.000	899155.000	
4	96	40.082	1398074.200	
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3	97	40.082	1940812.800	
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14	86	40.082	1940812.800	
11	89	40.082	1940812.800	
8	92	40.082	1940812.800	
8	92	40.082	1940812.800	
4	96	40.082	1940812.800	
1	99	40.082	1940812.800	
0	100	35.914	1940812.800	
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6	94	40.082	1940812.800	
12	88	40.082	1940812.800	
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27	73	40.082	1398074.200	
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17	83	40.082	1940812.800	

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5	95	40.082	1978070.200	
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15	85	40.082	1978070.200	
17	83	40.082	1940812.800	
97	3	40.082	1398074.200	
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16	84	40.082	1940812.800	
27	73	40.082	1398074.200	
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34		0.000	899155.000	
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11		0.000	899155.000	
14		0.000	899155.000	
14		0.000	899155.000	
19		0.000	899155.000	
19		0.000	899155.000	
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6		0.000	899155.000	
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-1	100	34.558	1940812.800	
-2	100	31.901	1940812.800	
-1	100	35.234	1940812.800	
27	73	40.082	1398074.200	
34		0.000	899155.000	
53		0.000	899155.000	
50		0.000	899155.000	
34		0.000	899155.000	
38		0.000	899155.000	
26		0.000	899155.000	
16		0.000	899155.000	
11		0.000	899155.000	
8		0.000	899155.000	
5		0.000	899155.000	
2	98	35.234	1398074.200	
6	94	40.082	1940812.800	
8	92	40.082	1940812.800	
12	88	40.082	1940812.800	

9	91	40.082	1940812.800	
7	93	40.082	1940812.800	
14	86	40.082	1940812.800	
15	85	40.082	1940812.800	
12	88	40.082	1940812.800	
9	91	40.082	1940812.800	
5	95	40.082	1940812.800	
2	98	40.082	1940812.800	
0	100	38.675	1940812.800	
5	95	40.082	1940812.800	
15	85	40.082	1940812.800	
39	61	40.082	1398074.200	
69		0.000	899155.000	
108		0.000	899155.000	
108		0.000	899155.000	
71		0.000	899155.000	
51		0.000	899155.000	
28		0.000	899155.000	
28		0.000	899155.000	
20		0.000	899155.000	
11		0.000	899155.000	
20		0.000	899155.000	
18		0.000	899155.000	
24		0.000	899155.000	
34		0.000	899155.000	
34		0.000	899155.000	
38		0.000	899155.000	
37		0.000	899155.000	
31		0.000	899155.000	
31		0.000	899155.000	
22		0.000	899155.000	
18		0.000	899155.000	
18		0.000	899155.000	
24		0.000	899155.000	
51		0.000	899155.000	
43		0.000	899155.000	
37		0.000	899155.000	
50		0.000	899155.000	
38		0.000	899155.000	
31		0.000	899155.000	

22		0.000	899155.000	
12		0.000	899155.000	
9		0.000	899155.000	
5		0.000	899155.000	
2	98	35.914	1398074.200	1998
6	94	40.082	1940812.800	
11	89	40.082	1940812.800	
18	82	40.082	1940812.800	
29	71	40.082	1398074.200	
34		0.000	899155.000	
32		0.000	899155.000	
26		0.000	899155.000	
18		0.000	899155.000	
11		0.000	899155.000	
8		0.000	899155.000	
5		0.000	899155.000	
3	97	38.675	1398074.200	
4	96	40.082	1978070.200	
5	95	40.082	1978070.200	
21	79	40.082	1940812.800	
39	61	40.082	1398074.200	
54		0.000	899155.000	
69		0.000	899155.000	
53		0.000	899155.000	
51		0.000	899155.000	
31		0.000	899155.000	
20		0.000	899155.000	
12		0.000	899155.000	
9		0.000	899155.000	
14		0.000	899155.000	
49		0.000	899155.000	
66		0.000	899155.000	
54		0.000	899155.000	
50		0.000	899155.000	
38		0.000	899155.000	
31		0.000	899155.000	
22		0.000	899155.000	
12		0.000	899155.000	
9		0.000	899155.000	
3		0.000	899155.000	

7	93	40.082	1398074.200	
8	92	40.082	1978070.200	
15	85	40.082	1978070.200	
17	83	40.082	1940812.800	
19	81	40.082	1940812.800	
19	81	40.082	1940812.800	
14	86	40.082	1940812.800	
12	88	40.082	1940812.800	
5	95	40.082	1940812.800	
4	96	40.082	1940812.800	
11	89	40.082	1940812.800	
7	93	40.082	1940812.800	
7	93	40.082	1940812.800	
4	96	40.082	1978070.200	
6	94	40.082	1978070.200	
6	94	40.082	1940812.800	
6	94	40.082	1940812.800	
13	87	40.082	1940812.800	
9	91	40.082	1978070.200	
5	95	40.082	1978070.200	
3	97	40.082	1978070.200	
4	96	40.082	1978070.200	
1	99	40.082	1978070.200	
-1	100	35.234	1978070.200	
0	100	37.286	1978070.200	
-1	100	34.558	1978070.200	
2	98	40.082	1978070.200	
3	97	40.082	1978070.200	
15	85	40.082	1978070.200	
27	73	40.082	1398074.200	
35		0.000	899155.000	
26		0.000	899155.000	
16		0.000	899155.000	
9		0.000	899155.000	
11		0.000	899155.000	
5		0.000	899155.000	
5	95	40.082	1398074.200	
1	99	40.082	1940812.800	
6	94	40.082	1940812.800	
8	92	40.082	1940812.800	

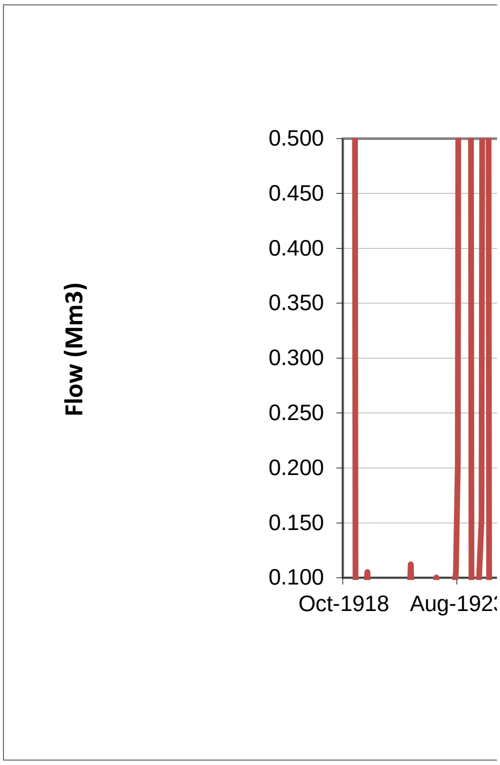
15	85	40.082	1940812.800	
21	79	40.082	1940812.800	
27	73	40.082	1398074.200	
22		0.000	899155.000	
14		0.000	899155.000	
12		0.000	899155.000	
8		0.000	899155.000	
5		0.000	899155.000	
2	98	35.234	1398074.200	
0	100	37.286	1940812.800	
5	95	40.082	1940812.800	
5	95	40.082	1940812.800	
12	88	40.082	1940812.800	
16	84	40.082	1940812.800	
16	84	40.082	1940812.800	
14	86	40.082	1940812.800	
9	91	40.082	1940812.800	
5	95	40.082	1940812.800	
1	99	40.082	1940812.800	
3	97	40.082	1940812.800	
3	97	40.082	1940812.800	
6	94	40.082	1940812.800	
11	89	40.082	1940812.800	
26	74	40.082	1398074.200	
29		0.000	899155.000	
23		0.000	899155.000	
15		0.000	899155.000	
15		0.000	899155.000	
8		0.000	899155.000	
11		0.000	899155.000	
5		0.000	899155.000	
0	100	29.955	1398074.200	
0	100	38.675	1978070.200	
5	95	40.082	1978070.200	
11	89	40.082	1978070.200	
8	92	40.082	1978070.200	
8	92	40.082	1978070.200	
8	92	40.082	1978070.200	
10	90	40.082	1978070.200	
14	86	40.082	1978070.200	

8	92	40.082	1978070.200	
5	95	40.082	1978070.200	
1	99	40.082	1978070.200	
-1	100	35.234	1978070.200	
0	100	37.286	1978070.200	2008
0	100	36.598	1978070.200	
0	100	36.598	1978070.200	
1	99	39.377	1978070.200	
8	92	40.082	1978070.200	
11	89	40.082	1978070.200	
10	90	40.082	1978070.200	
7	93	40.082	1978070.200	
5	95	40.082	1978070.200	
3	97	40.082	1978070.200	
0	100	37.286	1978070.200	
1	99	38.675	1978070.200	
1	99	40.082	1978070.200	
4	96	40.082	1978070.200	
8	92	40.082	1978070.200	
6	94	40.082	1978070.200	
3	97	40.082	1978070.200	
1	99	39.377	1978070.200	
0	100	36.598	1978070.200	
-2	100	33.221	1978070.200	
-2	100	25.576	1978070.200	
-3	100	19.179	1978070.200	
4	96	40.082	1978070.200	

AVERAGE EVAPORATION (mm)

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
140	155	175.00	175.00	145.00	150.00	105.00	85.00
90	120	150.00	180.00	195.00	180.00	150.00	120.00

WL vs. VOLUME RELATIONSHIP			
WL	Volume (m3)	Volume (Mm3)	Area(km2)
0	598000.000	0.598	0.982
0.01	593101.300	0.593	0.967
0.02	588545.200	0.589	0.953
0.03	584331.700	0.584	0.939
0.04	580460.800	0.580	0.926
0.05	576932.500	0.577	0.914
0.06	573746.800	0.574	0.902
0.07	570903.700	0.571	0.890
0.08	568403.200	0.568	0.880
0.09	566245.300	0.566	0.869
0.1	564430.000	0.564	0.860
0.11	562957.300	0.563	0.851
0.12	561827.200	0.562	0.843
0.13	561039.700	0.561	0.835
0.14	560594.800	0.561	0.828
0.15	560492.500	0.560	0.821
0.16	560732.800	0.561	0.815
0.17	561315.700	0.561	0.810
0.18	562241.200	0.562	0.805
0.19	563509.300	0.564	0.801
0.2	565120.000	0.565	0.797
0.21	567073.300	0.567	0.794
0.22	569369.200	0.569	0.792
0.23	572007.700	0.572	0.790
0.24	574988.800	0.575	0.789
0.25	578312.500	0.578	0.788
0.26	581978.800	0.582	0.788
0.27	585987.700	0.586	0.788
0.28	590339.200	0.590	0.789



0.29	595033.300	0.595	0.791
0.3	600070.000	0.600	0.793
0.31	605449.300	0.605	0.796
0.32	611171.200	0.611	0.800
0.33	617235.700	0.617	0.804
0.34	623642.800	0.624	0.809
0.35	630392.500	0.630	0.814
0.36	637484.800	0.637	0.820
0.37	644919.700	0.645	0.826
0.38	652697.200	0.653	0.833
0.39	660817.300	0.661	0.841
0.4	669280.000	0.669	0.849
0.41	678085.300	0.678	0.858
0.42	687233.200	0.687	0.867
0.43	696723.700	0.697	0.877
0.44	706556.800	0.707	0.888
0.45	716732.500	0.717	0.899
0.46	727250.800	0.727	0.911
0.47	738111.700	0.738	0.923
0.48	749315.200	0.749	0.936
0.49	760861.300	0.761	0.950
0.5	772750.000	0.773	0.964
0.51	784981.300	0.785	0.979
0.52	797555.200	0.798	0.994
0.53	810471.700	0.810	1.010
0.54	823730.800	0.824	1.027
0.55	837332.500	0.837	1.044
0.56	851276.800	0.851	1.061
0.57	865563.700	0.866	1.080
0.58	880193.200	0.880	1.099
0.59	895165.300	0.895	1.118
0.6	910480.000	0.910	1.138
0.61	926137.300	0.926	1.159
0.62	942137.200	0.942	1.180
0.63	958479.700	0.958	1.202
0.64	975164.800	0.975	1.224
0.65	992192.500	0.992	1.247
0.66	1009562.800	1.010	1.271
0.67	1027275.700	1.027	1.295
0.68	1045331.200	1.045	1.320

0.69	1063729.300	1.064	1.345
0.7	1082470.000	1.082	1.371
0.71	1101553.300	1.102	1.398
0.72	1120979.200	1.121	1.425
0.73	1140747.700	1.141	1.453
0.74	1160858.800	1.161	1.481
0.75	1181312.500	1.181	1.510
0.76	1202108.800	1.202	1.540
0.77	1223247.700	1.223	1.570
0.78	1244729.200	1.245	1.601
0.79	1266553.300	1.267	1.632
0.8	1288720.000	1.289	1.664
0.81	1311229.300	1.311	1.697
0.82	1334081.200	1.334	1.730
0.83	1357275.700	1.357	1.763
0.84	1380812.800	1.381	1.798
0.85	1404692.500	1.405	1.833
0.86	1428914.800	1.429	1.868
0.87	1453479.700	1.453	1.904
0.88	1478387.200	1.478	1.941
0.89	1503637.300	1.504	1.978
0.9	1529230.000	1.529	2.016
0.91	1555165.300	1.555	2.054
0.92	1581443.200	1.581	2.093
0.93	1608063.700	1.608	2.133
0.94	1635026.800	1.635	2.173
0.95	1662332.500	1.662	2.214
0.96	1689980.800	1.690	2.255
0.97	1717971.700	1.718	2.297
0.98	1746305.200	1.746	2.340
0.99	1774981.300	1.775	2.383
1	1804000.000	1.804	2.427
1.01	1833361.300	1.833	2.471
1.02	1863065.200	1.863	2.516
1.03	1893111.700	1.893	2.562
1.04	1923500.800	1.924	2.608
1.05	1954232.500	1.954	2.655
1.06	1985306.800	1.985	2.702
1.07	2016723.700	2.017	2.750
1.08	2048483.200	2.048	2.799

1.09	2080585.300	2.081	2.848
1.1	2113030.000	2.113	2.897
1.11	2145817.300	2.146	2.948
1.12	2178947.200	2.179	2.998
1.13	2212419.700	2.212	3.050
1.14	2246234.800	2.246	3.102
1.15	2280392.500	2.280	3.155
1.16	2314892.800	2.315	3.208
1.17	2349735.700	2.350	3.262
1.18	2384921.200	2.385	3.316
1.19	2420449.300	2.420	3.371
1.2	2456320.000	2.456	3.427
1.21	2492533.300	2.493	3.483
1.22	2529089.200	2.529	3.540
1.23	2565987.700	2.566	3.597
1.24	2603228.800	2.603	3.655
1.25	2640812.500	2.641	3.714
1.26	2678738.800	2.679	3.773
1.27	2717007.700	2.717	3.833
1.28	2755619.200	2.756	3.893
1.29	2794573.300	2.795	3.954
1.3	2833870.000	2.834	4.016
1.31	2873509.300	2.874	4.078
1.32	2913491.200	2.913	4.141
1.33	2953815.700	2.954	4.204
1.34	2994482.800	2.994	4.268
1.35	3035492.500	3.035	4.332
1.36	3076844.800	3.077	4.397
1.37	3118539.700	3.119	4.463
1.38	3160577.200	3.161	4.529
1.39	3202957.300	3.203	4.596
1.4	3245680.000	3.246	6.087
1.41	3288745.300	3.289	6.431
1.42	3332153.200	3.332	6.774
1.43	3375903.700	3.376	7.116
1.44	3419996.800	3.420	7.457
1.45	3464432.500	3.464	7.796
1.46	3509210.800	3.509	8.135
1.47	3554331.700	3.554	8.472
1.48	3599795.200	3.600	8.808

1.49	3645601.300	3.646	9.142
1.5	3691750.000	3.692	9.476
1.51	3738241.300	3.738	9.808
1.52	3785075.200	3.785	10.139
1.53	3832251.700	3.832	10.468
1.54	3879770.800	3.880	10.797
1.55	3927632.500	3.928	11.124
1.56	3975836.800	3.976	11.450
1.57	4024383.700	4.024	11.775
1.58	4073273.200	4.073	12.098
1.59	4122505.300	4.123	12.420
1.6	4172080.000	4.172	12.741
1.61	4221997.300	4.222	13.061
1.62	4272257.200	4.272	13.380
1.63	4322859.700	4.323	13.697
1.64	4373804.800	4.374	14.013
1.65	4425092.500	4.425	14.328
1.66	4447213.200	4.447	14.642
1.67	4670323.300	4.670	14.954
1.68	4895012.800	4.895	15.266
1.69	5121281.700	5.121	15.576
1.7	5349130.000	5.349	15.884
1.71	5578557.700	5.579	16.192
1.72	5809564.800	5.810	16.498
1.73	6042151.300	6.042	16.803
1.74	6276317.200	6.276	17.107
1.75	6512062.500	6.512	17.410
1.76	6749387.200	6.749	17.711
1.77	6988291.300	6.988	18.011
1.78	7228774.800	7.229	18.310
1.79	7470837.700	7.471	18.608
1.8	7714480.000	7.714	18.904
1.81	7959701.700	7.960	19.199
1.82	8206502.800	8.207	19.493
1.83	8454883.300	8.455	19.786
1.84	8704843.200	8.705	20.078
1.85	8956382.500	8.956	20.368
1.86	9209501.200	9.210	20.657
1.87	9464199.300	9.464	20.945
1.88	9720476.800	9.720	21.232

1.89	9978333.700	9.978	21.517
1.9	10237770.000	10.238	21.801
1.91	10498785.700	10.499	22.084
1.92	10761380.800	10.761	22.366
1.93	11025555.300	11.026	22.646
1.94	11291309.200	11.291	22.925
1.95	11558642.500	11.559	23.203
1.96	11827555.200	11.828	23.480
1.97	12098047.300	12.098	23.756
1.98	12370118.800	12.370	24.030
1.99	12643769.700	12.644	24.303
2	12919000.000	12.919	24.575
2.01	13195809.700	13.196	24.846
2.02	13474198.800	13.474	25.115
2.03	13754167.300	13.754	25.383
2.04	14035715.200	14.036	25.650
2.05	14318842.500	14.319	25.916
2.06	14603549.200	14.604	26.180
2.07	14889835.300	14.890	26.444
2.08	15177700.800	15.178	26.706
2.09	15467145.700	15.467	26.966
2.1	15758170.000	15.758	27.226
2.11	16050773.700	16.051	27.484
2.12	16344956.800	16.345	27.741
2.13	16640719.300	16.641	27.997
2.14	16938061.200	16.938	28.252
2.15	17236982.500	17.237	28.505
2.16	17537483.200	17.537	28.757
2.17	17839563.300	17.840	29.008
2.18	18143222.800	18.143	29.258
2.19	18448461.700	18.448	29.507
2.2	18755280.000	18.755	29.754
2.21	19063677.700	19.064	30.000
2.22	19373654.800	19.374	30.245
2.23	19685211.300	19.685	30.488
2.24	19998347.200	19.998	30.731
2.25	20313062.500	20.313	30.972
2.26	20629357.200	20.629	31.211
2.27	20947231.300	20.947	31.450
2.28	21266684.800	21.267	31.688

2.29	21587717.700	21.588	31.924
2.3	21910330.000	21.910	32.159
2.31	22234521.700	22.235	32.392
2.32	22560292.800	22.560	32.625
2.33	22887643.300	22.888	32.856
2.34	23216573.200	23.217	33.086
2.35	23547082.500	23.547	33.315
2.36	23879171.200	23.879	33.543
2.37	24212839.300	24.213	33.769
2.38	24548086.800	24.548	33.994
2.39	24884913.700	24.885	34.218
2.4	25223320.000	25.223	34.441
2.41	25563305.700	25.563	34.662
2.42	25904870.800	25.905	34.882
2.43	26248015.300	26.248	35.101
2.44	26592739.200	26.593	35.319
2.45	26939042.500	26.939	35.535
2.46	27286925.200	27.287	35.751
2.47	27636387.300	27.636	35.965
2.48	27987428.800	27.987	36.178
2.49	28340049.700	28.340	36.389
2.5	28694250.000	28.694	36.599
2.51	29050029.700	29.050	36.809
2.52	29407388.800	29.407	37.017
2.53	29766327.300	29.766	37.223
2.54	30126845.200	30.127	37.429
2.55	30488942.500	30.489	37.633
2.56	30852619.200	30.853	37.836
2.57	31217875.300	31.218	38.038
2.58	31584710.800	31.585	38.238
2.59	31953125.700	31.953	38.437
2.6	32323120.000	32.323	38.635
2.61	32694693.700	32.695	38.832
2.62	33067846.800	33.068	39.028
2.63	33442579.300	33.443	39.222
2.64	33818891.200	33.819	39.415
2.65	34196782.500	34.197	39.607
2.66	34576253.200	34.576	39.798
2.67	34957303.300	34.957	39.987
2.68	35339932.800	35.340	40.176

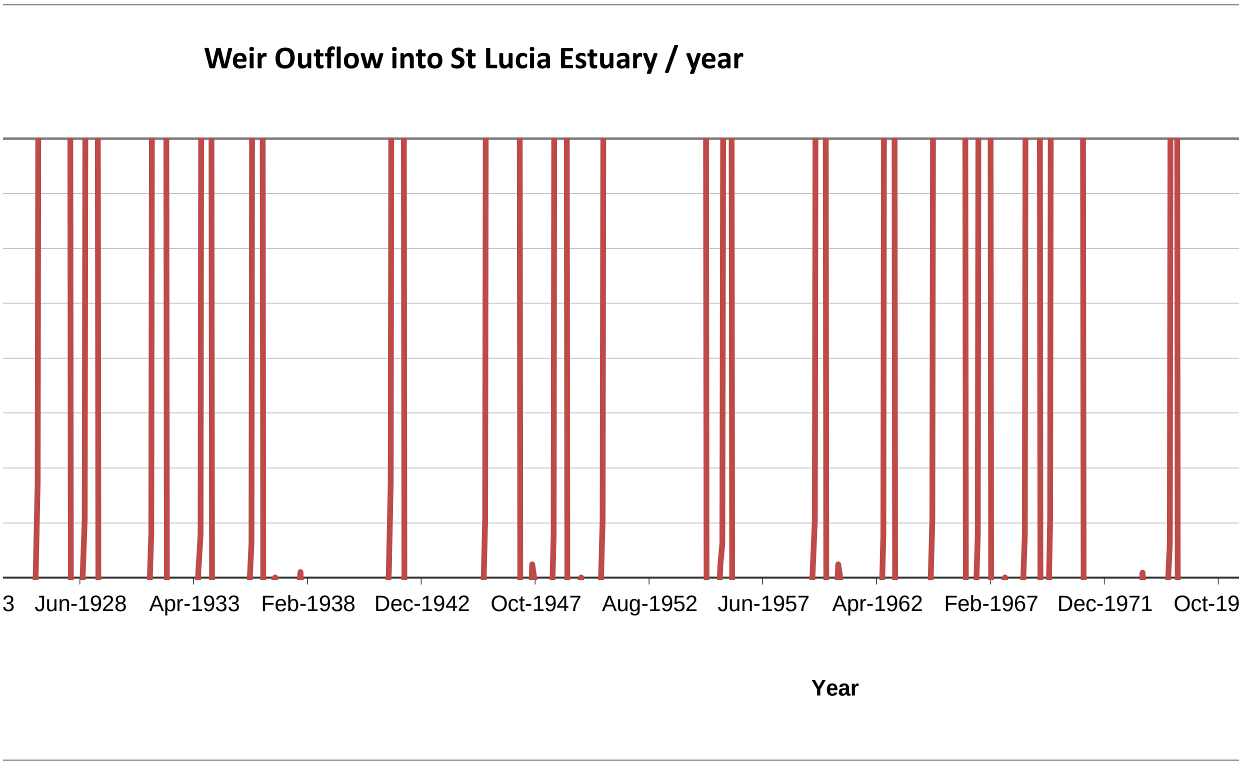
2.69	35724141.700	35.724	40.363
2.7	36109930.000	36.110	40.548
2.71	36497297.700	36.497	40.733
2.72	36886244.800	36.886	40.916
2.73	37276771.300	37.277	41.098
2.74	37668877.200	37.669	41.279
2.75	38062562.500	38.063	41.459
2.76	38457827.200	38.458	41.637
2.77	38854671.300	38.855	41.814
2.78	39253094.800	39.253	41.990
2.79	39653097.700	39.653	42.165
2.8	40054680.000	40.055	42.338
2.81	40457841.700	40.458	42.510
2.82	40862582.800	40.863	42.681
2.83	41268903.300	41.269	42.851
2.84	41676803.200	41.677	43.020
2.85	42086282.500	42.086	43.187
2.86	42497341.200	42.497	43.353
2.87	42909979.300	42.910	43.518
2.88	43324196.800	43.324	43.682
2.89	43739993.700	43.740	43.844
2.9	44157370.000	44.157	44.005
2.91	44576325.700	44.576	44.165
2.92	44996860.800	44.997	44.324
2.93	45418975.300	45.419	44.481
2.94	45842669.200	45.843	44.637
2.95	46267942.500	46.268	44.792
2.96	46694795.200	46.695	44.946
2.97	47123227.300	47.123	45.099
2.98	47553238.800	47.553	45.250
2.99	47984829.700	47.985	45.400
3	48418000.000	48.418	45.549
3.01	48852749.700	48.853	45.697
3.02	49289078.800	49.289	45.843
3.03	49726987.300	49.727	45.988
3.04	50166475.200	50.166	46.132
3.05	50607542.500	50.608	46.275
3.06	51050189.200	51.050	46.416
3.07	51494415.300	51.494	46.557
3.08	51940220.800	51.940	46.696

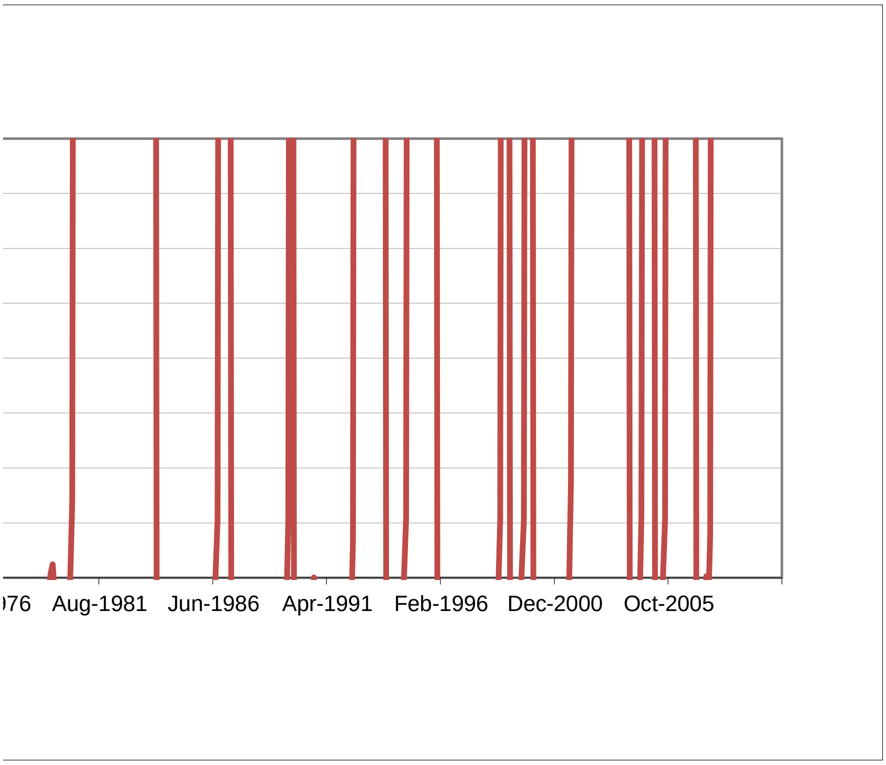
3.09	52387605.700	52.388	46.833
3.1	52836570.000	52.837	46.970
3.11	53287113.700	53.287	47.105
3.12	53739236.800	53.739	47.239
3.13	54192939.300	54.193	47.372
3.14	54648221.200	54.648	47.504
3.15	55105082.500	55.105	47.634
3.16	55563523.200	55.564	47.763
3.17	56023543.300	56.024	47.891
3.18	56485142.800	56.485	48.018
3.19	56948321.700	56.948	48.144
3.2	57413080.000	57.413	48.268
3.21	57879417.700	57.879	48.391
3.22	58347334.800	58.347	48.513
3.23	58816831.300	58.817	48.633
3.24	59287907.200	59.288	48.753
3.25	59760562.500	59.761	48.871
3.26	60234797.200	60.235	48.987
3.27	60710611.300	60.711	49.103
3.28	61188004.800	61.188	49.218
3.29	61666977.700	61.667	49.331
3.3	62147530.000	62.148	49.443
3.31	62629661.700	62.630	49.553
3.32	63113372.800	63.113	49.663
3.33	63598663.300	63.599	49.771
3.34	64085533.200	64.086	49.878
3.35	64573982.500	64.574	49.984
3.36	65064011.200	65.064	50.089
3.37	65555619.300	65.556	50.192
3.38	66048806.800	66.049	50.294
3.39	66543573.700	66.544	50.395
3.4	67039920.000	67.040	50.495
3.41	67537845.700	67.538	50.593
3.42	68037350.800	68.037	50.690
3.43	68538435.300	68.538	50.786
3.44	69041099.200	69.041	50.881
3.45	69545342.500	69.545	50.974
3.46	70051165.200	70.051	51.067
3.47	70558567.300	70.559	51.158
3.48	71067548.800	71.068	51.248

3.49	71578109.700	71.578	51.336
3.5	72090250.000	72.090	51.423
3.51	72603969.700	72.604	51.510
3.52	73119268.800	73.119	51.595
3.53	73636147.300	73.636	51.678
3.54	74154605.200	74.155	51.761
3.55	74674642.500	74.675	51.842
3.56	75196259.200	75.196	51.922
3.57	75719455.300	75.719	52.001
3.58	76244230.800	76.244	52.078
3.59	76770585.700	76.771	52.154
3.6	77298520.000	77.299	52.229
3.61	77828033.700	77.828	52.303
3.62	78359126.800	78.359	52.376
3.63	78891799.300	78.892	52.447
3.64	79426051.200	79.426	52.517
3.65	79961882.500	79.962	52.586
3.66	80499293.200	80.499	52.654
3.67	81038283.300	81.038	52.720
3.68	81578852.800	81.579	52.786
3.69	82121001.700	82.121	52.850
3.7	82664730.000	82.665	52.912
3.71	83210037.700	83.210	52.974
3.72	83756924.800	83.757	53.034
3.73	84305391.300	84.305	53.093
3.74	84855437.200	84.855	53.151
3.75	85407062.500	85.407	53.208
3.76	85960267.200	85.960	53.263
3.77	86515051.300	86.515	53.317
3.78	87071414.800	87.071	53.370
3.79	87629357.700	87.629	53.422
3.8	88188880.000	88.189	53.472
3.81	88749981.700	88.750	53.521
3.82	89312662.800	89.313	53.569
3.83	89876923.300	89.877	53.616
3.84	90442763.200	90.443	53.662
3.85	91010182.500	91.010	53.706
3.86	91579181.200	91.579	53.749
3.87	92149759.300	92.150	53.791
3.88	92721916.800	92.722	53.832

3.89	93295653.700	93.296	53.871
3.9	93870970.000	93.871	53.909
3.91	94447865.700	94.448	53.946
3.92	95026340.800	95.026	53.982
3.93	95606395.300	95.606	54.016
3.94	96188029.200	96.188	54.049
3.95	96771242.500	96.771	54.081
3.96	97356035.200	97.356	54.112
3.97	97942407.300	97.942	54.142
3.98	98530358.800	98.530	54.170
3.99	99119889.700	99.120	54.197
4	99711000.000	99.711	54.223

Jun	Jul	Aug	Sep	Total	References
65.00	70.00	90.00	115.00	1470.00	Hutchison (1974)
90.00	75.00	60.00	75.00	1485.00	Kelbe & Rawlins (1989)





Please No
row of

	OCT
1918	0.880
1919	0.450
1920	0.450
1921	0.450
1922	0.450
1923	0.890
1924	0.890
1925	0.450
1926	0.890
1927	0.880
1928	0.880
1929	0.450
1930	0.450
1931	0.880
1932	0.450
1933	0.890
1934	0.450
1935	0.890
1936	0.450
1937	0.450
1938	0.450
1939	0.450
1940	0.450
1941	0.880
1942	0.450
1943	0.450
1944	0.450
1945	0.880
1946	0.880

1947	0.450
1948	0.890
1949	0.450
1950	0.880
1951	0.880
1952	0.890
1953	0.880
1954	0.880
1955	0.890
1956	0.450
1957	0.450
1958	0.450
1959	0.880
1960	0.450
1961	0.450
1962	0.890
1963	0.450
1964	0.880
1965	0.880
1966	0.880
1967	0.450
1968	0.880
1969	0.880
1970	0.880
1971	0.450
1972	0.450
1973	0.450
1974	0.880
1975	0.450
1976	0.450
1977	0.450
1978	0.450
1979	0.450
1980	0.880
1981	0.880
1982	0.890
1983	0.890
1984	0.450
1985	0.450
1986	0.880

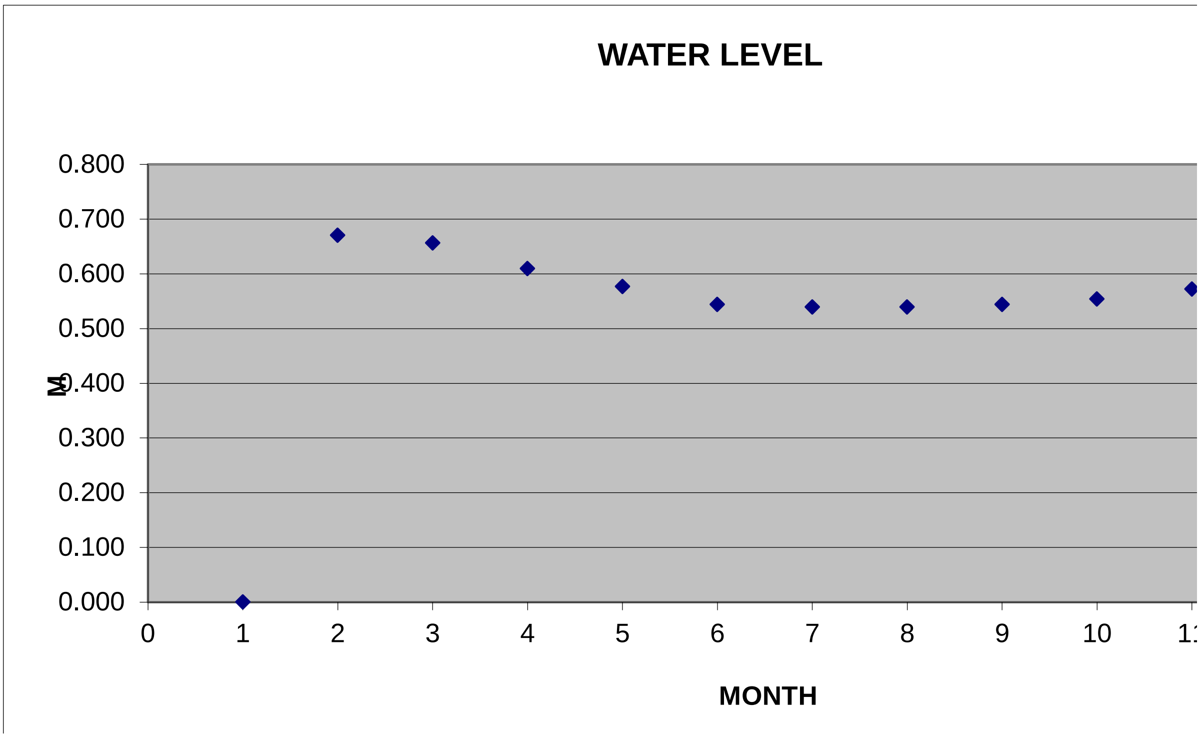
1987	0.450
1988	0.450
1989	0.890
1990	0.450
1991	0.450
1992	0.880
1993	0.450
1994	0.880
1995	0.880
1996	0.450
1997	0.450
1998	0.880
1999	0.890
2000	0.450
2001	0.890
2002	0.890
2003	0.890
2004	0.880
2005	0.880
2006	0.880
2007	0.890
2008	0.890
2009	0.890
AVERAGE	0.000

ote: Year Column indicates the year for the month October, e.g. the
f 1931 will commence with Oct 1931 but will end with Sep 1932.

WATER LEVEL								
NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
0.880	0.880	0.880	0.880	0.880	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.890	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450
0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.880
0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450

0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.890	0.890	0.880	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.890	0.890	0.890	0.890	0.890
0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.890
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890
0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450

0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.890	0.890
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.890
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.880	0.880	0.880	0.880	0.890	0.890	0.890	0.890	0.890
0.890	0.890	0.890	0.450	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.450	0.450	0.450	0.450	0.450
0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
0.880	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890
0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890
0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890
0.670	0.656	0.609	0.577	0.544	0.539	0.539	0.544	0.554



Please Note: Year Column indicates the ye
row of 1931 will commence with Oct 19

AUG	SEP
0.450	0.450
0.450	0.450
0.450	0.450
0.450	0.450
0.450	0.880
0.450	0.890
0.450	0.450
0.450	0.880
0.880	0.880
0.450	0.880
0.450	0.450
0.450	0.450
0.880	0.880
0.450	0.450
0.890	0.880
0.450	0.450
0.450	0.450
0.450	0.450
0.450	0.450
0.450	0.450
0.450	0.450
0.450	0.450
0.450	0.880
0.450	0.450
0.450	0.450
0.450	0.450
0.450	0.880
0.880	0.880
0.450	0.450

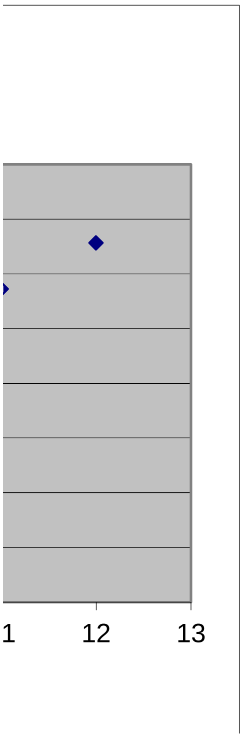
	OCT	NOV	DEC	JAN
1918	1.41	2.12	20.20	31.74
1919	0.00	0.00	0.00	0.00
1920	0.00	0.00	0.00	0.00
1921	0.00	0.00	0.00	0.00
1922	0.00	0.00	0.00	0.00
1923	3.89	4.81	16.96	17.19
1924	11.81	31.37	7.24	0.00
1925	0.00	0.00	0.00	0.00
1926	7.98	11.56	16.96	20.42
1927	14.21	16.82	36.28	16.36
1928	6.76	7.72	11.71	23.81
1929	0.00	0.00	0.00	0.00
1930	0.00	0.00	0.00	0.00
1931	3.28	6.51	9.93	11.93
1932	0.00	0.00	0.00	0.00
1933	3.89	13.96	36.28	7.20
1934	0.00	0.00	0.00	0.00
1935	3.48	3.97	6.65	20.42
1936	0.00	0.00	0.00	0.00
1937	0.00	0.00	0.00	0.00
1938	0.00	0.00	0.00	0.00
1939	0.00	0.00	0.00	0.00
1940	0.00	0.00	0.00	0.00
1941	4.22	9.79	9.93	31.74
1942	0.00	0.00	0.00	0.00
1943	0.00	0.00	0.00	0.00
1944	0.00	0.00	0.00	0.00
1945	4.22	3.63	6.65	36.50
1946	6.76	9.79	20.20	27.84

0.890	0.890	1947	0.00	0.00	0.00	0.00
0.450	0.450	1948	6.76	13.96	16.96	50.12
0.450	0.880	1949	0.00	0.00	0.00	0.00
0.880	0.880	1950	5.07	4.81	20.20	23.81
0.880	0.880	1951	17.07	9.79	27.62	27.84
0.880	0.880	1952	3.89	11.56	31.52	31.74
0.880	0.880	1953	5.07	13.96	16.96	20.42
0.450	0.450	1954	31.63	42.10	31.52	7.20
0.450	0.450	1955	11.07	27.47	42.25	23.81
0.450	0.450	1956	0.00	0.00	0.00	0.00
0.450	0.450	1957	0.00	0.00	0.00	0.00
0.450	0.880	1958	0.00	0.00	0.00	0.00
0.450	0.450	1959	14.21	16.82	36.28	31.74
0.450	0.450	1960	0.00	0.00	0.00	0.00
0.880	0.880	1961	0.00	0.00	0.00	0.00
0.450	0.450	1962	7.98	23.44	49.90	16.36
0.450	0.880	1963	0.00	0.00	0.00	0.00
0.890	0.880	1964	20.30	23.44	36.28	27.84
0.880	0.880	1965	14.21	20.05	20.20	45.40
0.450	0.450	1966	5.07	7.72	16.96	31.74
0.880	0.880	1967	0.00	0.00	0.00	0.00
0.450	0.880	1968	6.76	9.79	23.58	20.42
0.880	0.880	1969	20.30	20.05	23.58	23.81
0.450	0.450	1970	11.81	23.44	23.58	45.40
0.450	0.450	1971	0.00	0.00	0.00	0.00
0.450	0.450	1972	0.00	0.00	0.00	0.00
0.450	0.450	1973	0.00	0.00	0.00	0.00
0.450	0.450	1974	4.32	16.82	36.28	3.89
0.450	0.450	1975	0.00	0.00	0.00	0.00
0.450	0.450	1976	0.00	0.00	0.00	0.00
0.450	0.450	1977	0.00	0.00	0.00	0.00
0.450	0.450	1978	0.00	0.00	0.00	0.00
0.890	0.880	1979	0.00	0.00	0.00	0.00
0.880	0.880	1980	4.22	11.56	14.10	31.74
0.880	0.880	1981	20.30	27.47	20.20	27.84
0.890	0.890	1982	7.98	7.72	7.87	10.16
0.450	0.450	1983	5.06	31.37	36.28	0.36
0.450	0.450	1984	0.00	0.00	0.00	0.00
0.450	0.880	1985	0.00	0.00	0.00	0.00
0.450	0.450	1986	5.07	6.51	20.20	42.47

0.450	0.450
0.450	0.880
0.450	0.450
0.450	0.450
0.890	0.890
0.880	0.880
0.450	0.880
0.880	0.880
0.450	0.450
0.450	0.450
0.450	0.880
0.450	0.880
0.450	0.450
0.450	0.890
0.880	0.880
0.890	0.890
0.450	0.880
0.450	0.880
0.880	0.880
0.890	0.890
0.890	0.890
0.890	0.890
0.000	0.000
0.572	0.656

1987	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00
1989	7.98	3.91	0.00	0.00
1990	0.00	0.00	0.00	0.00
1991	0.00	0.00	0.00	0.00
1992	3.28	6.51	9.93	11.93
1993	46.31	0.00	0.00	0.00
1994	11.81	13.96	23.58	17.19
1995	10.04	31.37	3.90	0.00
1996	0.00	0.00	0.00	0.00
1997	0.00	0.00	0.00	0.00
1998	11.81	20.05	42.25	16.36
1999	7.98	9.79	49.90	3.89
2000	0.00	0.00	0.00	0.00
2001	14.21	31.37	36.28	42.47
2002	7.98	11.56	11.71	11.93
2003	3.28	6.51	6.65	31.74
2004	5.07	11.56	14.10	31.74
2005	4.22	9.79	9.93	23.81
2006	11.81	20.05	47.21	0.00
2007	10.04	20.05	14.10	14.32
2008	3.88	3.97	4.96	14.32
2009	7.97	13.96	11.70	6.88
AVERAGE	5.08	7.68	11.28	11.04
MEDIAN				

% EXCEEDED				
2	22.34	31.37	47.70	45.40
5	18.53	29.23	38.96	39.19
10	13.97	23.10	36.28	31.74
25	7.98	12.16	20.20	21.27
50	3.28	3.77	4.43	0.00
75	0.00	0.00	0.00	0.00
90	0.00	0.00	0.00	0.00



ar for the month October, e.g. the
31 but will end with Sep 1932.

RESULTANT WEIR OUTFLOW INTO ST LUCIA (Mm3)

FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	sum
51.09	51.63	15.92	0.00	0.00	0.00	0.00	0.00	174.10
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.96	1.96
32.71	36.06	0.00	0.00	0.00	0.00	0.00	9.63	121.25
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.43
0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.35	6.35
32.71	51.63	28.29	17.35	10.03	10.08	6.32	5.39	218.72
0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.35	90.02
21.38	3.06	0.00	0.00	0.00	0.00	0.00	0.00	74.44
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	3.51	2.83	2.70	9.04
3.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.18
0.00	0.00	0.00	0.00	0.00	0.00	2.72	3.60	6.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51.09	14.97	0.00	0.00	0.00	0.00	0.00	0.00	100.57
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81	3.81
43.44	6.92	0.00	0.00	0.00	0.00	0.00	0.00	106.04
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81	3.81
32.71	51.63	32.19	14.48	7.96	5.11	3.44	4.21	202.75
15.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.03

0.00	0.00	0.00	0.00	0.00	0.00	2.72	4.54	7.26
38.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	126.75
0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81	3.81
18.15	33.25	28.29	14.48	10.03	5.11	13.77	10.37	187.33
28.81	25.32	14.78	12.09	7.96	8.02	4.62	4.21	188.12
43.44	38.01	28.29	14.48	7.96	5.11	3.78	4.55	224.32
43.44	38.01	36.95	36.66	20.29	10.08	6.32	10.37	258.53
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	112.45
2.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	107.44
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.35	6.35
38.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	138.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	3.90	4.55	8.44
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	97.68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81	3.81
24.77	15.83	12.38	8.25	7.96	5.10	7.53	8.30	197.99
0.00	0.00	0.00	0.00	0.00	0.00	3.90	5.39	109.14
15.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.93
0.00	0.00	0.00	0.00	0.00	0.00	5.60	5.39	10.99
18.15	6.92	0.00	0.00	0.00	0.00	0.00	6.35	91.98
28.81	21.93	14.78	14.48	7.96	5.11	3.78	5.39	189.98
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	104.23
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.31
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	2.57	1.92	5.39	9.88
37.47	25.32	14.78	28.00	27.71	14.25	11.37	20.63	241.15
28.81	51.63	36.95	20.58	10.03	6.80	3.44	4.21	258.27
9.06	9.60	7.33	4.49	3.87	4.26	4.62	4.21	81.16
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.08
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81	3.81
32.71	36.06	0.00	0.00	0.00	0.00	0.00	0.00	143.01

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.66	4.66
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.89
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	3.11	2.41	1.92	2.69	10.14
18.15	18.70	14.78	7.04	4.21	3.32	2.83	3.60	104.27
0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.48	49.78
12.89	29.35	32.19	23.96	17.06	10.08	6.32	4.55	202.95
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81	3.81
0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.66	95.13
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.56
0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.63	9.63
43.44	29.35	24.26	10.32	7.96	20.34	13.77	12.14	285.91
24.77	15.83	10.61	7.03	7.96	5.10	3.44	4.21	122.14
38.94	0.00	0.00	0.00	0.00	0.00	0.00	6.35	93.48
51.09	36.06	0.00	0.00	0.00	0.00	0.00	3.48	153.10
32.71	33.25	28.29	17.35	10.03	5.11	7.53	7.09	189.10
0.00	0.00	0.00	0.00	0.00	0.00	2.72	4.54	86.34
15.29	18.70	28.29	14.48	10.03	5.10	3.44	4.21	158.06
21.38	18.70	12.38	10.31	6.75	4.26	4.62	5.39	110.92
4.97	3.99	2.93	2.36	1.86	8.01	0.00	0.00	64.64
10.41	7.84	4.62	3.02	2.07	1.62	1.51	2.76	68.94
								47.55
							std dev	78.51
							min	0.00
51.09	51.63	33.05	24.69	17.64	10.83	11.80	10.69	258.32
43.44	38.01	28.29	17.35	10.03	8.95	6.87	9.63	221.24
38.80	33.25	23.42	14.48	7.96	5.11	4.62	6.35	189.89
18.96	7.59	0.00	0.00	0.00	0.00	2.72	4.55	109.59
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.55
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Please Note: Year Column indicates the year for the month Octob
row of 1931 will commence with Oct 1931 but will end with Se

		MOUTH					
Av/month		OCT	NOV	DEC	JAN	FEB	MAR
29.02	1918	1	1	1	1	1	1
	1919	0	0	0	0	0	0
	1920	0	0	0	0	0	0
	1921	0	0	0	0	0	0
0.98	1922	0	0	0	0	0	0
17.32	1923	1	1	1	1	1	0
25.22	1924	1	1	0	0	0	0
3.18	1925	0	0	0	0	0	0
18.23	1926	1	1	1	1	1	1
18.00	1927	1	1	1	0	0	0
14.89	1928	1	1	1	1	1	0
	1929	0	0	0	0	0	0
2.26	1930	0	0	0	0	0	0
8.80	1931	1	1	1	1	0	0
2.11	1932	0	0	0	0	0	0
20.44	1933	1	1	1	0	0	0
0.00	1934	0	0	0	0	0	0
20.11	1935	1	1	1	1	1	0
	1936	0	0	0	0	0	0
	1937	0	0	0	0	0	0
	1938	0	0	0	0	0	0
	1939	0	0	0	0	0	0
1.90	1940	0	0	0	0	0	0
21.21	1941	1	1	1	1	1	0
	1942	0	0	0	0	0	0
	1943	0	0	0	0	0	0
1.90	1944	0	0	0	0	0	0
16.90	1945	1	1	1	1	1	1
20.01	1946	1	1	1	1	0	0

2.42	1947	0	0	0	0	0	0
31.69	1948	1	1	1	1	0	0
1.90	1949	0	0	0	0	0	0
15.61	1950	1	1	1	1	1	1
15.68	1951	1	1	1	1	1	1
18.69	1952	1	1	1	1	1	1
21.54	1953	1	1	1	1	1	1
28.11	1954	1	1	1	0	0	0
26.86	1955	1	1	1	1	0	0
	1956	0	0	0	0	0	0
	1957	0	0	0	0	0	0
3.18	1958	0	0	0	0	0	0
34.50	1959	1	1	1	1	0	0
	1960	0	0	0	0	0	0
2.81	1961	0	0	0	0	0	0
32.56	1962	1	1	1	0	0	0
1.90	1963	0	0	0	0	0	0
16.50	1964	1	1	1	1	1	1
18.19	1965	1	1	1	0	0	0
19.23	1966	1	1	1	1	0	0
3.66	1967	0	0	0	0	0	0
13.14	1968	1	1	1	1	1	0
15.83	1969	1	1	1	1	1	1
34.74	1970	1	1	1	0	0	0
	1971	0	0	0	0	0	0
	1972	0	0	0	0	0	0
0.00	1973	0	0	0	0	0	0
20.44	1974	1	1	1	0	0	0
	1975	0	0	0	0	0	0
	1976	0	0	0	0	0	0
	1977	0	0	0	0	0	0
	1978	0	0	0	0	0	0
2.47	1979	0	0	0	0	0	0
20.10	1980	1	1	1	1	1	1
21.52	1981	1	1	1	1	1	1
6.76	1982	1	1	1	1	1	1
24.36	1983	1	1	1	0	0	0
	1984	0	0	0	0	0	0
1.90	1985	0	0	0	0	0	0
28.60	1986	1	1	1	1	1	0

	1987	0	0	0	0	0	0
2.33	1988	0	0	0	0	0	0
11.89	1989	1	0	0	0	0	0
	1990	0	0	0	0	0	0
2.03	1991	0	0	0	0	0	0
8.69	1992	1	1	1	1	1	1
24.89	1993	0	0	0	0	0	0
16.91	1994	1	1	1	1	1	1
22.66	1995	1	1	0	0	0	0
	1996	0	0	0	0	0	0
1.90	1997	0	0	0	0	0	0
19.03	1998	1	1	1	0	0	0
23.85	1999	1	1	1	0	0	0
4.82	2000	0	0	0	0	0	0
23.83	2001	1	1	1	1	1	1
10.18	2002	1	1	1	1	1	1
15.58	2003	1	1	1	1	0	0
21.87	2004	1	1	1	1	1	0
15.76	2005	1	1	1	1	1	1
17.27	2006	1	1	0	0	0	0
13.17	2007	1	1	1	1	1	1
9.24	2008	1	1	1	1	1	1
6.46	2009	1	1	1	1	1	1
14.49	MEDIAN	1	1	0	0	0	0
10.88	AVERAGE	0.521739	0.51087	0.478261	0.369565	0.293478	0.217391

ULATE % CHANCE OF MOUTH BEING CLOSED

SUM OF 1'S	48	47	44	34	27	20
NO.OF ROWS	92	92	92	92	92	92
% CHANCE OBEING CLOSED						
	0.521739	0.51087	0.478261	0.369565	0.293478	0.217391

0.48

ber, e.g. the
ep 1932.

STATE

APR	MAY	JUN	JUL	AUG	SEP	months closed
0	0	0	0	0	0	6
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	1	1	2
0	0	0	0	1	1	7
0	0	0	0	0	0	2
0	0	0	0	1	1	2
1	1	1	1	1	1	12
0	0	0	0	1	1	5
0	0	0	0	0	0	5
0	0	0	0	0	0	0
0	0	1	1	1	1	4
0	0	0	0	0	0	4
0	0	0	1	1	1	3
0	0	0	0	0	0	3
0	0	0	0	0	1	1
0	0	0	0	0	0	5
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	1	1	2
0	0	0	0	0	0	5
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	1	1	2
1	1	1	1	1	1	12
0	0	0	0	0	0	4

0	0	0	1	1	1	3
0	0	0	0	0	0	4
0	0	0	0	1	1	2
1	1	1	1	1	1	12
1	1	1	1	1	1	12
1	1	1	1	1	1	12
1	1	1	1	1	1	12
0	0	0	0	0	1	4
0	0	0	0	0	0	4
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	1	1	2
0	0	0	0	0	0	4
0	0	0	0	0	0	0
0	0	0	1	1	1	3
0	0	0	0	0	0	3
0	0	0	0	1	1	2
1	1	1	1	1	1	12
0	0	0	1	1	1	6
0	0	0	0	0	0	4
0	0	0	1	1	1	3
0	0	0	0	1	1	7
1	1	1	1	1	1	12
0	0	0	0	0	0	3
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	1	1
0	0	0	0	0	0	3
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	1	1	1	1	4
1	1	1	1	1	1	12
1	1	1	1	1	1	12
1	1	1	1	1	1	12
0	0	0	0	0	0	3
0	0	0	0	0	0	0
0	0	0	0	1	1	2
0	0	0	0	0	0	5

0	0	0	0	0	0	0
0	0	0	0	1	1	2
0	0	0	0	0	0	1
0	0	0	0	0	0	0
0	1	1	1	1	1	5
1	1	1	1	1	1	12
0	0	0	0	1	1	2
1	1	1	1	1	1	12
0	0	0	0	0	0	2
0	0	0	0	0	0	0
0	0	0	0	1	1	2
0	0	0	0	1	1	5
0	0	0	0	0	0	3
0	0	0	0	1	1	2
1	1	1	1	1	1	12
1	1	1	1	1	1	12
0	0	0	0	1	1	6
0	0	0	0	1	1	7
1	1	1	1	1	1	12
0	0	0	1	1	1	5
1	1	1	1	1	1	12
1	1	1	1	1	1	12
1	1	1	1	0	0	10
0	0	0	0	0	1	
0.206522	0.217391	0.23913	0.304348	0.48913	0.521739	4.369565

19	20	22	28	45	48
92	92	92	92	92	92
0.206522	0.217391	0.23913	0.304348	0.48913	0.521739

Please Note: Year Column indicates the year for the month October, e.g. the row of 1931 will commence with Oct 1931 but will end with Sep 1932.

	RESULTANT INFLOW INTO ESTUARY (Mm3)							
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
1918	2.192	2.116	20.195	31.742	51.089	51.632	69.429	58.823
1919	6.807	13.975	16.989	325.668	326.615	684.017	255.682	89.737
1920	36.431	49.774	89.354	89.564	69.937	139.259	69.450	42.656
1921	23.736	126.340	144.683	89.564	90.511	70.480	42.944	28.026
1922	14.254	27.491	36.305	137.769	121.739	70.480	36.975	17.372
1923	3.886	4.812	16.963	17.187	32.707	60.147	36.975	28.026
1924	11.813	31.374	89.328	126.702	242.929	3223.066	1135.811	791.654
1925	68.906	58.288	58.440	58.650	51.083	60.140	32.215	20.604
1926	7.976	11.561	16.963	20.419	32.707	51.632	28.293	17.345
1927	14.211	16.820	36.279	68.978	69.937	51.626	36.975	28.026
1928	6.764	7.722	11.705	23.807	21.384	139.265	69.450	36.687
1929	36.431	36.153	36.305	216.513	138.716	139.259	69.450	31.927
1930	8.019	11.579	16.989	20.431	24.766	25.309	14.798	8.275
1931	3.277	6.510	9.933	11.929	127.655	146.384	255.682	255.394
1932	11.858	16.837	42.273	50.136	59.597	43.973	24.280	12.114
1933	3.886	13.957	36.279	89.552	121.739	91.054	59.111	36.687
1934	10.086	20.069	58.440	58.650	51.083	51.626	32.215	23.991
1935	4.263	3.966	6.654	20.419	51.089	70.486	42.944	58.823
1936	11.858	42.121	27.644	89.564	185.369	128.192	90.025	31.927
1937	6.807	9.807	49.926	58.650	90.511	60.140	59.111	28.026
1938	14.254	13.975	42.273	50.136	242.929	256.712	127.163	89.737
1939	20.348	58.288	58.440	89.564	51.083	70.480	50.596	89.737
1940	17.116	42.121	89.354	68.990	51.083	38.005	36.975	17.372
1941	4.220	9.790	9.933	31.742	43.436	91.061	50.596	31.927
1942	11.858	27.491	89.354	68.990	90.511	256.712	326.128	216.686
1943	58.567	89.202	126.492	89.564	217.460	122.282	59.111	23.991
1944	23.736	31.392	36.305	50.136	69.937	243.472	90.025	42.656
1945	4.220	3.633	6.654	36.503	32.707	51.632	32.193	14.483
1946	6.764	9.790	20.195	27.842	69.943	70.480	50.596	23.991

1947	8.019	23.457	31.544	31.754	43.430	51.626	42.944	20.604
1948	6.762	13.957	16.963	50.123	59.603	60.140	127.163	50.308
1949	14.254	20.069	68.779	68.990	69.937	91.054	50.596	31.927
1950	5.066	4.813	20.195	23.807	18.153	33.251	28.293	14.483
1951	17.073	9.790	27.618	27.842	28.807	25.315	14.776	12.087
1952	3.886	11.561	31.518	31.742	43.436	38.011	28.293	14.483
1953	5.066	13.957	16.963	20.419	43.436	38.011	36.954	36.661
1954	31.628	42.103	31.518	89.552	90.511	185.912	90.025	42.656
1955	11.858	27.473	42.247	23.807	145.846	146.384	59.111	42.656
1956	23.736	42.121	216.303	241.982	256.169	243.472	255.682	89.737
1957	325.584	216.151	184.211	325.668	484.834	218.003	216.974	69.162
1958	17.116	36.153	49.926	89.564	69.937	43.973	28.314	28.026
1959	14.211	16.820	36.279	31.742	59.603	60.140	69.450	36.687
1960	10.086	42.121	184.211	184.422	145.841	91.054	90.025	50.308
1961	20.348	27.491	27.644	31.754	24.766	43.973	42.944	20.604
1962	7.976	23.439	49.900	68.978	59.597	70.480	59.111	28.026
1963	27.770	36.153	36.305	58.650	43.430	33.244	42.944	20.604
1964	20.305	23.439	36.279	27.842	24.772	15.833	12.379	8.247
1965	14.211	20.052	20.195	58.638	69.937	43.973	28.314	17.372
1966	5.066	7.722	16.963	31.742	69.943	60.140	90.025	42.656
1967	11.858	31.392	27.644	31.754	37.462	51.626	28.314	14.510
1968	6.764	9.790	23.583	20.419	18.153	91.061	69.450	42.656
1969	20.305	20.052	23.583	23.807	28.807	21.928	14.776	14.483
1970	11.815	23.439	23.583	58.638	43.430	51.626	50.596	120.965
1971	23.736	23.457	58.440	144.893	618.677	327.158	145.354	137.941
1972	10.086	16.837	20.221	27.854	69.937	51.626	50.596	23.991
1973	23.736	49.774	58.440	120.792	69.937	70.480	50.596	36.687
1974	5.109	16.820	36.279	120.780	242.929	185.912	127.163	58.823
1975	17.116	27.491	58.440	216.513	256.169	327.158	255.682	216.686
1976	23.736	23.457	42.273	89.564	640.356	619.220	242.442	89.737
1977	14.254	13.975	27.644	89.564	90.511	70.480	59.111	31.927
1978	27.770	36.153	31.544	31.754	28.801	25.309	20.892	14.510
1979	10.086	9.807	16.989	27.854	28.801	18.690	10.630	7.062
1980	4.220	11.561	14.101	31.742	37.468	25.315	14.776	27.999
1981	20.305	27.474	20.195	27.842	28.807	51.632	36.954	20.577
1982	7.976	7.722	7.865	10.157	9.056	9.599	7.328	4.491
1983	5.064	31.374	36.279	791.470	792.429	684.017	326.128	145.066
1984	36.431	36.153	36.305	58.650	256.169	128.192	50.596	28.026
1985	23.736	23.457	23.609	42.483	59.597	43.973	36.975	17.372
1986	5.066	6.510	20.195	42.471	32.707	60.147	36.975	20.604

1987	325.584	325.305	255.011	216.513	326.615	327.158	184.882	58.823
1988	27.770	42.121	126.492	58.650	185.369	91.054	42.944	23.991
1989	7.976	120.412	126.492	89.564	121.739	122.282	69.450	36.687
1990	11.858	16.837	31.544	68.990	127.649	139.259	59.111	58.823
1991	10.086	9.807	14.127	14.337	21.378	21.921	12.402	5.365
1992	3.276	6.510	9.933	11.929	18.153	18.696	14.776	7.036
1993	58.524	58.288	137.559	120.792	59.597	70.480	36.975	17.372
1994	11.815	13.957	23.583	17.187	12.894	29.350	32.193	23.965
1995	10.043	31.375	120.556	241.982	640.356	640.899	255.682	126.875
1996	23.736	20.069	31.544	58.650	59.597	70.480	69.450	50.308
1997	31.671	126.340	89.354	68.990	121.739	70.480	50.596	28.026
1998	11.815	20.052	42.247	68.978	59.597	51.626	36.975	20.604
1999	7.976	9.789	49.900	120.780	145.841	243.472	138.229	126.875
2000	14.254	120.430	216.303	144.893	121.739	70.480	50.596	28.026
2001	14.209	31.374	36.279	42.471	43.436	29.350	24.258	10.315
2002	7.976	11.561	11.705	11.929	24.772	15.833	10.608	7.035
2003	3.276	6.510	6.653	31.742	59.604	60.140	36.975	17.372
2004	5.066	11.561	14.101	31.742	51.089	60.147	28.314	14.510
2005	4.220	9.790	9.933	23.807	32.707	33.251	28.293	17.345
2006	11.815	20.052	58.414	42.483	28.801	15.827	14.798	7.062
2007	10.041	20.051	14.100	14.325	15.290	18.696	28.292	14.482
2008	3.885	3.966	4.955	14.325	21.385	18.696	12.379	10.314
2009	7.974	13.957	11.704	6.878	4.966	3.992	2.934	2.364
AVERAGE	21.506	32.093	48.869	77.927	112.791	144.475	82.347	50.670

Please Note: Year C
row of 1931 will

JUN	JUL	AUG	SEP	sum
27.739	14.289	9.662	8.352	347.259
50.021	27.805	13.829	12.191	1823.335
20.316	11.893	6.382	10.419	635.435
14.222	8.054	11.433	7.140	657.133
7.987	6.842	3.505	2.745	483.464
14.222	6.842	4.685	10.419	236.871
586.869	241.933	68.482	69.239	6619.202
14.222	6.842	3.839	7.140	440.369
10.029	10.082	6.321	5.392	218.722
11.826	6.842	4.685	7.140	353.343
31.639	20.383	11.433	24.069	404.309
20.316	11.893	7.594	10.419	754.976
5.077	4.298	2.835	2.695	145.071
89.449	36.466	16.692	12.191	971.563
6.775	5.144	3.505	3.602	280.093
27.739	20.383	16.692	10.419	527.498
17.084	10.121	7.594	5.442	346.403
31.639	17.151	7.594	7.140	322.168
17.084	11.893	7.594	8.352	651.622
23.704	17.151	11.433	8.352	423.619
42.368	31.706	16.692	20.681	948.624
120.677	50.087	27.346	24.069	710.715
10.054	6.842	3.839	4.596	386.346
23.704	11.893	9.662	12.191	330.155
89.449	68.941	68.482	36.764	1351.366
36.400	20.383	11.433	24.069	878.955
20.316	10.121	4.685	4.596	627.375
7.962	5.105	3.444	4.212	202.750
17.084	11.893	6.382	7.140	322.099

	OCT	NOV
1918	0.00	0.00
1919	0.00	0.00
1920	0.00	0.00
1921	0.00	0.00
1922	0.00	0.00
1923	0.00	0.00
1924	0.00	0.00
1925	0.00	0.00
1926	0.00	0.00
1927	0.00	0.00
1928	0.00	0.00
1929	0.00	0.00
1930	0.00	0.00
1931	0.00	0.00
1932	0.00	0.00
1933	0.00	0.00
1934	0.00	0.00
1935	0.00	0.00
1936	0.00	0.00
1937	0.00	0.00
1938	0.00	0.00
1939	0.00	0.00
1940	0.00	0.00
1941	0.00	0.00
1942	0.00	0.00
1943	0.00	0.00
1944	0.00	0.00
1945	0.00	0.00
1946	0.00	0.00

10.054	5.144	3.505	4.544	276.626	1947	0.00	0.00
31.639	14.289	7.594	7.140	445.681	1948	0.00	0.00
14.222	8.054	4.685	4.596	447.162	1949	0.00	0.00
10.029	5.105	13.768	10.369	187.331	1950	0.00	0.00
7.962	8.015	4.623	4.212	188.120	1951	0.00	0.00
7.962	5.105	3.778	4.546	224.322	1952	0.00	0.00
20.291	10.082	6.321	10.369	258.531	1953	0.00	0.00
20.316	10.121	6.382	5.442	646.167	1954	0.00	0.00
23.704	11.893	7.594	10.419	552.992	1955	0.00	0.00
42.368	42.435	23.311	121.042	1598.357	1956	0.00	0.00
36.400	17.151	9.662	10.419	2114.219	1957	0.00	0.00
11.826	6.842	4.685	7.140	393.501	1958	0.00	0.00
17.084	10.121	6.382	7.140	365.660	1959	0.00	0.00
50.021	27.805	13.829	17.449	907.172	1960	0.00	0.00
10.054	5.144	4.685	4.546	263.953	1961	0.00	0.00
36.400	184.373	58.142	28.103	674.525	1962	0.00	0.00
11.826	8.054	4.685	4.596	328.260	1963	0.00	0.00
7.961	5.104	7.531	8.300	197.993	1964	0.00	0.00
10.054	5.144	4.685	5.392	297.967	1965	0.00	0.00
17.084	11.893	7.594	7.140	367.969	1966	0.00	0.00
7.987	5.144	6.382	5.392	259.465	1967	0.00	0.00
20.316	11.893	4.685	7.140	325.908	1968	0.00	0.00
7.962	5.105	3.778	5.392	189.977	1969	0.00	0.00
50.021	31.706	13.829	14.587	494.235	1970	0.00	0.00
58.535	31.706	13.829	8.352	1592.079	1971	0.00	0.00
11.826	6.842	11.433	32.004	333.254	1972	0.00	0.00
23.704	14.289	7.594	5.442	531.471	1973	0.00	0.00
27.739	14.289	7.594	24.069	867.504	1974	0.00	0.00
58.535	36.466	19.923	12.191	1502.371	1975	0.00	0.00
31.639	14.289	11.433	14.587	1842.734	1976	0.00	0.00
17.084	11.893	11.433	10.419	448.294	1977	0.00	0.00
7.987	6.842	6.382	8.352	246.295	1978	0.00	0.00
4.231	3.355	1.925	5.390	144.820	1979	0.00	0.00
27.713	14.250	11.372	20.631	241.150	1980	0.00	0.00
10.029	6.803	3.444	4.212	258.274	1981	0.00	0.00
3.872	4.258	4.621	4.211	81.155	1982	0.00	0.00
89.449	89.516	58.142	32.004	3080.939	1983	0.00	0.00
20.316	14.289	7.594	8.352	681.074	1984	0.00	0.00
11.826	6.842	4.685	4.596	299.151	1985	0.00	0.00
20.316	11.893	19.923	325.917	602.726	1986	0.00	0.00

42.368	27.805	16.692	12.191	2118.948
14.222	10.121	4.685	5.442	632.861
17.084	8.054	11.433	7.140	738.314
36.400	23.771	11.433	8.352	594.026
3.898	2.407	1.925	2.693	120.346
4.206	3.317	2.833	3.603	104.267
10.054	6.842	4.685	4.262	585.430
17.059	10.082	6.321	4.546	202.954
42.368	42.435	23.311	10.419	2186.301
50.021	27.805	19.923	20.681	502.265
11.826	8.054	4.685	4.596	616.357
10.054	6.842	4.685	5.442	338.916
50.021	23.771	11.433	8.352	936.438
11.826	8.054	3.839	10.419	800.859
7.962	20.344	13.768	12.141	285.908
7.961	5.104	3.442	4.211	122.136
7.987	10.121	4.685	7.140	252.204
11.826	6.842	4.685	4.262	244.145
10.029	5.105	7.533	7.090	189.104
10.054	5.144	3.505	4.544	222.499
10.028	5.104	3.442	4.211	158.062
6.749	4.258	4.621	5.390	110.924
1.856	8.014	0.000	0.000	64.639
29.350	18.872	10.704	14.831	644.436

1987	0.00	0.00
1988	0.00	0.00
1989	0.00	0.00
1990	0.00	0.00
1991	0.00	0.00
1992	0.00	0.00
1993	0.00	0.00
1994	0.00	0.00
1995	0.00	0.00
1996	0.00	0.00
1997	0.00	0.00
1998	0.00	0.00
1999	0.00	0.00
2000	0.00	0.00
2001	0.00	0.00
2002	0.00	0.00
2003	0.00	0.00
2004	0.00	0.00
2005	0.00	0.00
2006	0.00	0.00
2007	0.00	0.00
2008	0.00	0.00
2009	0.00	0.00
AVERAGE	0.00	0.00
MEDIAN		

% EXCEEDED		
2	0.00	0.00
5	0.00	0.00
10	0.00	0.00
25	0.00	0.00
50	0.00	0.00
75	0.00	0.00
90	0.00	0.00

olumn indicates the year for the month October, e.g. the
commence with Oct 1931 but will end with Sep 1932.

SEDIMENT INTO ST LUCIA VIA BACKCHANNEL (ton)

DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
0.00	0.00	7088.14	1089.19	750.45	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	915.54	1078.45	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	915.54	1089.19	0.00	0.00	0.00	0.00	0.00
0.00	2518.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	141.79	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	887.69	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1966.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	7088.14	515.12	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	4568.03	277.47	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	915.54	1089.19	0.00	0.00	0.00	0.00	0.00
0.00	0.00	3094.10	0.00	0.00	0.00	0.00	0.00	0.00

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	6991.08	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	4568.03	223.29	0.00	0.00	0.00	0.00	0.00
0.00	0.00	4568.03	223.29	304.71	302.07	0.00	0.00	0.00
0.00	1966.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	733.37	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	6991.08	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2518.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2701.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	3094.10	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	277.47	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2701.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1443.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	2559.74	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	1089.19	304.71	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	171.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	915.54	1078.45	0.00	0.00	0.00	0.00	0.00

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2518.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1443.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	4568.03	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	6990.86	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	7088.14	1078.45	0.00	0.00	0.00	0.00	0.00
0.00	0.00	915.54	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	216.85	820.18	100.55	14.78	3.28	0.00	0.00	0.00

0.00	2551.20	7088.14	1089.19	304.71	0.00	0.00	0.00	0.00
0.00	2214.74	6990.96	1078.45	0.00	0.00	0.00	0.00	0.00
0.00	153.98	4420.63	272.05	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Please Note: Year Column indicates the year for the m
row of 1931 will commence with Oct 1931 but will

			SEDIMENT TRA				
SEP	sum		OCT	NOV	DEC	JAN	FEB
0.00	8927.78	1918	100.00	100.00	100.00	100.00	58.46
0.00	0.00	1919					
0.00	0.00	1920					
0.00	0.00	1921					
0.00	0.00	1922					
0.00	1993.99	1923	100.00	100.00	100.00	100.00	91.62
0.00	0.00	1924	100.00	100.00	100.00		
0.00	0.00	1925					
0.00	2004.73	1926	100.00	100.00	100.00	100.00	91.62
0.00	2518.12	1927	100.00	100.00	100.00	79.69	
0.00	141.79	1928	100.00	100.00	100.00	100.00	100.00
0.00	0.00	1929					
0.00	0.00	1930					
0.00	887.69	1931	100.00	100.00	100.00	100.00	24.79
0.00	0.00	1932					
0.00	1966.51	1933	100.00	100.00	100.00	63.95	
0.00	0.00	1934					
0.00	7603.25	1935	100.00	100.00	100.00	100.00	58.46
0.00	0.00	1936					
0.00	0.00	1937					
0.00	0.00	1938					
0.00	0.00	1939					
0.00	0.00	1940					
0.00	4845.50	1941	100.00	100.00	100.00	100.00	68.51
0.00	0.00	1942					
0.00	0.00	1943					
0.00	0.00	1944					
0.00	2004.73	1945	100.00	100.00	100.00	100.00	91.62
0.00	3094.10	1946	100.00	100.00	100.00	100.00	40.00

0.00	0.00	1947					
0.00	6991.08	1948	100.00	100.00	100.00	100.00	46.25
0.00	0.00	1949					
0.00	0.00	1950	100.00	100.00	100.00	100.00	100.00
0.00	0.00	1951	100.00	100.00	100.00	100.00	100.00
0.00	4791.31	1952	100.00	100.00	100.00	100.00	68.51
0.00	5398.09	1953	100.00	100.00	100.00	100.00	68.51
0.00	1966.51	1954	100.00	100.00	100.00	63.95	
0.00	733.37	1955	100.00	100.00	100.00	100.00	22.77
0.00	0.00	1956					
0.00	0.00	1957					
0.00	0.00	1958					
0.00	6991.08	1959	100.00	100.00	100.00	100.00	46.25
0.00	0.00	1960					
0.00	0.00	1961					
0.00	2518.12	1962	100.00	100.00	100.00	79.69	
0.00	0.00	1963					
0.00	0.00	1964	100.00	100.00	100.00	100.00	100.00
0.00	2701.91	1965	100.00	100.00	100.00	92.14	
0.00	3094.10	1966	100.00	100.00	100.00	100.00	40.00
0.00	0.00	1967					
0.00	277.47	1968	100.00	100.00	100.00	100.00	100.00
0.00	0.00	1969	100.00	100.00	100.00	100.00	100.00
0.00	2701.91	1970	100.00	100.00	100.00	92.14	
0.00	0.00	1971					
0.00	0.00	1972					
0.00	0.00	1973					
0.00	1443.81	1974	100.00	100.00	100.00	51.03	
0.00	0.00	1975					
0.00	0.00	1976					
0.00	0.00	1977					
0.00	0.00	1978					
0.00	0.00	1979					
0.00	2559.74	1980	100.00	100.00	100.00	100.00	79.54
0.00	1393.90	1981	100.00	100.00	100.00	100.00	100.00
0.00	0.00	1982	100.00	100.00	100.00	100.00	100.00
0.00	171.09	1983	100.00	100.00	100.00	36.94	
0.00	0.00	1984					
0.00	0.00	1985					
0.00	1993.99	1986	100.00	100.00	100.00	100.00	91.62

0.00	0.00	1987					
0.00	0.00	1988					
0.00	0.00	1989	100.00	100.00			
0.00	0.00	1990					
0.00	0.00	1991					
0.00	0.00	1992	100.00	100.00	100.00	100.00	100.00
0.00	0.00	1993	100.00				
0.00	0.00	1994	100.00	100.00	100.00	100.00	100.00
0.00	0.00	1995	100.00	100.00	100.00		
0.00	0.00	1996					
0.00	0.00	1997					
0.00	2518.12	1998	100.00	100.00	100.00	79.69	
0.00	1443.81	1999	100.00	100.00	100.00	51.03	
0.00	0.00	2000					
0.00	4568.03	2001	100.00	100.00	100.00	100.00	68.51
0.00	0.00	2002	100.00	100.00	100.00	100.00	100.00
0.00	6990.86	2003	100.00	100.00	100.00	100.00	46.25
0.00	8166.59	2004	100.00	100.00	100.00	100.00	58.46
0.00	915.54	2005	100.00	100.00	100.00	100.00	91.62
0.00	0.00	2006	100.00	100.00	100.00		
0.00	0.00	2007	100.00	100.00	100.00	100.00	100.00
0.00	0.00	2008	100.00	100.00	100.00	100.00	100.00
0.00	0.00	2009	100.00	100.00	100.00	100.00	100.00
0.00	1155.64	AVERAGE	100.00	100.00	100.00	92.96	78.04
	0.00	MEDIAN					
max	8927.78		min	22.77	max	100.00	median
min	0.00	% EXCEEDED					
0.00	7704.65	2	100.00	100.00	100.00	100.00	100.00
0.00	6990.96	5	100.00	100.00	100.00	100.00	100.00
0.00	4420.63	10	100.00	100.00	100.00	100.00	100.00
0.00	1966.51	25	100.00	100.00	100.00	100.00	100.00
0.00	0.00	50	100.00	100.00	100.00	100.00	91.62
0.00	0.00	75	100.00	100.00	100.00	100.00	58.46
0.00	0.00	90	100.00	100.00	100.00	68.67	41.87

onth October, e.g. the
end with Sep 1932.

PPING EFFICIENCY (% trapped) - my method

MAR	APR	MAY	JUN	JUL	AUG	SEP	average
66.67	45.49						81.52
						100.00	100.00
52.75						100.00	92.05
							100.00
						100.00	100.00
66.67	100.00	100.00	100.00	100.00	100.00	100.00	96.52
						100.00	95.94
26.78							87.80
				100.00	100.00	100.00	100.00
							84.96
					100.00	100.00	100.00
							90.99
45.62							84.01
						100.00	100.00
36.61							84.19
						100.00	100.00
66.67	100.00	100.00	100.00	100.00	100.00	100.00	96.52
							88.00

					100.00	100.00	100.00
							89.25
						100.00	100.00
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
90.72	100.00	100.00	100.00	100.00	100.00	100.00	96.60
90.72	90.47	90.47	100.00	100.00	100.00	100.00	95.01
							90.99
							84.55
						100.00	100.00
							89.25
					100.00	100.00	100.00
							94.92
						100.00	100.00
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
					100.00	100.00	98.69
							88.00
					100.00	100.00	100.00
36.61						100.00	90.94
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
							98.04
							87.76
				100.00	100.00	100.00	100.00
100.00	100.00	100.00	100.00	100.00	100.00	100.00	98.30
66.67	90.47	100.00	100.00	100.00	100.00	100.00	96.43
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
							84.23
						100.00	100.00
52.75							90.73

						100.00	100.00	
							100.00	
			100.00	100.00	100.00	100.00	100.00	
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
						100.00	100.00	
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
							100.00	
						100.00	100.00	
						100.00	95.94	
							87.76	
						100.00	100.00	
100.00	100.00	100.00	100.00	100.00	100.00	100.00	97.38	
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
						100.00	91.04	
52.75						100.00	87.32	
100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.30	
					100.00	100.00	100.00	
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
100.00	100.00	100.00	100.00	100.00			100.00	
79.70	96.32	99.50	100.00	100.00	100.00	100.00	95.75	
100.00								
								%
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
59.71	100.00	100.00	100.00	100.00	100.00	100.00	90.99	
42.01	90.47	100.00	100.00	100.00	100.00	100.00	87.58	

Please Note: Year Column indicates the year for the month October, e.g. the row of 1931 will commence with Oct 1931 but will end with Sep 1932.

	SEDIMENT TRAPPING EFFICIENCY (% trapped) - churc							
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
1918	100.00	100.00	89.32	84.82	79.12	78.98	70.77	
1919								
1920								
1921								
1922								
1923	100.00	99.25	90.89	90.73	84.49	73.07		
1924	93.74	85.01	66.40					
1925								
1926	96.39	93.89	90.85	89.22	84.49	78.98	86.04	90.66
1927	92.29	90.92	83.33	70.88				
1928	97.36	96.56	93.76	87.77	88.79	57.53		
1929								
1930								
1931	100.00	97.58	94.92	93.62	59.40			
1932								
1933	100.00	92.43	83.33	66.35				
1934								
1935	98.50	100.00	97.45	89.22	79.12	70.52		
1936								
1937								
1938								
1939								
1940								
1941	99.87	95.02	94.92	84.82	81.19	66.04		
1942								
1943								
1944								
1945	99.87	100.00	97.45	83.26	84.49	78.98	84.67	92.14
1946	97.36	95.02	89.32	86.21	70.65			

1947								
1948	97.39	92.48	90.89	79.44	73.21			
1949								
1950	98.95	99.22	89.32	87.77	90.26	84.31	86.04	92.14
1951	90.79	95.02	86.29	86.21	85.85	87.17	91.98	93.53
1952	100.00	93.85	84.90	84.82	81.19	82.79	86.04	92.14
1953	98.95	92.43	90.85	89.22	81.19	82.79	83.12	83.21
1954	84.86	81.57	84.90	66.35				
1955	91.67	86.40	81.53	87.77	56.52			
1956								
1957								
1958								
1959	92.29	90.92	83.33	84.82	73.21			
1960								
1961								
1962	96.39	87.98	79.43	70.88				
1963								
1964	89.27	87.92	83.33	86.21	87.39	91.47	93.39	96.18
1965	92.29	89.38	89.32	73.46				
1966	98.95	96.56	90.85	84.82	70.65			
1967								
1968	97.36	95.02	87.87	89.22	90.26	66.04		
1969	89.27	89.38	87.87	87.77	85.85	88.56	91.98	92.14
1970	93.69	87.92	87.87	73.46				
1971								
1972								
1973								
1974	97.48	90.92	83.33	60.55				
1975								
1976								
1977								
1978								
1979								
1980	99.87	93.85	92.35	84.82	82.96	87.17	91.98	86.15
1981	89.27	86.34	89.32	86.21	85.85	78.98	83.12	89.15
1982	96.39	96.59	96.48	94.81	95.58	95.19	96.91	99.60
1983	98.99	85.01	83.33	2.86				
1984								
1985								
1986	98.95	97.58	89.32	81.46	84.49	73.07		

1987								
1988								
1989	96.39	60.61						
1990								
1991								
1992	100.00	97.58	94.92	93.62	90.26	90.01	91.98	97.12
1993	73.49							
1994	93.69	92.43	87.87	90.73	93.04	85.66	84.67	87.71
1995	94.85	84.95	60.59					
1996								
1997								
1998	93.69	89.38	81.53	70.88				
1999	96.39	95.06	79.43	60.55				
2000								
2001	92.34	85.01	83.33	81.46	81.19	85.66	87.59	94.66
2002	96.39	93.89	93.76	93.62	87.39	91.47	94.51	97.16
2003	100.00	97.61	97.48	84.88	73.21			
2004	98.95	93.85	92.35	84.82	79.12	73.07		
2005	99.87	95.02	94.92	87.77	84.49	84.31	86.04	90.66
2006	93.69	89.38	73.52					
2007	94.89	89.43	92.40	92.27	91.75	90.06	86.10	92.19
2008	100.00	100.00	99.10	92.27	88.84	90.06	93.39	94.70
2009	96.39	92.48	93.80	97.29	99.09	100.00	100.00	100.00
AVERAGE	95.70	92.06	87.86	81.82	82.49	81.92	88.52	92.70
MEDIAN								

EXCEEDED								
2	100.00	100.00	97.61	95.16	96.77	97.50	98.83	99.85
5	100.00	100.00	97.45	93.62	93.93	94.07	97.07	99.64
10	100.00	99.23	95.54	93.22	91.31	91.47	94.75	97.64
25	98.99	96.56	93.08	89.22	88.44	89.28	92.33	95.44
50	96.39	93.17	89.32	85.54	84.49	84.31	86.85	92.14
75	93.69	89.38	83.33	80.96	79.12	76.03	85.70	90.66
90	90.49	85.01	80.69	67.71	71.42	68.73	83.12	87.40

Please Note: Year C
row of 1931 will

chill method

JUN	JUL	AUG	SEP	average
				86.14
			100.00	100.00
			92.69	90.16
				81.71
			95.40	95.40
94.86	94.82	97.75	98.62	91.38
			95.40	86.56
				86.96
	98.45	100.00	100.00	99.48
				89.10
		99.51	100.00	99.76
				85.53
				89.13
			98.08	98.08
				86.98
			98.08	98.08
96.37	98.91	100.00	99.88	93.00
				87.71

	OCT	NOV
1918	0.00	0.00
1919		
1920		
1921		
1922		
1923	0.00	0.75
1924	6.26	14.99
1925		
1926	3.61	6.11
1927	7.71	9.08
1928	2.64	3.44
1929		
1930		
1931	0.00	2.42
1932		
1933	0.00	7.57
1934		
1935	1.50	0.00
1936		
1937		
1938		
1939		
1940		
1941	0.13	4.98
1942		
1943		
1944		
1945	0.13	0.00
1946	2.64	4.98

		99.51	99.54	99.52	1947		
				86.68	1948	2.61	7.52
			98.08	98.08	1949		
94.86	98.91	92.54	94.63	92.41	1950	1.05	0.78
96.37	96.33	99.42	99.88	92.40	1951	9.21	4.98
96.37	98.91	100.00	99.51	91.71	1952	0.00	6.15
89.27	94.82	97.75	94.63	89.85	1953	1.05	7.57
				79.42	1954	15.14	18.43
				80.78	1955	8.33	13.60
					1956		
					1957		
			95.40	95.40	1958		
				84.91	1959	7.71	9.08
					1960		
		97.98	99.51	98.74	1961		
				83.67	1962	3.61	12.02
			98.08	98.08	1963		
96.40	98.94	96.75	96.14	91.95	1964	10.73	12.08
		97.98	98.62	90.18	1965	7.71	10.62
				88.36	1966	1.05	3.44
		96.13	98.62	97.38	1967		
			95.40	88.74	1968	2.64	4.98
96.37	98.91	100.00	98.62	92.23	1969	10.73	10.62
				85.74	1970	6.31	12.08
					1971		
					1972		
					1973		
				83.07	1974	2.52	9.08
					1975		
					1976		
					1977		
					1978		
	99.73	100.00	98.63	99.45	1979		
86.26	92.27	93.97	89.12	90.06	1980	0.13	6.15
94.86	97.32	100.00	99.88	90.02	1981	10.73	13.66
100.00	99.86	99.45	99.91	97.56	1982	3.61	3.41
				67.55	1983	1.01	14.99
					1984		
			98.08	98.08	1985		
				87.48	1986	1.05	2.42

					1987		
			97.11	97.11	1988		
				78.50	1989	3.61	39.39
					1990		
98.97	100.00	100.00	100.00	99.74	1991		
99.89	100.00	100.00	100.00	96.28	1992	0.00	2.42
			98.50	85.99	1993	26.51	
90.80	94.82	97.75	99.51	91.56	1994	6.31	7.57
				80.13	1995	5.15	15.05
					1996		
			98.08	98.08	1997		
			97.11	86.52	1998	6.31	10.62
				82.86	1999	3.61	4.94
			92.69	92.69	2000		
96.37	89.25	92.54	93.49	88.57	2001	7.66	14.99
96.40	98.94	100.00	99.91	95.29	2002	3.61	6.11
			95.40	91.43	2003	0.00	2.39
			98.50	88.67	2004	1.05	6.15
94.86	98.91	96.71	97.08	92.55	2005	0.13	4.98
		99.51	99.54	91.13	2006	6.31	10.62
94.90	98.94	100.00	99.91	93.57	2007	5.11	10.57
97.40	99.86	99.45	98.66	96.14	2008	0.00	0.00
100.00	96.36	0.00	0.00	81.28	2009	3.61	7.52
95.58	97.51	94.81	95.56	90.54	AVERAGE	4.30	7.94
					MEDIAN		

					% EXCEEDED		
100.00	100.00	100.00	100.00	99.75	2	15.60	19.69
100.00	99.99	100.00	100.00	99.51	5	10.73	15.03
99.90	99.86	100.00	99.96	98.35	10	9.51	14.99
96.65	98.94	100.00	99.54	96.21	25	6.31	10.62
96.37	98.91	99.45	98.50	91.13	50	3.61	6.83
94.86	96.34	97.50	95.59	86.62	75	1.01	3.44
90.65	94.82	93.54	94.06	82.40	90	0.00	0.77

olumn indicates the year for the month October, e.g. the
commence with Oct 1931 but will end with Sep 1932.

DIFFERENCE IN SEDIMENT TRAPPING EFFICIENCY (% trapped) my method - churchill method

DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
10.68	15.18	-20.66	-12.31	-25.28				
9.11	9.27	7.13	-20.32					
33.60								
9.15	10.78	7.13	-12.31	13.96	9.34	5.14	5.18	2.25
16.67	8.81							
6.24	12.23	11.21	-30.75					
							1.55	0.00
5.08	6.38	-34.60						
								0.49
16.67	-2.40							
2.55	10.78	-20.66	-24.90					
5.08	15.18	-12.67	-29.44					
2.55	16.74	7.13	-12.31	15.33	7.86	3.63	1.09	0.00
10.68	13.79	-30.65						

								0.49
9.11	20.56	-26.96						
10.68	12.23	9.74	15.69	13.96	7.86	5.14	1.09	7.46
13.71	13.79	14.15	12.83	8.02	6.47	3.63	3.67	0.58
15.10	15.18	-12.67	7.93	13.96	7.86	3.63	1.09	0.00
9.15	10.78	-12.67	7.93	7.35	7.26	10.73	5.18	2.25
15.10	-2.40							
18.47	12.23	-33.75						
16.67	15.18	-26.96						
								2.02
20.57	8.81							
16.67	13.79	12.61	8.53	6.61	3.82	3.60	1.06	3.25
10.68	18.68							2.02
9.15	15.18	-30.65						
								3.87
12.13	10.78	9.74	-29.44					
12.13	12.23	14.15	11.44	8.02	7.86	3.63	1.09	0.00
12.13	18.68							
16.67	-9.52							
							0.27	0.00
7.65	15.18	-3.41	12.83	8.02	13.85	13.74	7.73	6.03
10.68	13.79	14.15	-12.31	7.35	10.85	5.14	2.68	0.00
3.52	5.19	4.42	4.81	3.09	0.40	0.00	0.14	0.55
16.67	34.08							
10.68	18.54	7.13	-20.32					

						1.03	0.00	0.00
5.08	6.38	9.74	9.99	8.02	2.88	0.11	0.00	0.00
12.13	9.27	6.96	14.34	15.33	12.29	9.20	5.18	2.25
39.41								
18.47	8.81							
20.57	-9.52							
16.67	18.54	-12.67	14.34	12.41	5.34	3.63	10.75	7.46
6.24	6.38	12.61	8.53	5.49	2.84	3.60	1.06	0.00
2.52	15.12	-26.96						
7.65	15.18	-20.66	-20.32					
5.08	12.23	7.13	15.69	13.96	9.34	5.14	1.09	3.29
26.48								0.49
7.60	7.73	8.25	9.94	13.90	7.81	5.10	1.06	0.00
0.90	7.73	11.16	9.94	6.61	5.30	2.60	0.14	0.55
6.20	2.71	0.91	0.00	0.00	0.00	0.00	3.64	
12.14	11.14	-4.45	-2.22	7.81	6.80	4.42	2.49	1.68

34.07	22.45	14.15	15.69	15.33	13.29	12.60	9.48	7.46
24.71	18.68	14.15	15.29	15.33	12.45	10.88	7.60	7.03
19.31	18.54	12.61	14.34	14.10	11.14	9.35	5.18	4.73
16.67	15.18	9.74	10.72	13.96	8.60	5.14	3.66	2.25
10.68	12.23	5.69	7.93	8.02	7.81	3.63	1.09	0.55
6.92	8.54	-20.66	-16.31	6.61	4.56	3.35	1.06	0.00
4.46	3.45	-29.54	-26.72	2.78	2.36	0.10	0.14	0.00

SEP	sum
	-32.38
	0.00
	0.00
	0.00
0.00	0.00
7.31	13.24
	54.86
4.60	4.60
1.38	61.73
4.60	46.87
	5.00
	0.00
0.00	1.55
	-20.73
0.00	0.49
	21.83
	0.00
	-30.72
	0.00
	0.00
	0.00
	0.00
1.92	1.92
	-16.75
	0.00
	0.00
1.92	1.92
0.12	42.27
	1.45

	RESULTANT WEIR OUTFL				
	OCT	NOV	DEC	JAN	FEB
1918	1.41	2.12	20.20	31.74	51.09
1919					
1920					
1921					
1922					
1923	3.89	4.81	16.96	17.19	32.71
1924	11.81	31.37	7.24		
1925					
1926	7.98	11.56	16.96	20.42	32.71
1927	14.21	16.82	36.28	16.36	
1928	6.76	7.72	11.71	23.81	21.38
1929					
1930					
1931	3.28	6.51	9.93	11.93	3.53
1932					
1933	3.89	13.96	36.28	7.20	
1934					
1935	3.48	3.97	6.65	20.42	51.09
1936					
1937					
1938					
1939					
1940					
1941	4.22	9.79	9.93	31.74	43.44
1942					
1943					
1944					
1945	4.22	3.63	6.65	36.50	32.71
1946	6.76	9.79	20.20	27.84	15.44

0.46	0.95	1947					
	12.84	1948	6.76	13.96	16.96	50.12	38.95
1.92	1.92	1949					
5.37	91.04	1950	5.07	4.81	20.20	23.81	18.15
0.12	91.16	1951	17.07	9.79	27.62	27.84	28.81
0.49	58.72	1952	3.89	11.56	31.52	31.74	43.44
5.37	61.95	1953	5.07	13.96	16.96	20.42	43.44
	46.27	1954	31.63	42.10	31.52	7.20	
	18.88	1955	11.07	27.47	42.25	23.81	2.84
	0.00	1956					
	0.00	1957					
4.60	4.60	1958					
	21.69	1959	14.21	16.82	36.28	31.74	38.95
	0.00	1960					
0.49	2.52	1961					
	45.01	1962	7.98	23.44	49.90	16.36	
1.92	1.92	1963					
3.86	96.61	1964	20.30	23.44	36.28	27.84	24.77
1.38	51.09	1965	14.21	20.05	20.20	45.40	
	-1.83	1966	5.07	7.72	16.96	31.74	15.44
1.38	5.25	1967					
4.60	15.44	1968	6.76	9.79	23.58	20.42	18.15
1.38	93.27	1969	20.30	20.05	23.58	23.81	28.81
	49.20	1970	11.81	23.44	23.58	45.40	
	0.00	1971					
	0.00	1972					
	0.00	1973					
	18.76	1974	4.32	16.82	36.28	3.89	
	0.00	1975					
	0.00	1976					
	0.00	1977					
	0.00	1978					
1.37	1.64	1979					
10.88	98.77	1980	4.22	11.56	14.10	31.74	37.47
0.12	76.85	1981	20.30	27.47	20.20	27.84	28.81
0.09	29.23	1982	7.98	7.72	7.87	10.16	9.06
	66.76	1983	5.06	31.37	36.28	0.36	
	0.00	1984					
1.92	1.92	1985					
	19.50	1986	5.07	6.51	20.20	42.47	32.71

	0.00	1987					
2.89	2.89	1988					
	43.00	1989	7.98	3.91			
	0.00	1990					
0.00	1.03	1991					
0.00	44.61	1992	3.28	6.51	9.93	11.93	18.15
1.50	28.01	1993	46.31				
0.49	101.33	1994	11.81	13.96	23.58	17.19	12.89
	59.62	1995	10.04	31.37	3.90		
	0.00	1996					
1.92	1.92	1997					
2.89	47.10	1998	11.81	20.05	42.25	16.36	
	19.60	1999	7.98	9.79	49.90	3.89	
7.31	7.31	2000					
6.51	105.63	2001	14.21	31.37	36.28	42.47	43.44
0.09	56.55	2002	7.98	11.56	11.71	11.93	24.77
4.60	-2.34	2003	3.28	6.51	6.65	31.74	38.94
1.50	-9.46	2004	5.07	11.56	14.10	31.74	51.09
2.92	80.97	2005	4.22	9.79	9.93	23.81	32.71
0.46	44.35	2006	11.81	20.05	47.21		
0.09	77.16	2007	10.04	20.05	14.10	14.32	15.29
1.34	46.27	2008	3.88	3.97	4.96	14.32	21.38
	24.58	2009	7.97	13.96	11.70	6.88	4.97
2.31	21.95	AVERAGE	9.55	14.72	22.07	23.09	28.16
	2.70	MEDIAN					

		% EXCEEDED					
7.74	187.54	2	32.22	32.02	49.90	46.06	51.09
7.15	159.02	5	20.30	31.37	45.72	44.96	51.09
5.37	139.19	10	17.72	28.64	38.67	40.68	43.44
3.86	106.71	25	11.81	20.05	33.90	31.74	38.95
1.50	69.57	50	7.97	11.56	20.20	23.81	28.81
0.46	-1.03	75	4.22	7.72	11.70	14.32	18.15
0.04	-42.17	90	3.80	4.56	7.01	7.20	10.21

OW INTO ST LUCIA - EXCLUDING ZERO FLOWS (Mm3)

MAR	APR	MAY	JUN	JUL	AUG	SEP	sum
51.63	15.92						174.10
							0.00
							0.00
							0.00
						1.96	1.96
36.06						9.63	121.25
							50.43
						6.35	6.35
51.63	28.29	17.35	10.03	10.08	6.32	5.39	218.72
						6.35	90.02
3.06							74.44
							0.00
				3.51	2.83	2.70	9.04
							35.18
					2.72	3.60	6.32
							61.32
							0.00
14.97							100.57
							0.00
							0.00
							0.00
							0.00
						3.81	3.81
6.92							106.04
							0.00
							0.00
						3.81	3.81
51.63	32.19	14.48	7.96	5.11	3.44	4.21	202.75
							80.03

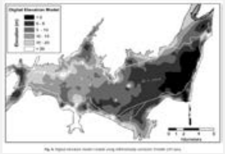
					2.72	4.54	7.26
							126.75
						3.81	3.81
33.25	28.29	14.48	10.03	5.11	13.77	10.37	187.33
25.32	14.78	12.09	7.96	8.02	4.62	4.21	188.12
38.01	28.29	14.48	7.96	5.11	3.78	4.55	224.32
38.01	36.95	36.66	20.29	10.08	6.32	10.37	258.53
							112.45
							107.44
							0.00
							0.00
						6.35	6.35
							138.00
							0.00
					3.90	4.55	8.44
							97.68
						3.81	3.81
15.83	12.38	8.25	7.96	5.10	7.53	8.30	197.99
					3.90	5.39	109.14
							76.93
					5.60	5.39	10.99
6.92						6.35	91.98
21.93	14.78	14.48	7.96	5.11	3.78	5.39	189.98
							104.23
							0.00
							0.00
							0.00
							61.31
							0.00
							0.00
							0.00
							0.00
				2.57	1.92	5.39	9.88
25.32	14.78	28.00	27.71	14.25	11.37	20.63	241.15
51.63	36.95	20.58	10.03	6.80	3.44	4.21	258.27
9.60	7.33	4.49	3.87	4.26	4.62	4.21	81.16
							73.08
							0.00
						3.81	3.81
36.06							143.01

							0.00
						4.66	4.66
							11.89
							0.00
			3.11	2.41	1.92	2.69	10.14
18.70	14.78	7.04	4.21	3.32	2.83	3.60	104.27
						3.48	49.78
29.35	32.19	23.96	17.06	10.08	6.32	4.55	202.95
							45.32
							0.00
						3.81	3.81
						4.66	95.13
							71.56
						9.63	9.63
29.35	24.26	10.32	7.96	20.34	13.77	12.14	285.91
15.83	10.61	7.03	7.96	5.10	3.44	4.21	122.14
						6.35	93.48
36.06						3.48	153.10
33.25	28.29	17.35	10.03	5.11	7.53	7.09	189.10
					2.72	4.54	86.34
18.70	28.29	14.48	10.03	5.10	3.44	4.21	158.06
18.70	12.38	10.31	6.75	4.26	4.62	5.39	110.92
3.99	2.93	2.36	1.86	8.01			64.64
26.73	21.23	14.64	9.54	6.76	5.16	5.64	68.94
							47.55
						max	285.91
						min	0.00
51.63	36.95	33.54	24.89	17.78	13.77	13.16	258.32
51.63	36.95	28.87	20.66	14.04	13.05	10.37	221.24
51.63	32.67	24.77	17.38	10.08	9.07	9.63	189.89
36.06	28.29	17.35	10.03	8.01	6.32	6.35	109.59
25.32	20.09	14.48	7.96	5.11	3.90	4.55	47.55
15.83	14.18	9.28	7.66	4.47	3.14	3.81	0.00
6.92	10.28	6.53	3.80	3.34	2.72	3.53	0.00

Sediment Trapping efficiency - supporting Calculations:

CHURCHILL METHOD (1948)

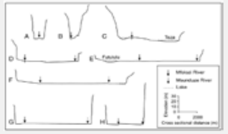
Calculation of Average Cross-Sectional Area



images from
Grenfell et al (2009)

look at extent of
area under 5m

see that cross sections
H-H, G-G & F_F
applicable to floodplain
</= 4 gmsl

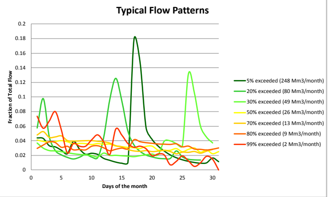


width F-F = 11 667 m
width G-G = 8 167 m
width H-H = 4 000m

average = 7 944 m

My Method

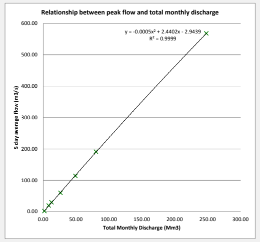
Calcultion of Peak Inflow Rates


Typical Flow Patterns

	prob. Exd. Mm3/month	99% 2.19	80% 8.60	70% 12.80	50% 26.50	30% 49.20	20% 80.30	5% 248.00
5	Int 1	1.69	3.41	7.03	12.13	16.47	46.16	103.03
10	Int 2	0.84	2.95	5.93	11.14	12.28	16.51	77.47
15	Int 3	1.07	2.95	5.33	10.52	11.44	70.25	40.54
20	Int 4	0.75	3.65	3.89	9.55	11.31	28.17	251.04
25	Int 5	0.41	3.46	3.69	8.29	19.24	16.98	63.28
30	Int 6	0.31	2.92	3.75	8.05	43.08	13.06	33.06
	max (m3/s)	1.69	19.33	29.62	59.69	113.82	191.12	568.42

Note: Each interval is a period of 5 days. Each tabled figure refers to average m3/s flow from daily data relevant 5 day period.

Mm3	peak (m3/s)
2.19	1.69
8.60	19.33
12.80	29.62
26.50	59.69
49.20	113.82
80.30	191.12
248.00	568.42


Relationship between peak flow and total monthly discharge

SEDIMENT SETTLING VELOCITY

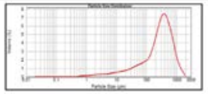


Figure 4-33: showing the particle size distribution for Mfolozi silt sample 1

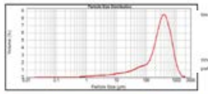


Figure 4-34: showing the particle size distribution for Mfolozi silt sample 2

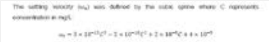
Particle size distribution curves completed by Maine (2011)

PARTICLE SIZES OF MFOLOZI SILT - data from C. Maine (2010)

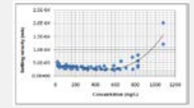
SAMPLE NAME	d_{10} (mm)	d_{50} (mm)	d_{90} (mm)		
Mfolozi Silt Sar	0.031	0.303	0.780		
Mfolozi Silt Sar	0.040	0.314	0.712		
Average	0.036	0.309	0.746		
settling velocity (stokes) m/s	0.0051	0.0962	2.2492		
Soulsby (1997)		0.0120		0.509	4.421
Van Rijn (1993)		0.012			

	floc	sediment	
ρp =	1300.0	2650	kg/m3
ρf =	1000.0	1000	kg/m3
g =	9.810	9.810	m/s2
μ =	0.001	0.001	N s/m2

Stoke's theory



mg/l	m/s
0.00	4.00E-05
200.00	3.84E-05
400.00	3.52E-05
600.00	4.48E-05
800.00	8.16E-05
1000.00	1.60E-04

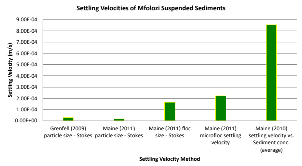


Maine (2010)

GRENFELL & ELLERY (2009) sediment data

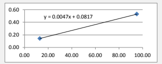
	(mm)	Stokes theory set. Vel (m/s)	Soulsby (1997)	Van Rijn (1993)
Bed Load D_{50}:	0.3500	0.4951		
Suspended Solids D_{50}:	0.0052	0.000027	0.00000403 0.075	0.0000040
Maine - floc - stokes	0.0300	0.000165337		
Maine (2011) particle siz	0.0040	0.00001631212		

Soil Sample - Method	Settling velocity
Grenfell (2009) particle size - Stokes	0.000027321
Grenfell - Soulsby	0.000004029
Grenfell - Van Rijn	0.000003979
Maine - Stokes	0.096161400
Maine - Soulsby	0.012026746
Maine - Van Rijn	0.011841636
Maine (2011) particle size - Stokes	0.000016312
Maine (2011) floc size - Stokes	0.000165337
Maine (2011) microfloc settling veloci	0.000222700
Maine (2010) settling velocity vs. Sedi	0.000852579
Maine - Conc - Oct	0.002504469
Maine - Conc - Nov	0.000598755
Maine - Conc - Dec	0.001132437
Maine - Conc - Jan	0.000070817
Maine - Conc - Feb	0.000035547
Maine - Conc - Mar	0.000040541
Maine - Conc - Apr	0.000040428
Maine - Conc - May	0.000040428
Maine - Conc - Jun	0.000037444
Maine - Conc - Jul	0.000036141
Maine - Conc - Aug	0.002656782
Maine - Conc - Sep	0.003037164


Settling Velocities of Mfolozi Suspended Sediments

micro m	mm/s
13.00	0.14
95.12	0.53
30.00	0.22

Maine (2011) fig 4-19 B



Measured Results by Prof Stretch and TUD Delf students

Validation of model

Results taken using *Hatch* turbidity meter

					Ave:	Trapping Eff.
Water entering flood plain (NTU):	473	471	447		464	
Transfer through old backchannel (20m): (flow rate: 1.6 m^3/s)	64	64	63	63	64	86.30%
Transfer through new backchannel (30m): (flow rate: 1.0 m^3/s)	74	74	73	71	73	84.26%
Mfolozi Mouth Area	86	86	87		86	81.38%

Results taken using *YSL*

					Ave:	Trapping Eff.
Water entering flood plain (NTU):	720	700			710	
Mfolozi Mouth Area	110	108	106		108	84.79%
						84.18%

m^3/s		Mm^3
1.60	=	4.22
1.00	=	2.64
		6.85

Email from Ricky Taylor to Prof Stretch (dated 21/11/2011)

	B(m)	Cd	h (m)	Q calc	Q measured	calc/measured	relationship
old outlet	20	0.385	0.262	4.57	0.87	526%	1.04
new outlet	30	0.385	0.262	6.86	2.08	330%	

TUD Delft field measurements

	B(m)	Cd	h (m)	Q calc	Q measured	calc/measured	
old outlet	20	0.385	0.500	12.06	1.60	753%	5.71
new outlet	30	0.385	0.500	18.08	1.00	1808%	

Sensitivity Analysis of Change in Berm Height

Berm Height (m)	Output into Estuary (Mm3 / year)	General Proportion of time that mouth is closed (%)	Sediment into St Lucia (ton/year)
1.00	0.07	2.99%	0.00
1.20	3.17	7.08%	0.00
1.50	11.43	12.07%	11.00
2.00	55.39	26.13%	909.68
2.25	73.50	30.76%	2326.99
2.50	85.01	32.30%	3760.72
3.00	129.16	42.29%	6971.92
3.50	235.14	56.26%	10564.94
4.00	256.35	56.81%	17445.89
5.00	256.35	56.81%	17445.89

Sensitivity Analysis of Change in Threshold Flow

Threshold Flow (Mm3)	Output into Estuary (Mm3 / year)	General Proportion of time that mouth is closed (%)	Sediment into St Lucia (ton/year)
2.00	11.82	5.90%	153.24
4.00	55.39	26.13%	909.68
6.00	84.89	40.56%	1308.00
8.00	113.41	52.18%	1649.83
10.00	118.88	55.26%	1767.57
15.00	145.38	65.61%	2127.41
20.00	150.22	67.88%	2175.20
30.00	160.30	72.41%	2245.18
40.00	169.80	75.68%	2263.95
50.00	175.04	77.22%	2445.47

Sensitivity Analysis of Change in Weir Height

Weir Height (m)	Output into Estuary (Mm3 / year)	General Proportion of time that mouth is closed (%)	Sediment into St Lucia (ton/year)
0.45	90.50	34.30%	3733.35
0.70	71.15	30.76%	2067.03
0.90	55.39	26.13%	909.68
1.10	32.89	18.60%	271.13
1.30	21.96	15.15%	88.49
1.50	12.04	12.34%	5.59
1.80	1.17	7.17%	0.00
2.00	0.00	6.26%	0.00

Sensitivity Analysis of Change in Breadth of Backchannel

Breadth	Output into Estuary	General Proportion of time that mouth is closed	Sediment into St Lucia

(m)	(Mm3 / year)	(%)	(ton/year)
0.00	0.00	6.26%	0.00
10.00	23.35	15.34%	137.34
20.00	55.39	26.13%	909.68
50.00	122.16	42.11%	5571.88
100.00	209.92	53.45%	16275.62
150.00	253.18	56.81%	21926.97
200.00	314.96	70.42%	26013.73
300.00	484.44	89.29%	46474.05
400.00	573.07	98.46%	55537.97
500.00	573.10	98.46%	55558.50

Sensitivity Analysis of Change in DTM model

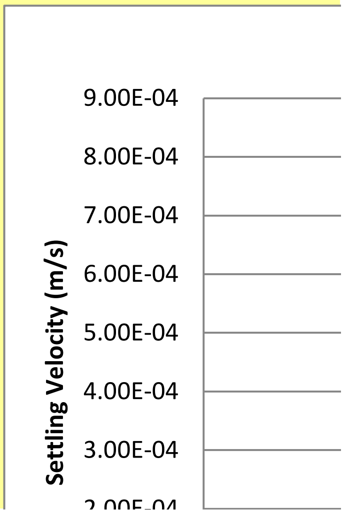
Model	Output into Estuary (Mm3 / year)	General Proportion of time that mouth is closed (%)	Sediment into St Lucia (ton/year)
Grenfell 2009	123.08	48.64%	0.00
Kelbe 2010	164.81	57.71%	0.00
Jugwanth 2010	132.54	50.45%	0.00
Crystal 2012	73.16	30.76%	2342.83

Sensitivity Analysis of Change Sediment Loading Conditions

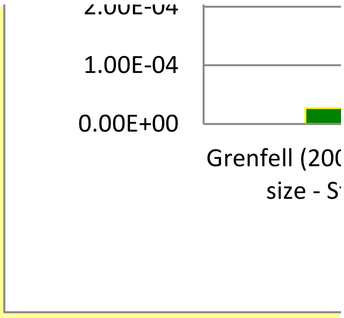
Estimate	Sediment into St Lucia (ton/year)
Maro (2012)	4003.86
Ave. of Mtubatuba WTW & UCOSP data	2342.83

Sensitivity Analysis of Change settling velocity

Model	Sediment into St Lucia (ton/year)	Sediment Trapping Efficiency (%)
Grenfell (2009) particle size - Stokes	12582.71	84.50
Maine (2011) particle size - Stokes	20431.50	75.73
Maine (2011) floc size - Stokes	1.87	99.53



Maine (2011) microfloc settling velocity	0.00	99.62
Maine (2010) settling velocity vs. Sediment conc.	2342.83	93.96



Sediment Trapping Efficiency (%)
98.52
99.05
98.30
95.13
93.96
92.35
92.05
91.98
90.13
90.13

OK!

First Enter Values in Column B for each Parameter, then ent
relevant macro-key:

Parameter	Control value
Berm Height (amsl)	2
Threshold Flow (Mm3/month)	4
Outflow Weir Height (amsl)	1.2
Breadth of Back Channel (m)	10
Hypsometric Curve	Chrystal (2011)
Settling Velocity	Maine (2010) settling
Sediment Loading	Ave. of Mtubatuba WTW

Sediment Trapping Efficiency (%)
89.38
95.13
95.74
95.79
95.83
95.74
95.92
95.93
96.05
95.97

Sediment Trapping Efficiency (%)
92.28
93.49
95.13
96.21
97.38
99.03
99.07
99.07

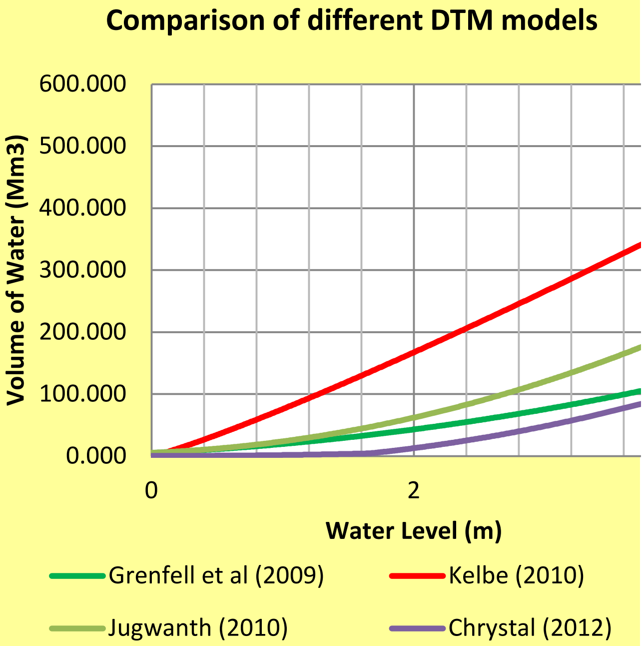
OK!

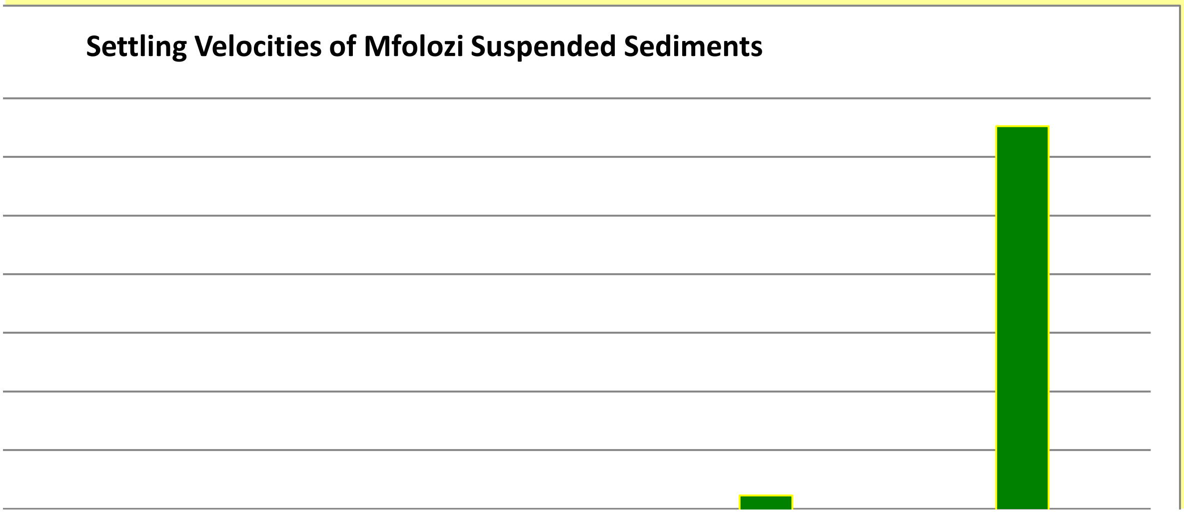
max value
must be <
height of berm

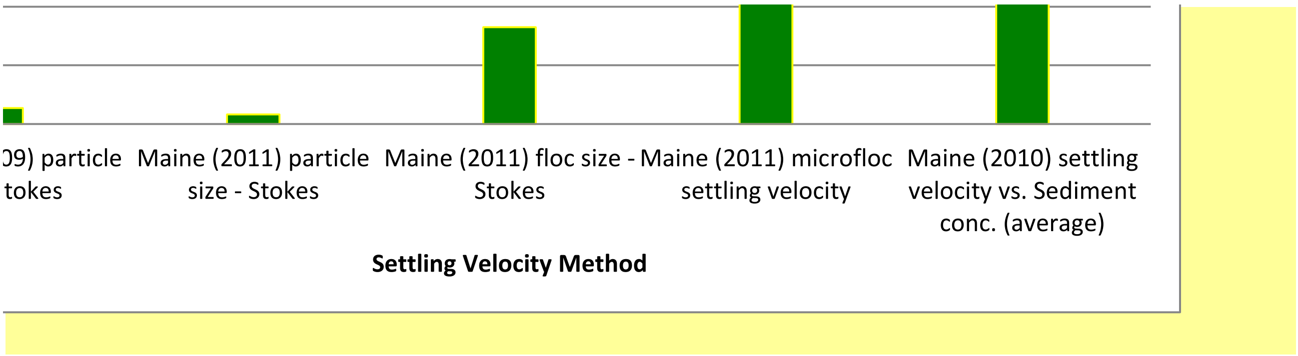
Sediment Trapping Efficiency

(%)
99.07
96.69
95.13
92.16
89.81
89.00
88.91
87.30
86.79
86.78

Sediment Trapping Efficiency (%)
99.76
99.77
99.76
93.96

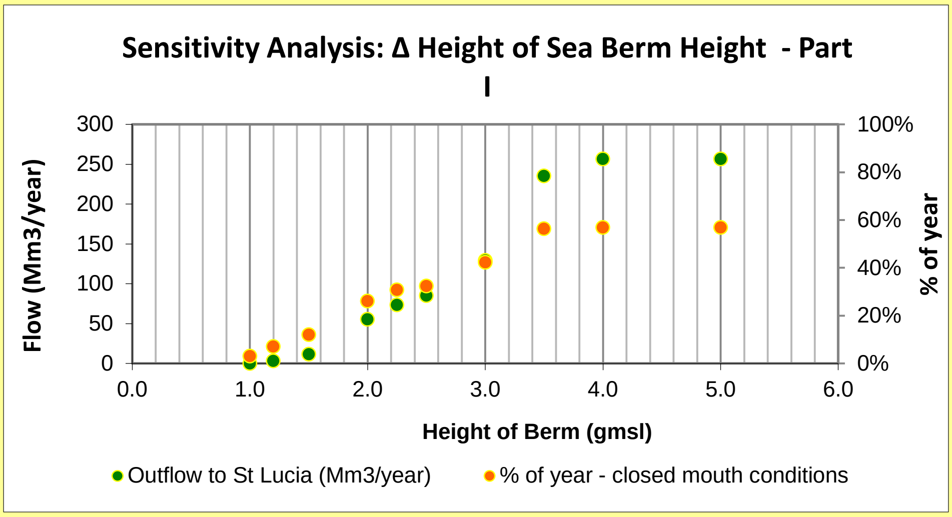

Comparison of different DTM models

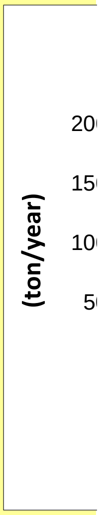

Settling Velocities of Mfolozi Suspended Sediments

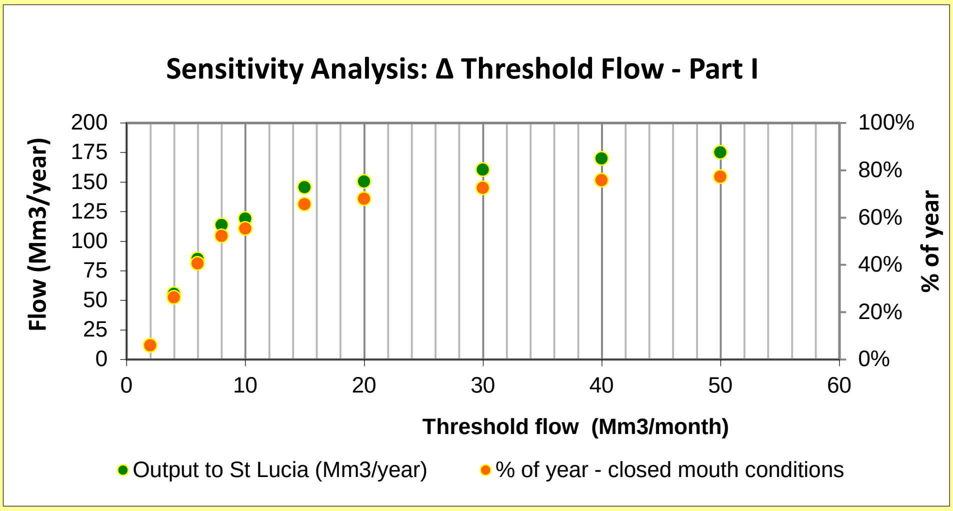

09) particle
tokes
Maine (2011) particle size - Stokes
Maine (2011) floc size - Stokes
Maine (2011) microfloc settling velocity
Maine (2010) settling velocity vs. Sediment conc. (average)
Settling Velocity Method

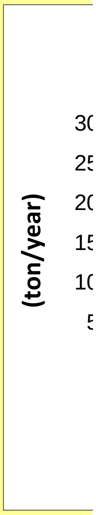
er the

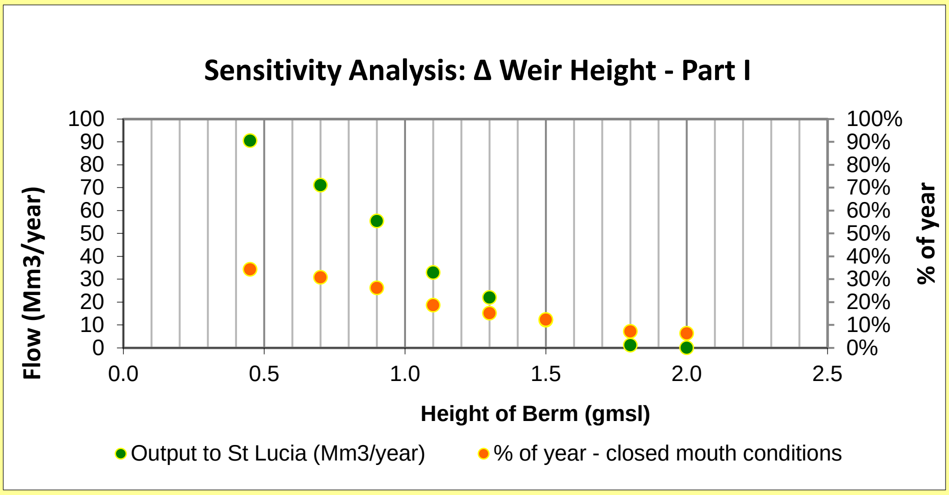
Macro Key:
Ctrl+Shift+b
Ctrl+Shift+t
Ctrl+Shift+w
Ctrl+Shift+c
Ctrl+Shift+d

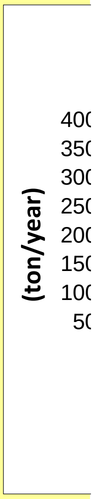

Sensitivity Analysis: Δ Height of Sea Berm Height - Part I

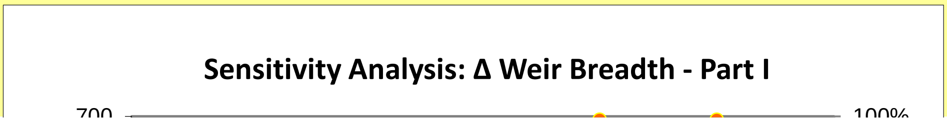



Sensitivity Analysis: Δ Threshold Flow - Part I

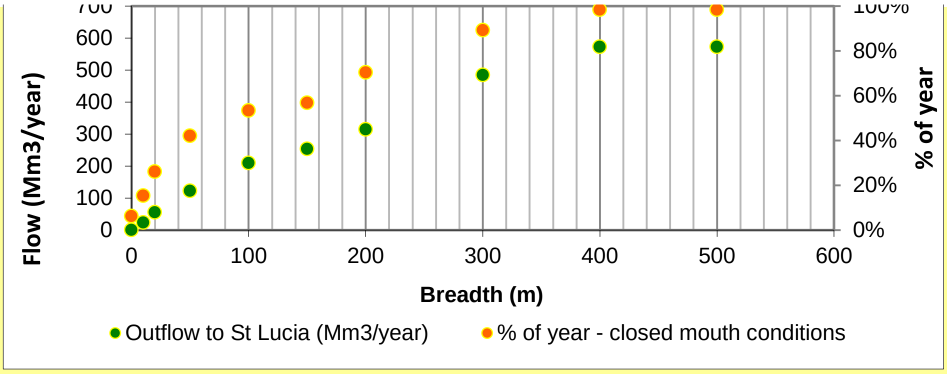


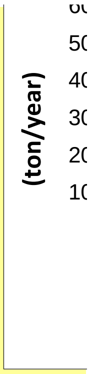

Sensitivity Analysis: Δ Weir Height - Part I

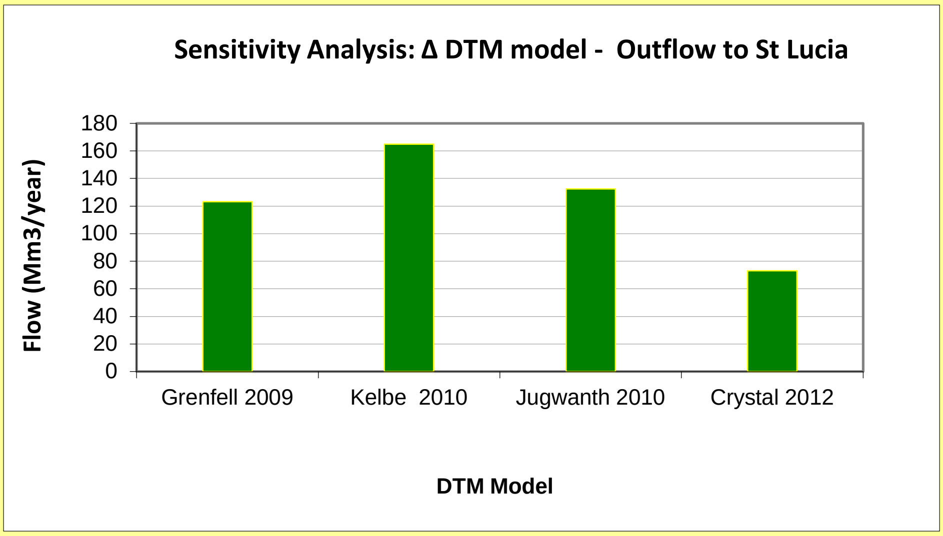


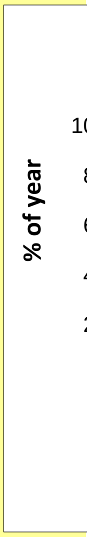

Sensitivity Analysis: Δ Weir Breadth - Part I

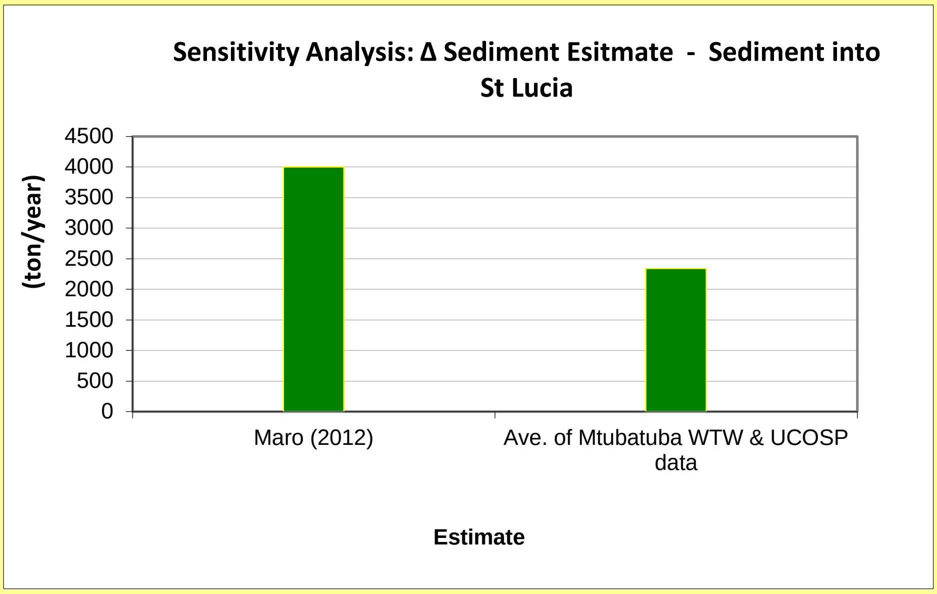

4

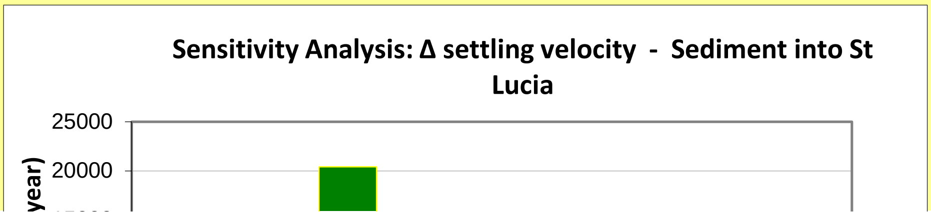

Flow (Mm3/year)
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
Breadth (m)
100%
80%
60%
40%
20%
0%
% of year
● Outflow to St Lucia (Mm3/year)
● % of year - closed mouth conditions

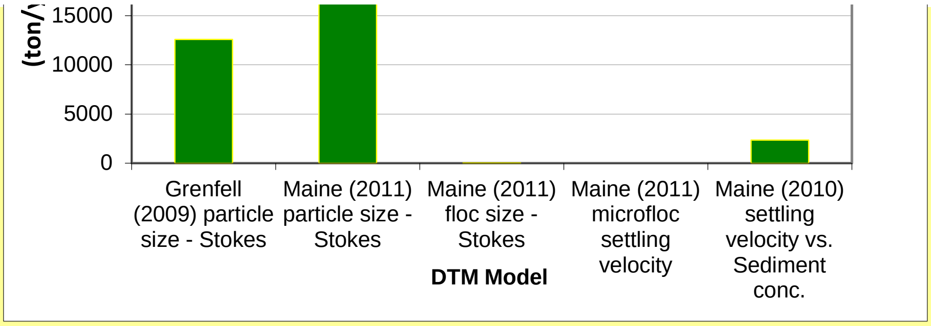

(ton/year)

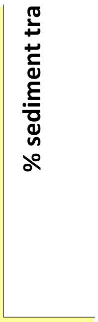

Sensitivity Analysis: Δ DTM model - Outflow to St Lucia
Flow (Mm3/year)
180
160
140
120
100
80
60
40
20
0
Grenfell 2009
Kelbe 2010
Jugwanth 2010
Crystal 2012
DTM Model

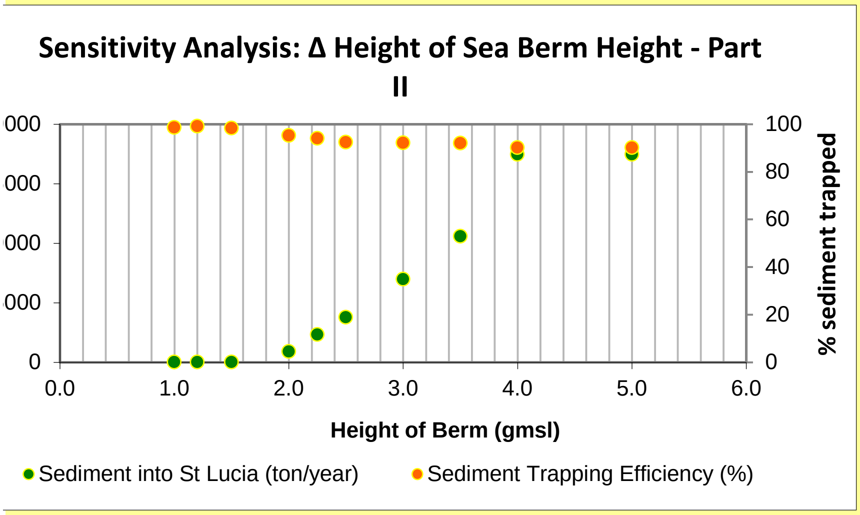

% of year

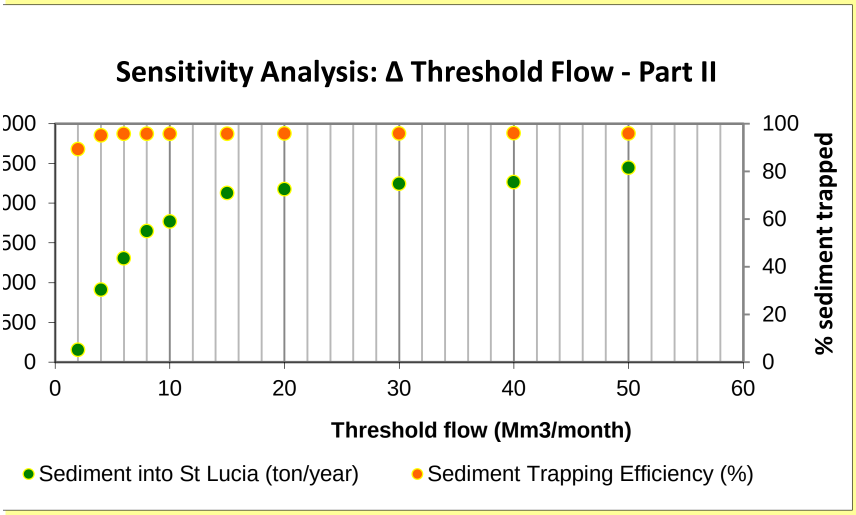

Sensitivity Analysis: Δ Sediment Esitmate - Sediment into St Lucia
(ton/year)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Maro (2012)
Ave. of Mtubatuba WTW & UCOSP data
Estimate

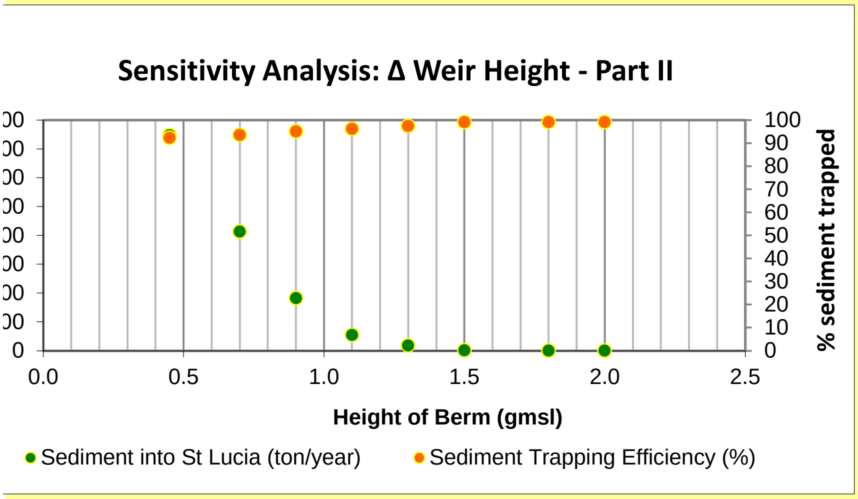

Sensitivity Analysis: Δ settling velocity - Sediment into St Lucia
25000
20000
year)

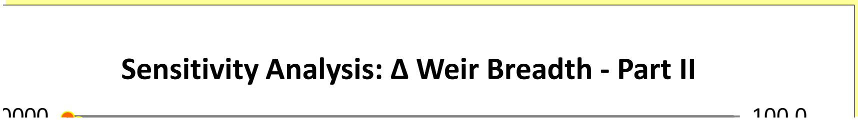

(ton/y
15000
10000
5000
0
Grenfell (2009) particle size - Stokes
Maine (2011) particle size - Stokes
Maine (2011) floc size - Stokes
Maine (2011) microfloc settling velocity
Maine (2010) settling velocity vs. Sediment conc.
DTM Model

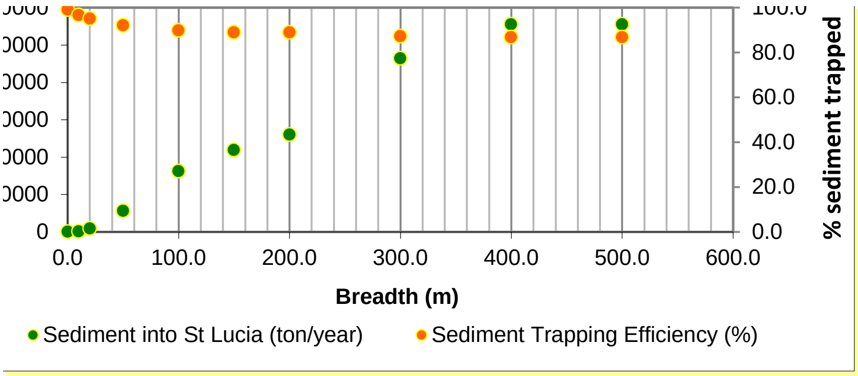

% sediment tra

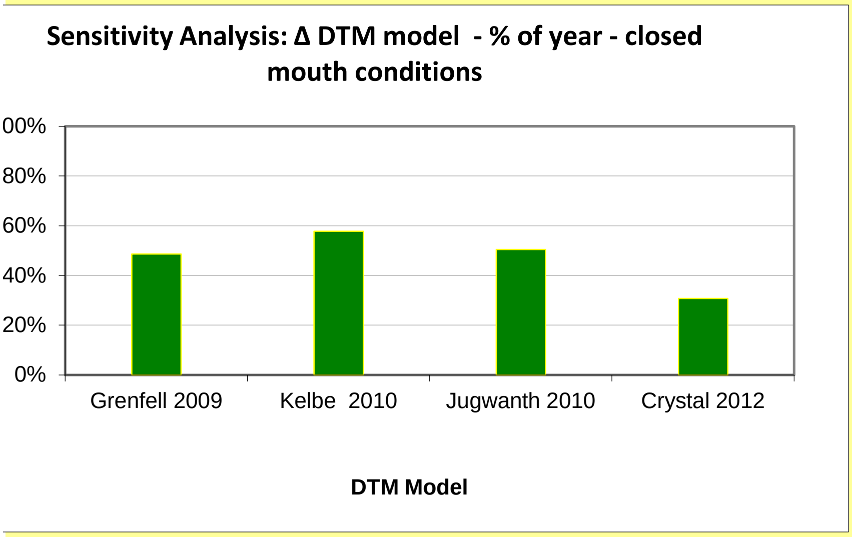

Sensitivity Analysis: Δ Height of Sea Berm Height - Part II
000
000
000
000
0
100
80
60
40
20
0
% sediment trapped
0.0
1.0
2.0
3.0
4.0
5.0
6.0
Height of Berm (gmsl)
● Sediment into St Lucia (ton/year)
● Sediment Trapping Efficiency (%)

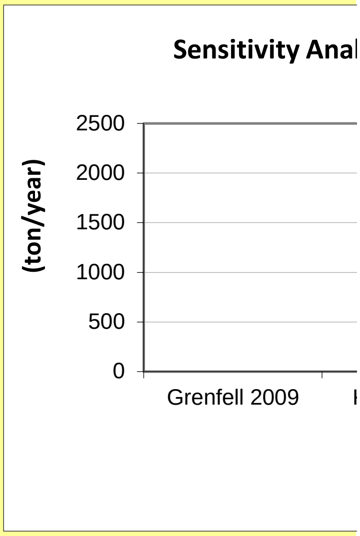

Sensitivity Analysis: Δ Threshold Flow - Part II
000
500
000
500
000
500
0
100
80
60
40
20
0
% sediment trapped
0
10
20
30
40
50
60
Threshold flow (Mm3/month)
● Sediment into St Lucia (ton/year)
● Sediment Trapping Efficiency (%)

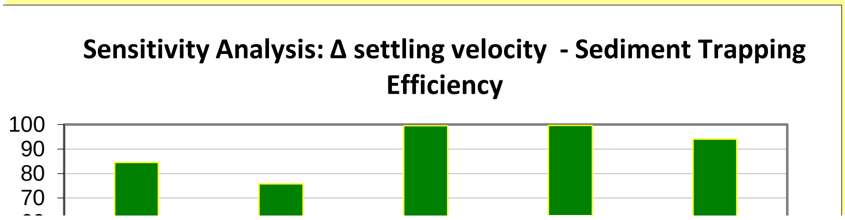

Sensitivity Analysis: Δ Weir Height - Part II
00
00
00
00
00
00
00
00
0
100
90
80
70
60
50
40
30
20
10
0
% sediment trapped
0.0
0.5
1.0
1.5
2.0
2.5
Height of Berm (gmsl)
● Sediment into St Lucia (ton/year)
● Sediment Trapping Efficiency (%)

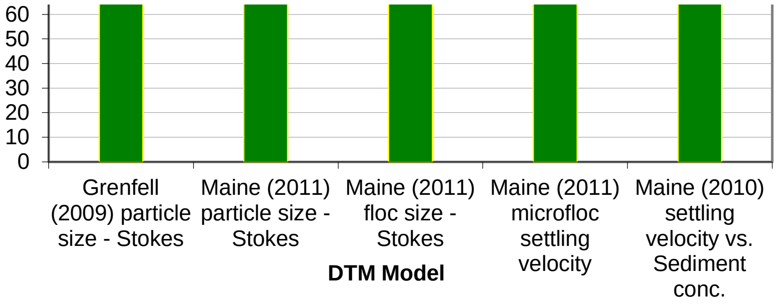

Sensitivity Analysis: Δ Weir Breadth - Part II
0000
100.0

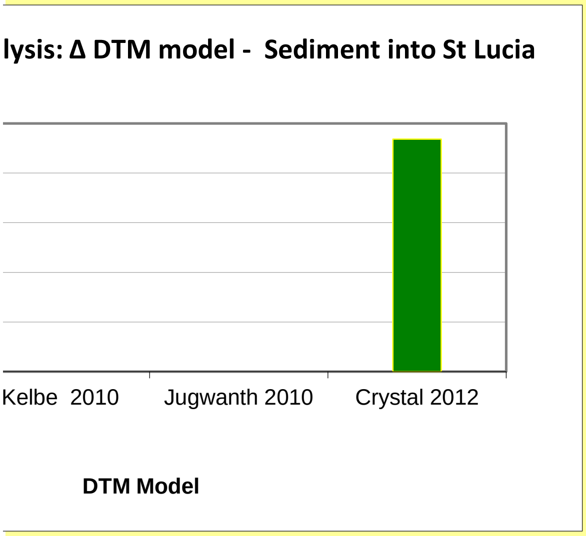



Sensitivity Analysis: Δ DTM model - % of year - closed mouth conditions

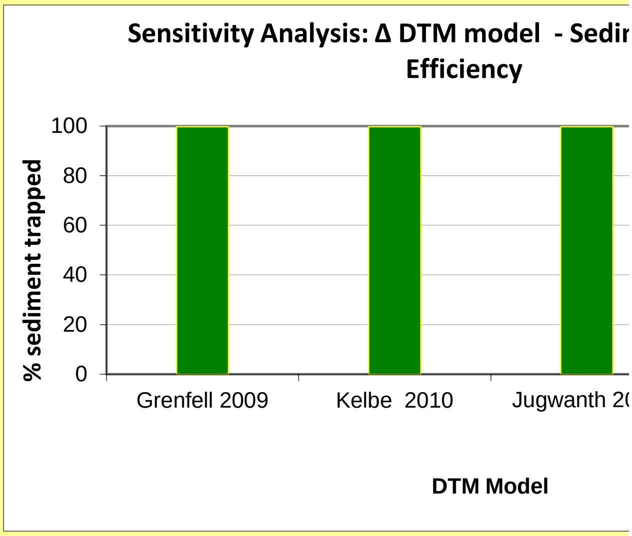

Sensitivity Anal


Sensitivity Analysis: Δ settling velocity - Sediment Trapping Efficiency

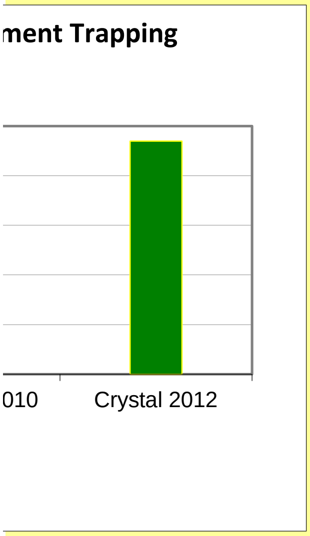

60
50
40
30
20
10
0
Grenfell (2009) particle size - Stokes
Maine (2011) particle size - Stokes
Maine (2011) floc size - Stokes
Maine (2011) microfloc settling velocity
Maine (2010) settling velocity vs. Sediment conc.
DTM Model

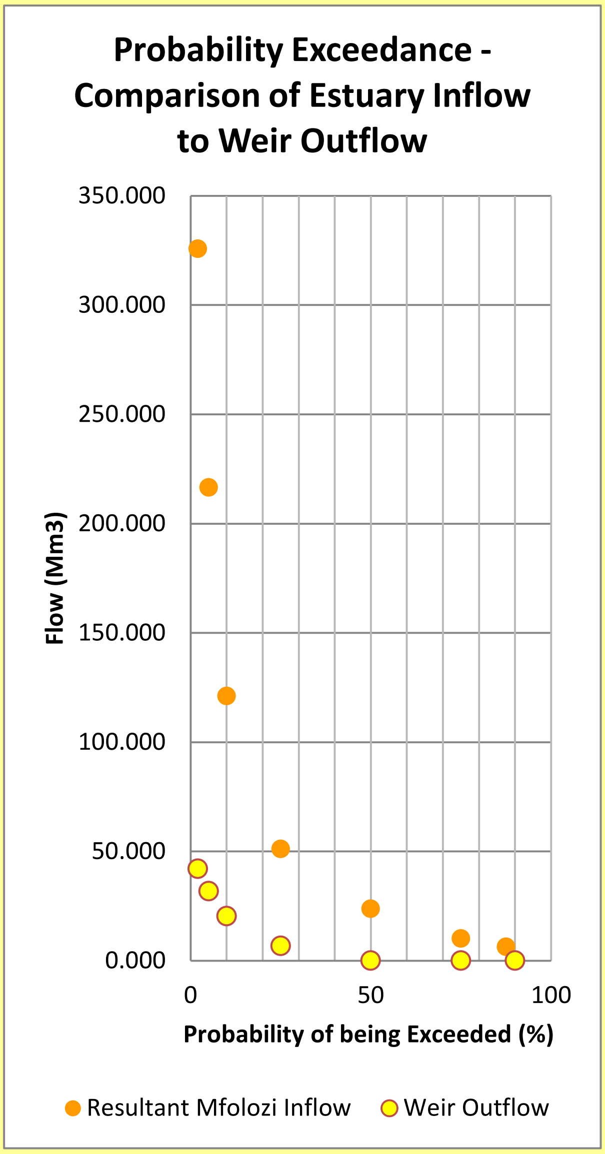


lysis: Δ DTM model - Sediment into St Lucia



Sensitivity Analysis: Δ DTM model - Sedir Efficiency


ment Trapping
010
Crystal 2012



% Exceedance - Mfolozi Flo		
% Exceeded		Position
2	% exceeded	1082
5	% exceeded	1049
10	% exceeded	994
25	% exceeded	828
50	% exceeded	552
75	% exceeded	276
87.5	% exceeded	138

% Exceedance - Flow into Estu (including 0 flows		
% Exceeded		Position
2	% exceeded	1082
5	% exceeded	1049
10	% exceeded	994
25	% exceeded	828
50	% exceeded	552
75	% exceeded	276
90	% exceeded	110

% Exceedance - Flow into Est		
% Exceeded		Position
2	% exceeded	90
5	% exceeded	87
10	% exceeded	83
25	% exceeded	69
50	% exceeded	46
75	% exceeded	23
90	% exceeded	9

w / month
Flow (Mm3)
325.668
216.513
121.034
51.088
23.704
10.083
6.382

uary / month)
Flow (Mm3)
42.04027745
31.74235495
20.41930495
6.763226504
0
0
0

tuary / year
Flow (Mm3)
258.326
221.522
189.977
110.034
45.322
0.000
0.000

Flow into Estuary / year			
Date	Resultant Inflow into Flood Plain (Mm3)	Flow from river into estuary (Mm3)	Flow into estuary / year
Oct-1918	2.192	1.405	
Nov-1918	2.116	2.116	
Dec-1918	20.195	20.195	
Jan-1919	31.742	31.742	
Feb-1919	51.089	51.089	
Mar-1919	51.632	51.632	
Apr-1919	69.429	15.918	
May-1919	58.823	0.000	
Jun-1919	27.739	0.000	
Jul-1919	14.289	0.000	
Aug-1919	9.662	0.000	
Sep-1919	8.352	0.000	174.098
Oct-1919	6.807	0.000	
Nov-1919	13.975	0.000	
Dec-1919	16.989	0.000	
Jan-1920	325.668	0.000	
Feb-1920	326.615	0.000	
Mar-1920	684.017	0.000	
Apr-1920	255.682	0.000	
May-1920	89.737	0.000	
Jun-1920	50.021	0.000	
Jul-1920	27.805	0.000	
Aug-1920	13.829	0.000	
Sep-1920	12.191	0.000	Jan-1900
Oct-1920	36.431	0.000	
Nov-1920	49.774	0.000	
Dec-1920	89.354	0.000	
Jan-1921	89.564	0.000	
Feb-1921	69.937	0.000	
Mar-1921	139.259	0.000	
Apr-1921	69.450	0.000	
May-1921	42.656	0.000	
Jun-1921	20.316	0.000	
Jul-1921	11.893	0.000	
Aug-1921	6.382	0.000	
Sep-1921	10.419	0.000	Jan-1900
Oct-1921	23.736	0.000	
Nov-1921	126.340	0.000	
Dec-1921	144.683	0.000	
Jan-1922	89.564	0.000	
Feb-1922	90.511	0.000	
Mar-1922	70.480	0.000	

Apr-1922	42.944	0.000	
May-1922	28.026	0.000	
Jun-1922	14.222	0.000	
Jul-1922	8.054	0.000	
Aug-1922	11.433	0.000	
Sep-1922	7.140	0.000	Jan-1900
Oct-1922	14.254	0.000	
Nov-1922	27.491	0.000	
Dec-1922	36.305	0.000	
Jan-1923	137.769	0.000	
Feb-1923	121.739	0.000	
Mar-1923	70.480	0.000	
Apr-1923	36.975	0.000	
May-1923	17.372	0.000	
Jun-1923	7.987	0.000	
Jul-1923	6.842	0.000	
Aug-1923	3.505	0.000	
Sep-1923	2.745	1.958	Jan-1900
Oct-1923	3.886	3.886	
Nov-1923	4.812	4.812	
Dec-1923	16.963	16.963	
Jan-1924	17.187	17.187	
Feb-1924	32.707	32.707	
Mar-1924	60.147	36.061	
Apr-1924	36.975	0.000	
May-1924	28.026	0.000	
Jun-1924	14.222	0.000	
Jul-1924	6.842	0.000	
Aug-1924	4.685	0.000	
Sep-1924	10.419	9.632	Apr-1900
Oct-1924	11.813	11.813	
Nov-1924	31.374	31.374	
Dec-1924	89.328	7.243	
Jan-1925	126.702	0.000	
Feb-1925	242.929	0.000	
Mar-1925	3223.066	0.000	
Apr-1925	1135.811	0.000	
May-1925	791.654	0.000	
Jun-1925	586.869	0.000	
Jul-1925	241.933	0.000	
Aug-1925	68.482	0.000	
Sep-1925	69.239	0.000	Feb-1900
Oct-1925	68.906	0.000	
Nov-1925	58.288	0.000	
Dec-1925	58.440	0.000	
Jan-1926	58.650	0.000	
Feb-1926	51.083	0.000	
Mar-1926	60.140	0.000	
Apr-1926	32.215	0.000	
May-1926	20.604	0.000	

Jun-1926	14.222	0.000	
Jul-1926	6.842	0.000	
Aug-1926	3.839	0.000	
Sep-1926	7.140	6.353	Jan-1900
Oct-1926	7.976	7.976	
Nov-1926	11.561	11.561	
Dec-1926	16.963	16.963	
Jan-1927	20.419	20.419	
Feb-1927	32.707	32.707	
Mar-1927	51.632	51.632	
Apr-1927	28.293	28.293	
May-1927	17.345	17.345	
Jun-1927	10.029	10.029	
Jul-1927	10.082	10.082	
Aug-1927	6.321	6.321	
Sep-1927	5.392	5.392	Aug-1900
Oct-1927	14.211	14.211	
Nov-1927	16.820	16.820	
Dec-1927	36.279	36.279	
Jan-1928	68.978	16.362	
Feb-1928	69.937	0.000	
Mar-1928	51.626	0.000	
Apr-1928	36.975	0.000	
May-1928	28.026	0.000	
Jun-1928	11.826	0.000	
Jul-1928	6.842	0.000	
Aug-1928	4.685	0.000	
Sep-1928	7.140	6.353	Mar-1900
Oct-1928	6.764	6.764	
Nov-1928	7.722	7.722	
Dec-1928	11.705	11.705	
Jan-1929	23.807	23.807	
Feb-1929	21.384	21.384	
Mar-1929	139.265	3.059	
Apr-1929	69.450	0.000	
May-1929	36.687	0.000	
Jun-1929	31.639	0.000	
Jul-1929	20.383	0.000	
Aug-1929	11.433	0.000	
Sep-1929	24.069	0.000	Mar-1900
Oct-1929	36.431	0.000	
Nov-1929	36.153	0.000	
Dec-1929	36.305	0.000	
Jan-1930	216.513	0.000	
Feb-1930	138.716	0.000	
Mar-1930	139.259	0.000	
Apr-1930	69.450	0.000	
May-1930	31.927	0.000	
Jun-1930	20.316	0.000	
Jul-1930	11.893	0.000	

Aug-1930	7.594	0.000	
Sep-1930	10.419	0.000	Jan-1900
Oct-1930	8.019	0.000	
Nov-1930	11.579	0.000	
Dec-1930	16.989	0.000	
Jan-1931	20.431	0.000	
Feb-1931	24.766	0.000	
Mar-1931	25.309	0.000	
Apr-1931	14.798	0.000	
May-1931	8.275	0.000	
Jun-1931	5.077	0.000	
Jul-1931	4.298	3.511	
Aug-1931	2.835	2.835	
Sep-1931	2.695	2.695	Jan-1900
Oct-1931	3.277	3.277	
Nov-1931	6.510	6.510	
Dec-1931	9.933	9.933	
Jan-1932	11.929	11.929	
Feb-1932	127.655	3.534	
Mar-1932	146.384	0.000	
Apr-1932	255.682	0.000	
May-1932	255.394	0.000	
Jun-1932	89.449	0.000	
Jul-1932	36.466	0.000	
Aug-1932	16.692	0.000	
Sep-1932	12.191	0.000	Feb-1900
Oct-1932	11.858	0.000	
Nov-1932	16.837	0.000	
Dec-1932	42.273	0.000	
Jan-1933	50.136	0.000	
Feb-1933	59.597	0.000	
Mar-1933	43.973	0.000	
Apr-1933	24.280	0.000	
May-1933	12.114	0.000	
Jun-1933	6.775	0.000	
Jul-1933	5.144	0.000	
Aug-1933	3.505	2.718	
Sep-1933	3.602	3.602	Jan-1900
Oct-1933	3.886	3.886	
Nov-1933	13.957	13.957	
Dec-1933	36.279	36.279	
Jan-1934	89.552	7.199	
Feb-1934	121.739	0.000	
Mar-1934	91.054	0.000	
Apr-1934	59.111	0.000	
May-1934	36.687	0.000	
Jun-1934	27.739	0.000	
Jul-1934	20.383	0.000	
Aug-1934	16.692	0.000	
Sep-1934	10.419	0.000	Mar-1900

Oct-1934	10.086	0.000	
Nov-1934	20.069	0.000	
Dec-1934	58.440	0.000	
Jan-1935	58.650	0.000	
Feb-1935	51.083	0.000	
Mar-1935	51.626	0.000	
Apr-1935	32.215	0.000	
May-1935	23.991	0.000	
Jun-1935	17.084	0.000	
Jul-1935	10.121	0.000	
Aug-1935	7.594	0.000	
Sep-1935	5.442	0.000	Jan-1900
Oct-1935	4.263	3.476	
Nov-1935	3.966	3.966	
Dec-1935	6.654	6.654	
Jan-1936	20.419	20.419	
Feb-1936	51.089	51.089	
Mar-1936	70.486	14.965	
Apr-1936	42.944	0.000	
May-1936	58.823	0.000	
Jun-1936	31.639	0.000	
Jul-1936	17.151	0.000	
Aug-1936	7.594	0.000	
Sep-1936	7.140	0.000	Apr-1900
Oct-1936	11.858	0.000	
Nov-1936	42.121	0.000	
Dec-1936	27.644	0.000	
Jan-1937	89.564	0.000	
Feb-1937	185.369	0.000	
Mar-1937	128.192	0.000	
Apr-1937	90.025	0.000	
May-1937	31.927	0.000	
Jun-1937	17.084	0.000	
Jul-1937	11.893	0.000	
Aug-1937	7.594	0.000	
Sep-1937	8.352	0.000	Jan-1900
Oct-1937	6.807	0.000	
Nov-1937	9.807	0.000	
Dec-1937	49.926	0.000	
Jan-1938	58.650	0.000	
Feb-1938	90.511	0.000	
Mar-1938	60.140	0.000	
Apr-1938	59.111	0.000	
May-1938	28.026	0.000	
Jun-1938	23.704	0.000	
Jul-1938	17.151	0.000	
Aug-1938	11.433	0.000	
Sep-1938	8.352	0.000	Jan-1900
Oct-1938	14.254	0.000	
Nov-1938	13.975	0.000	

Dec-1938	42.273	0.000	
Jan-1939	50.136	0.000	
Feb-1939	242.929	0.000	
Mar-1939	256.712	0.000	
Apr-1939	127.163	0.000	
May-1939	89.737	0.000	
Jun-1939	42.368	0.000	
Jul-1939	31.706	0.000	
Aug-1939	16.692	0.000	
Sep-1939	20.681	0.000	Jan-1900
Oct-1939	20.348	0.000	
Nov-1939	58.288	0.000	
Dec-1939	58.440	0.000	
Jan-1940	89.564	0.000	
Feb-1940	51.083	0.000	
Mar-1940	70.480	0.000	
Apr-1940	50.596	0.000	
May-1940	89.737	0.000	
Jun-1940	120.677	0.000	
Jul-1940	50.087	0.000	
Aug-1940	27.346	0.000	
Sep-1940	24.069	0.000	Jan-1900
Oct-1940	17.116	0.000	
Nov-1940	42.121	0.000	
Dec-1940	89.354	0.000	
Jan-1941	68.990	0.000	
Feb-1941	51.083	0.000	
Mar-1941	38.005	0.000	
Apr-1941	36.975	0.000	
May-1941	17.372	0.000	
Jun-1941	10.054	0.000	
Jul-1941	6.842	0.000	
Aug-1941	3.839	0.000	
Sep-1941	4.596	3.809	Jan-1900
Oct-1941	4.220	4.220	
Nov-1941	9.790	9.790	
Dec-1941	9.933	9.933	
Jan-1942	31.742	31.742	
Feb-1942	43.436	43.436	
Mar-1942	91.061	6.915	
Apr-1942	50.596	0.000	
May-1942	31.927	0.000	
Jun-1942	23.704	0.000	
Jul-1942	11.893	0.000	
Aug-1942	9.662	0.000	
Sep-1942	12.191	0.000	Apr-1900
Oct-1942	11.858	0.000	
Nov-1942	27.491	0.000	
Dec-1942	89.354	0.000	
Jan-1943	68.990	0.000	

Feb-1943	90.511	0.000	
Mar-1943	256.712	0.000	
Apr-1943	326.128	0.000	
May-1943	216.686	0.000	
Jun-1943	89.449	0.000	
Jul-1943	68.941	0.000	
Aug-1943	68.482	0.000	
Sep-1943	36.764	0.000	Jan-1900
Oct-1943	58.567	0.000	
Nov-1943	89.202	0.000	
Dec-1943	126.492	0.000	
Jan-1944	89.564	0.000	
Feb-1944	217.460	0.000	
Mar-1944	122.282	0.000	
Apr-1944	59.111	0.000	
May-1944	23.991	0.000	
Jun-1944	36.400	0.000	
Jul-1944	20.383	0.000	
Aug-1944	11.433	0.000	
Sep-1944	24.069	0.000	Jan-1900
Oct-1944	23.736	0.000	
Nov-1944	31.392	0.000	
Dec-1944	36.305	0.000	
Jan-1945	50.136	0.000	
Feb-1945	69.937	0.000	
Mar-1945	243.472	0.000	
Apr-1945	90.025	0.000	
May-1945	42.656	0.000	
Jun-1945	20.316	0.000	
Jul-1945	10.121	0.000	
Aug-1945	4.685	0.000	
Sep-1945	4.596	3.809	Jan-1900
Oct-1945	4.220	4.220	
Nov-1945	3.633	3.633	
Dec-1945	6.654	6.654	
Jan-1946	36.503	36.503	
Feb-1946	32.707	32.707	
Mar-1946	51.632	51.632	
Apr-1946	32.193	32.193	
May-1946	14.483	14.483	
Jun-1946	7.962	7.962	
Jul-1946	5.105	5.105	
Aug-1946	3.444	3.444	
Sep-1946	4.212	4.212	Jul-1900
Oct-1946	6.764	6.764	
Nov-1946	9.790	9.790	
Dec-1946	20.195	20.195	
Jan-1947	27.842	27.842	
Feb-1947	69.943	15.440	
Mar-1947	70.480	0.000	

Apr-1947	50.596	0.000	
May-1947	23.991	0.000	
Jun-1947	17.084	0.000	
Jul-1947	11.893	0.000	
Aug-1947	6.382	0.000	
Sep-1947	7.140	0.000	Mar-1900
Oct-1947	8.019	0.000	
Nov-1947	23.457	0.000	
Dec-1947	31.544	0.000	
Jan-1948	31.754	0.000	
Feb-1948	43.430	0.000	
Mar-1948	51.626	0.000	
Apr-1948	42.944	0.000	
May-1948	20.604	0.000	
Jun-1948	10.054	0.000	
Jul-1948	5.144	0.000	
Aug-1948	3.505	2.718	
Sep-1948	4.544	4.544	Jan-1900
Oct-1948	6.762	6.762	
Nov-1948	13.957	13.957	
Dec-1948	16.963	16.963	
Jan-1949	50.123	50.123	
Feb-1949	59.603	38.946	
Mar-1949	60.140	0.000	
Apr-1949	127.163	0.000	
May-1949	50.308	0.000	
Jun-1949	31.639	0.000	
Jul-1949	14.289	0.000	
Aug-1949	7.594	0.000	
Sep-1949	7.140	0.000	May-1900
Oct-1949	14.254	0.000	
Nov-1949	20.069	0.000	
Dec-1949	68.779	0.000	
Jan-1950	68.990	0.000	
Feb-1950	69.937	0.000	
Mar-1950	91.054	0.000	
Apr-1950	50.596	0.000	
May-1950	31.927	0.000	
Jun-1950	14.222	0.000	
Jul-1950	8.054	0.000	
Aug-1950	4.685	0.000	
Sep-1950	4.596	3.809	Jan-1900
Oct-1950	5.066	5.066	
Nov-1950	4.813	4.813	
Dec-1950	20.195	20.195	
Jan-1951	23.807	23.807	
Feb-1951	18.153	18.153	
Mar-1951	33.251	33.251	
Apr-1951	28.293	28.293	
May-1951	14.483	14.483	

Jun-1951	10.029	10.029	
Jul-1951	5.105	5.105	
Aug-1951	13.768	13.768	
Sep-1951	10.369	10.369	Jul-1900
Oct-1951	17.073	17.073	
Nov-1951	9.790	9.790	
Dec-1951	27.618	27.618	
Jan-1952	27.842	27.842	
Feb-1952	28.807	28.807	
Mar-1952	25.315	25.315	
Apr-1952	14.776	14.776	
May-1952	12.087	12.087	
Jun-1952	7.962	7.962	
Jul-1952	8.015	8.015	
Aug-1952	4.623	4.623	
Sep-1952	4.212	4.212	Jul-1900
Oct-1952	3.886	3.886	
Nov-1952	11.561	11.561	
Dec-1952	31.518	31.518	
Jan-1953	31.742	31.742	
Feb-1953	43.436	43.436	
Mar-1953	38.011	38.011	
Apr-1953	28.293	28.293	
May-1953	14.483	14.483	
Jun-1953	7.962	7.962	
Jul-1953	5.105	5.105	
Aug-1953	3.778	3.778	
Sep-1953	4.546	4.546	Aug-1900
Oct-1953	5.066	5.066	
Nov-1953	13.957	13.957	
Dec-1953	16.963	16.963	
Jan-1954	20.419	20.419	
Feb-1954	43.436	43.436	
Mar-1954	38.011	38.011	
Apr-1954	36.954	36.954	
May-1954	36.661	36.661	
Jun-1954	20.291	20.291	
Jul-1954	10.082	10.082	
Aug-1954	6.321	6.321	
Sep-1954	10.369	10.369	Sep-1900
Oct-1954	31.628	31.628	
Nov-1954	42.103	42.103	
Dec-1954	31.518	31.518	
Jan-1955	89.552	7.199	
Feb-1955	90.511	0.000	
Mar-1955	185.912	0.000	
Apr-1955	90.025	0.000	
May-1955	42.656	0.000	
Jun-1955	20.316	0.000	
Jul-1955	10.121	0.000	

Aug-1955	6.382	0.000	
Sep-1955	5.442	0.000	Apr-1900
Oct-1955	11.858	11.071	
Nov-1955	27.473	27.473	
Dec-1955	42.247	42.247	
Jan-1956	23.807	23.807	
Feb-1956	145.846	2.843	
Mar-1956	146.384	0.000	
Apr-1956	59.111	0.000	
May-1956	42.656	0.000	
Jun-1956	23.704	0.000	
Jul-1956	11.893	0.000	
Aug-1956	7.594	0.000	
Sep-1956	10.419	0.000	Apr-1900
Oct-1956	23.736	0.000	
Nov-1956	42.121	0.000	
Dec-1956	216.303	0.000	
Jan-1957	241.982	0.000	
Feb-1957	256.169	0.000	
Mar-1957	243.472	0.000	
Apr-1957	255.682	0.000	
May-1957	89.737	0.000	
Jun-1957	42.368	0.000	
Jul-1957	42.435	0.000	
Aug-1957	23.311	0.000	
Sep-1957	121.042	0.000	Jan-1900
Oct-1957	325.584	0.000	
Nov-1957	216.151	0.000	
Dec-1957	184.211	0.000	
Jan-1958	325.668	0.000	
Feb-1958	484.834	0.000	
Mar-1958	218.003	0.000	
Apr-1958	216.974	0.000	
May-1958	69.162	0.000	
Jun-1958	36.400	0.000	
Jul-1958	17.151	0.000	
Aug-1958	9.662	0.000	
Sep-1958	10.419	0.000	Jan-1900
Oct-1958	17.116	0.000	
Nov-1958	36.153	0.000	
Dec-1958	49.926	0.000	
Jan-1959	89.564	0.000	
Feb-1959	69.937	0.000	
Mar-1959	43.973	0.000	
Apr-1959	28.314	0.000	
May-1959	28.026	0.000	
Jun-1959	11.826	0.000	
Jul-1959	6.842	0.000	
Aug-1959	4.685	0.000	
Sep-1959	7.140	6.353	Jan-1900

Oct-1959	14.211	14.211	
Nov-1959	16.820	16.820	
Dec-1959	36.279	36.279	
Jan-1960	31.742	31.742	
Feb-1960	59.603	38.946	
Mar-1960	60.140	0.000	
Apr-1960	69.450	0.000	
May-1960	36.687	0.000	
Jun-1960	17.084	0.000	
Jul-1960	10.121	0.000	
Aug-1960	6.382	0.000	
Sep-1960	7.140	0.000	May-1900
Oct-1960	10.086	0.000	
Nov-1960	42.121	0.000	
Dec-1960	184.211	0.000	
Jan-1961	184.422	0.000	
Feb-1961	145.841	0.000	
Mar-1961	91.054	0.000	
Apr-1961	90.025	0.000	
May-1961	50.308	0.000	
Jun-1961	50.021	0.000	
Jul-1961	27.805	0.000	
Aug-1961	13.829	0.000	
Sep-1961	17.449	0.000	Jan-1900
Oct-1961	20.348	0.000	
Nov-1961	27.491	0.000	
Dec-1961	27.644	0.000	
Jan-1962	31.754	0.000	
Feb-1962	24.766	0.000	
Mar-1962	43.973	0.000	
Apr-1962	42.944	0.000	
May-1962	20.604	0.000	
Jun-1962	10.054	0.000	
Jul-1962	5.144	0.000	
Aug-1962	4.685	3.898	
Sep-1962	4.546	4.546	Jan-1900
Oct-1962	7.976	7.976	
Nov-1962	23.439	23.439	
Dec-1962	49.900	49.900	
Jan-1963	68.978	16.362	
Feb-1963	59.597	0.000	
Mar-1963	70.480	0.000	
Apr-1963	59.111	0.000	
May-1963	28.026	0.000	
Jun-1963	36.400	0.000	
Jul-1963	184.373	0.000	
Aug-1963	58.142	0.000	
Sep-1963	28.103	0.000	Apr-1900
Oct-1963	27.770	0.000	
Nov-1963	36.153	0.000	

Dec-1963	36.305	0.000	
Jan-1964	58.650	0.000	
Feb-1964	43.430	0.000	
Mar-1964	33.244	0.000	
Apr-1964	42.944	0.000	
May-1964	20.604	0.000	
Jun-1964	11.826	0.000	
Jul-1964	8.054	0.000	
Aug-1964	4.685	0.000	
Sep-1964	4.596	3.809	Jan-1900
Oct-1964	20.305	20.305	
Nov-1964	23.439	23.439	
Dec-1964	36.279	36.279	
Jan-1965	27.842	27.842	
Feb-1965	24.772	24.772	
Mar-1965	15.833	15.833	
Apr-1965	12.379	12.379	
May-1965	8.247	8.247	
Jun-1965	7.961	7.961	
Jul-1965	5.104	5.104	
Aug-1965	7.531	7.531	
Sep-1965	8.300	8.300	Jul-1900
Oct-1965	14.211	14.211	
Nov-1965	20.052	20.052	
Dec-1965	20.195	20.195	
Jan-1966	58.638	45.397	
Feb-1966	69.937	0.000	
Mar-1966	43.973	0.000	
Apr-1966	28.314	0.000	
May-1966	17.372	0.000	
Jun-1966	10.054	0.000	
Jul-1966	5.144	0.000	
Aug-1966	4.685	3.898	
Sep-1966	5.392	5.392	Apr-1900
Oct-1966	5.066	5.066	
Nov-1966	7.722	7.722	
Dec-1966	16.963	16.963	
Jan-1967	31.742	31.742	
Feb-1967	69.943	15.440	
Mar-1967	60.140	0.000	
Apr-1967	90.025	0.000	
May-1967	42.656	0.000	
Jun-1967	17.084	0.000	
Jul-1967	11.893	0.000	
Aug-1967	7.594	0.000	
Sep-1967	7.140	0.000	Mar-1900
Oct-1967	11.858	0.000	
Nov-1967	31.392	0.000	
Dec-1967	27.644	0.000	
Jan-1968	31.754	0.000	

Feb-1968	37.462	0.000	
Mar-1968	51.626	0.000	
Apr-1968	28.314	0.000	
May-1968	14.510	0.000	
Jun-1968	7.987	0.000	
Jul-1968	5.144	0.000	
Aug-1968	6.382	5.595	
Sep-1968	5.392	5.392	Jan-1900
Oct-1968	6.764	6.764	
Nov-1968	9.790	9.790	
Dec-1968	23.583	23.583	
Jan-1969	20.419	20.419	
Feb-1969	18.153	18.153	
Mar-1969	91.061	6.915	
Apr-1969	69.450	0.000	
May-1969	42.656	0.000	
Jun-1969	20.316	0.000	
Jul-1969	11.893	0.000	
Aug-1969	4.685	0.000	
Sep-1969	7.140	6.353	Mar-1900
Oct-1969	20.305	20.305	
Nov-1969	20.052	20.052	
Dec-1969	23.583	23.583	
Jan-1970	23.807	23.807	
Feb-1970	28.807	28.807	
Mar-1970	21.928	21.928	
Apr-1970	14.776	14.776	
May-1970	14.483	14.483	
Jun-1970	7.962	7.962	
Jul-1970	5.105	5.105	
Aug-1970	3.778	3.778	
Sep-1970	5.392	5.392	Jul-1900
Oct-1970	11.815	11.815	
Nov-1970	23.439	23.439	
Dec-1970	23.583	23.583	
Jan-1971	58.638	45.397	
Feb-1971	43.430	0.000	
Mar-1971	51.626	0.000	
Apr-1971	50.596	0.000	
May-1971	120.965	0.000	
Jun-1971	50.021	0.000	
Jul-1971	31.706	0.000	
Aug-1971	13.829	0.000	
Sep-1971	14.587	0.000	Apr-1900
Oct-1971	23.736	0.000	
Nov-1971	23.457	0.000	
Dec-1971	58.440	0.000	
Jan-1972	144.893	0.000	
Feb-1972	618.677	0.000	
Mar-1972	327.158	0.000	

Apr-1972	145.354	0.000	
May-1972	137.941	0.000	
Jun-1972	58.535	0.000	
Jul-1972	31.706	0.000	
Aug-1972	13.829	0.000	
Sep-1972	8.352	0.000	Jan-1900
Oct-1972	10.086	0.000	
Nov-1972	16.837	0.000	
Dec-1972	20.221	0.000	
Jan-1973	27.854	0.000	
Feb-1973	69.937	0.000	
Mar-1973	51.626	0.000	
Apr-1973	50.596	0.000	
May-1973	23.991	0.000	
Jun-1973	11.826	0.000	
Jul-1973	6.842	0.000	
Aug-1973	11.433	0.000	
Sep-1973	32.004	0.000	Jan-1900
Oct-1973	23.736	0.000	
Nov-1973	49.774	0.000	
Dec-1973	58.440	0.000	
Jan-1974	120.792	0.000	
Feb-1974	69.937	0.000	
Mar-1974	70.480	0.000	
Apr-1974	50.596	0.000	
May-1974	36.687	0.000	
Jun-1974	23.704	0.000	
Jul-1974	14.289	0.000	
Aug-1974	7.594	0.000	
Sep-1974	5.442	0.000	Jan-1900
Oct-1974	5.109	4.322	
Nov-1974	16.820	16.820	
Dec-1974	36.279	36.279	
Jan-1975	120.780	3.892	
Feb-1975	242.929	0.000	
Mar-1975	185.912	0.000	
Apr-1975	127.163	0.000	
May-1975	58.823	0.000	
Jun-1975	27.739	0.000	
Jul-1975	14.289	0.000	
Aug-1975	7.594	0.000	
Sep-1975	24.069	0.000	Mar-1900
Oct-1975	17.116	0.000	
Nov-1975	27.491	0.000	
Dec-1975	58.440	0.000	
Jan-1976	216.513	0.000	
Feb-1976	256.169	0.000	
Mar-1976	327.158	0.000	
Apr-1976	255.682	0.000	
May-1976	216.686	0.000	

Jun-1976	58.535	0.000	
Jul-1976	36.466	0.000	
Aug-1976	19.923	0.000	
Sep-1976	12.191	0.000	Jan-1900
Oct-1976	23.736	0.000	
Nov-1976	23.457	0.000	
Dec-1976	42.273	0.000	
Jan-1977	89.564	0.000	
Feb-1977	640.356	0.000	
Mar-1977	619.220	0.000	
Apr-1977	242.442	0.000	
May-1977	89.737	0.000	
Jun-1977	31.639	0.000	
Jul-1977	14.289	0.000	
Aug-1977	11.433	0.000	
Sep-1977	14.587	0.000	Jan-1900
Oct-1977	14.254	0.000	
Nov-1977	13.975	0.000	
Dec-1977	27.644	0.000	
Jan-1978	89.564	0.000	
Feb-1978	90.511	0.000	
Mar-1978	70.480	0.000	
Apr-1978	59.111	0.000	
May-1978	31.927	0.000	
Jun-1978	17.084	0.000	
Jul-1978	11.893	0.000	
Aug-1978	11.433	0.000	
Sep-1978	10.419	0.000	Jan-1900
Oct-1978	27.770	0.000	
Nov-1978	36.153	0.000	
Dec-1978	31.544	0.000	
Jan-1979	31.754	0.000	
Feb-1979	28.801	0.000	
Mar-1979	25.309	0.000	
Apr-1979	20.892	0.000	
May-1979	14.510	0.000	
Jun-1979	7.987	0.000	
Jul-1979	6.842	0.000	
Aug-1979	6.382	0.000	
Sep-1979	8.352	0.000	Jan-1900
Oct-1979	10.086	0.000	
Nov-1979	9.807	0.000	
Dec-1979	16.989	0.000	
Jan-1980	27.854	0.000	
Feb-1980	28.801	0.000	
Mar-1980	18.690	0.000	
Apr-1980	10.630	0.000	
May-1980	7.062	0.000	
Jun-1980	4.231	0.000	
Jul-1980	3.355	2.568	

Aug-1980	1.925	1.925	
Sep-1980	5.390	5.390	Jan-1900
Oct-1980	4.220	4.220	
Nov-1980	11.561	11.561	
Dec-1980	14.101	14.101	
Jan-1981	31.742	31.742	
Feb-1981	37.468	37.468	
Mar-1981	25.315	25.315	
Apr-1981	14.776	14.776	
May-1981	27.999	27.999	
Jun-1981	27.713	27.713	
Jul-1981	14.250	14.250	
Aug-1981	11.372	11.372	
Sep-1981	20.631	20.631	Aug-1900
Oct-1981	20.305	20.305	
Nov-1981	27.474	27.474	
Dec-1981	20.195	20.195	
Jan-1982	27.842	27.842	
Feb-1982	28.807	28.807	
Mar-1982	51.632	51.632	
Apr-1982	36.954	36.954	
May-1982	20.577	20.577	
Jun-1982	10.029	10.029	
Jul-1982	6.803	6.803	
Aug-1982	3.444	3.444	
Sep-1982	4.212	4.212	Sep-1900
Oct-1982	7.976	7.976	
Nov-1982	7.722	7.722	
Dec-1982	7.865	7.865	
Jan-1983	10.157	10.157	
Feb-1983	9.056	9.056	
Mar-1983	9.599	9.599	
Apr-1983	7.328	7.328	
May-1983	4.491	4.491	
Jun-1983	3.872	3.872	
Jul-1983	4.258	4.258	
Aug-1983	4.621	4.621	
Sep-1983	4.211	4.211	Mar-1900
Oct-1983	5.064	5.064	
Nov-1983	31.374	31.374	
Dec-1983	36.279	36.279	
Jan-1984	791.470	0.358	
Feb-1984	792.429	0.000	
Mar-1984	684.017	0.000	
Apr-1984	326.128	0.000	
May-1984	145.066	0.000	
Jun-1984	89.449	0.000	
Jul-1984	89.516	0.000	
Aug-1984	58.142	0.000	
Sep-1984	32.004	0.000	Mar-1900

Oct-1984	36.431	0.000	
Nov-1984	36.153	0.000	
Dec-1984	36.305	0.000	
Jan-1985	58.650	0.000	
Feb-1985	256.169	0.000	
Mar-1985	128.192	0.000	
Apr-1985	50.596	0.000	
May-1985	28.026	0.000	
Jun-1985	20.316	0.000	
Jul-1985	14.289	0.000	
Aug-1985	7.594	0.000	
Sep-1985	8.352	0.000	Jan-1900
Oct-1985	23.736	0.000	
Nov-1985	23.457	0.000	
Dec-1985	23.609	0.000	
Jan-1986	42.483	0.000	
Feb-1986	59.597	0.000	
Mar-1986	43.973	0.000	
Apr-1986	36.975	0.000	
May-1986	17.372	0.000	
Jun-1986	11.826	0.000	
Jul-1986	6.842	0.000	
Aug-1986	4.685	0.000	
Sep-1986	4.596	3.809	Jan-1900
Oct-1986	5.066	5.066	
Nov-1986	6.510	6.510	
Dec-1986	20.195	20.195	
Jan-1987	42.471	42.471	
Feb-1987	32.707	32.707	
Mar-1987	60.147	36.061	
Apr-1987	36.975	0.000	
May-1987	20.604	0.000	
Jun-1987	20.316	0.000	
Jul-1987	11.893	0.000	
Aug-1987	19.923	0.000	
Sep-1987	325.917	0.000	May-1900
Oct-1987	325.584	0.000	
Nov-1987	325.305	0.000	
Dec-1987	255.011	0.000	
Jan-1988	216.513	0.000	
Feb-1988	326.615	0.000	
Mar-1988	327.158	0.000	
Apr-1988	184.882	0.000	
May-1988	58.823	0.000	
Jun-1988	42.368	0.000	
Jul-1988	27.805	0.000	
Aug-1988	16.692	0.000	
Sep-1988	12.191	0.000	Jan-1900
Oct-1988	27.770	0.000	
Nov-1988	42.121	0.000	

Dec-1988	126.492	0.000	
Jan-1989	58.650	0.000	
Feb-1989	185.369	0.000	
Mar-1989	91.054	0.000	
Apr-1989	42.944	0.000	
May-1989	23.991	0.000	
Jun-1989	14.222	0.000	
Jul-1989	10.121	0.000	
Aug-1989	4.685	0.000	
Sep-1989	5.442	4.655	Jan-1900
Oct-1989	7.976	7.976	
Nov-1989	120.412	3.913	
Dec-1989	126.492	0.000	
Jan-1990	89.564	0.000	
Feb-1990	121.739	0.000	
Mar-1990	122.282	0.000	
Apr-1990	69.450	0.000	
May-1990	36.687	0.000	
Jun-1990	17.084	0.000	
Jul-1990	8.054	0.000	
Aug-1990	11.433	0.000	
Sep-1990	7.140	0.000	Jan-1900
Oct-1990	11.858	0.000	
Nov-1990	16.837	0.000	
Dec-1990	31.544	0.000	
Jan-1991	68.990	0.000	
Feb-1991	127.649	0.000	
Mar-1991	139.259	0.000	
Apr-1991	59.111	0.000	
May-1991	58.823	0.000	
Jun-1991	36.400	0.000	
Jul-1991	23.771	0.000	
Aug-1991	11.433	0.000	
Sep-1991	8.352	0.000	Jan-1900
Oct-1991	10.086	0.000	
Nov-1991	9.807	0.000	
Dec-1991	14.127	0.000	
Jan-1992	14.337	0.000	
Feb-1992	21.378	0.000	
Mar-1992	21.921	0.000	
Apr-1992	12.402	0.000	
May-1992	5.365	0.000	
Jun-1992	3.898	3.111	
Jul-1992	2.407	2.407	
Aug-1992	1.925	1.925	
Sep-1992	2.693	2.693	Jan-1900
Oct-1992	3.276	3.276	
Nov-1992	6.510	6.510	
Dec-1992	9.933	9.933	
Jan-1993	11.929	11.929	

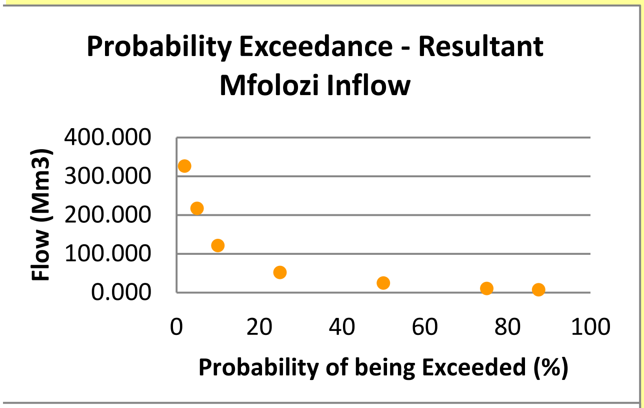
Feb-1993	18.153	18.153	
Mar-1993	18.696	18.696	
Apr-1993	14.776	14.776	
May-1993	7.036	7.036	
Jun-1993	4.206	4.206	
Jul-1993	3.317	3.317	
Aug-1993	2.833	2.833	
Sep-1993	3.603	3.603	Apr-1900
Oct-1993	58.524	46.306	
Nov-1993	58.288	0.000	
Dec-1993	137.559	0.000	
Jan-1994	120.792	0.000	
Feb-1994	59.597	0.000	
Mar-1994	70.480	0.000	
Apr-1994	36.975	0.000	
May-1994	17.372	0.000	
Jun-1994	10.054	0.000	
Jul-1994	6.842	0.000	
Aug-1994	4.685	0.000	
Sep-1994	4.262	3.476	Feb-1900
Oct-1994	11.815	11.815	
Nov-1994	13.957	13.957	
Dec-1994	23.583	23.583	
Jan-1995	17.187	17.187	
Feb-1995	12.894	12.894	
Mar-1995	29.350	29.350	
Apr-1995	32.193	32.193	
May-1995	23.965	23.965	
Jun-1995	17.059	17.059	
Jul-1995	10.082	10.082	
Aug-1995	6.321	6.321	
Sep-1995	4.546	4.546	Jul-1900
Oct-1995	10.043	10.043	
Nov-1995	31.375	31.375	
Dec-1995	120.556	3.904	
Jan-1996	241.982	0.000	
Feb-1996	640.356	0.000	
Mar-1996	640.899	0.000	
Apr-1996	255.682	0.000	
May-1996	126.875	0.000	
Jun-1996	42.368	0.000	
Jul-1996	42.435	0.000	
Aug-1996	23.311	0.000	
Sep-1996	10.419	0.000	Feb-1900
Oct-1996	23.736	0.000	
Nov-1996	20.069	0.000	
Dec-1996	31.544	0.000	
Jan-1997	58.650	0.000	
Feb-1997	59.597	0.000	
Mar-1997	70.480	0.000	

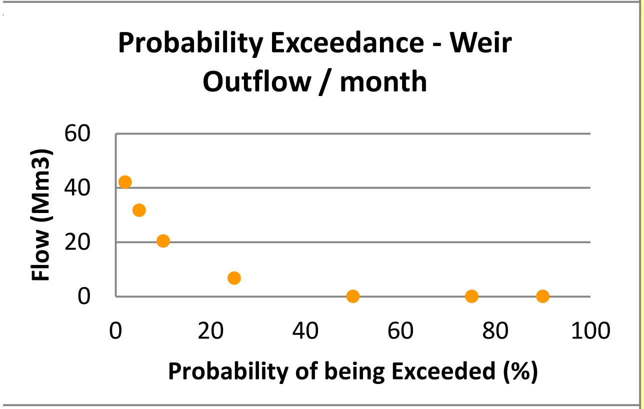
Apr-1997	69.450	0.000	
May-1997	50.308	0.000	
Jun-1997	50.021	0.000	
Jul-1997	27.805	0.000	
Aug-1997	19.923	0.000	
Sep-1997	20.681	0.000	Jan-1900
Oct-1997	31.671	0.000	
Nov-1997	126.340	0.000	
Dec-1997	89.354	0.000	
Jan-1998	68.990	0.000	
Feb-1998	121.739	0.000	
Mar-1998	70.480	0.000	
Apr-1998	50.596	0.000	
May-1998	28.026	0.000	
Jun-1998	11.826	0.000	
Jul-1998	8.054	0.000	
Aug-1998	4.685	0.000	
Sep-1998	4.596	3.809	Jan-1900
Oct-1998	11.815	11.815	
Nov-1998	20.052	20.052	
Dec-1998	42.247	42.247	
Jan-1999	68.978	16.362	
Feb-1999	59.597	0.000	
Mar-1999	51.626	0.000	
Apr-1999	36.975	0.000	
May-1999	20.604	0.000	
Jun-1999	10.054	0.000	
Jul-1999	6.842	0.000	
Aug-1999	4.685	0.000	
Sep-1999	5.442	4.655	Apr-1900
Oct-1999	7.976	7.976	
Nov-1999	9.789	9.789	
Dec-1999	49.900	49.900	
Jan-2000	120.780	3.892	
Feb-2000	145.841	0.000	
Mar-2000	243.472	0.000	
Apr-2000	138.229	0.000	
May-2000	126.875	0.000	
Jun-2000	50.021	0.000	
Jul-2000	23.771	0.000	
Aug-2000	11.433	0.000	
Sep-2000	8.352	0.000	Mar-1900
Oct-2000	14.254	0.000	
Nov-2000	120.430	0.000	
Dec-2000	216.303	0.000	
Jan-2001	144.893	0.000	
Feb-2001	121.739	0.000	
Mar-2001	70.480	0.000	
Apr-2001	50.596	0.000	
May-2001	28.026	0.000	

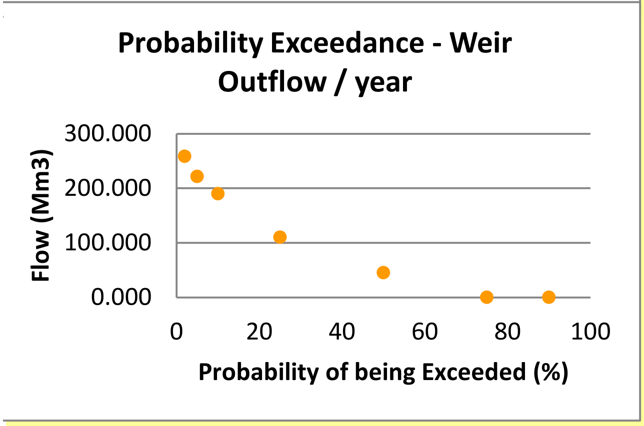
Jun-2001	11.826	0.000	
Jul-2001	8.054	0.000	
Aug-2001	3.839	0.000	
Sep-2001	10.419	9.632	Jan-1900
Oct-2001	14.209	14.209	
Nov-2001	31.374	31.374	
Dec-2001	36.279	36.279	
Jan-2002	42.471	42.471	
Feb-2002	43.436	43.436	
Mar-2002	29.350	29.350	
Apr-2002	24.258	24.258	
May-2002	10.315	10.315	
Jun-2002	7.962	7.962	
Jul-2002	20.344	20.344	
Aug-2002	13.768	13.768	
Sep-2002	12.141	12.141	Oct-1900
Oct-2002	7.976	7.976	
Nov-2002	11.561	11.561	
Dec-2002	11.705	11.705	
Jan-2003	11.929	11.929	
Feb-2003	24.772	24.772	
Mar-2003	15.833	15.833	
Apr-2003	10.608	10.608	
May-2003	7.035	7.035	
Jun-2003	7.961	7.961	
Jul-2003	5.104	5.104	
Aug-2003	3.442	3.442	
Sep-2003	4.211	4.211	May-1900
Oct-2003	3.276	3.276	
Nov-2003	6.510	6.510	
Dec-2003	6.653	6.653	
Jan-2004	31.742	31.742	
Feb-2004	59.604	38.944	
Mar-2004	60.140	0.000	
Apr-2004	36.975	0.000	
May-2004	17.372	0.000	
Jun-2004	7.987	0.000	
Jul-2004	10.121	0.000	
Aug-2004	4.685	0.000	
Sep-2004	7.140	6.353	Apr-1900
Oct-2004	5.066	5.066	
Nov-2004	11.561	11.561	
Dec-2004	14.101	14.101	
Jan-2005	31.742	31.742	
Feb-2005	51.089	51.089	
Mar-2005	60.147	36.061	
Apr-2005	28.314	0.000	
May-2005	14.510	0.000	
Jun-2005	11.826	0.000	
Jul-2005	6.842	0.000	

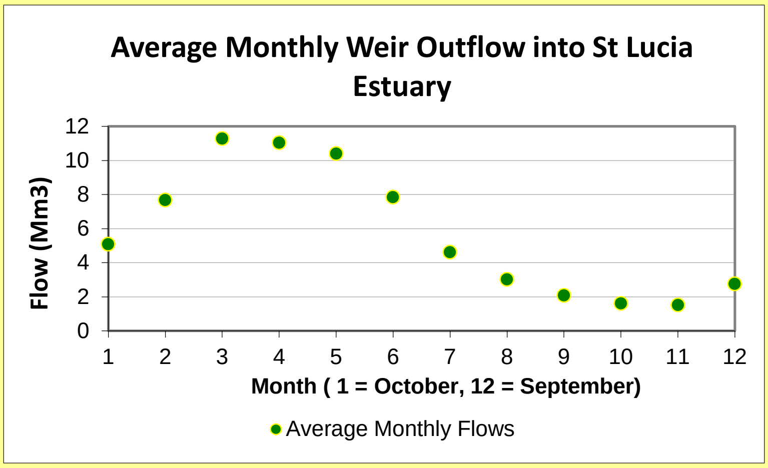
Aug-2005	4.685	0.000	
Sep-2005	4.262	3.476	Jun-1900
Oct-2005	4.220	4.220	
Nov-2005	9.790	9.790	
Dec-2005	9.933	9.933	
Jan-2006	23.807	23.807	
Feb-2006	32.707	32.707	
Mar-2006	33.251	33.251	
Apr-2006	28.293	28.293	
May-2006	17.345	17.345	
Jun-2006	10.029	10.029	
Jul-2006	5.105	5.105	
Aug-2006	7.533	7.533	
Sep-2006	7.090	7.090	Jul-1900
Oct-2006	11.815	11.815	
Nov-2006	20.052	20.052	
Dec-2006	58.414	47.211	
Jan-2007	42.483	0.000	
Feb-2007	28.801	0.000	
Mar-2007	15.827	0.000	
Apr-2007	14.798	0.000	
May-2007	7.062	0.000	
Jun-2007	10.054	0.000	
Jul-2007	5.144	0.000	
Aug-2007	3.505	2.718	
Sep-2007	4.544	4.544	Mar-1900
Oct-2007	10.041	10.041	
Nov-2007	20.051	20.051	
Dec-2007	14.100	14.100	
Jan-2008	14.325	14.325	
Feb-2008	15.290	15.290	
Mar-2008	18.696	18.696	
Apr-2008	28.292	28.292	
May-2008	14.482	14.482	
Jun-2008	10.028	10.028	
Jul-2008	5.104	5.104	
Aug-2008	3.442	3.442	
Sep-2008	4.211	4.211	Jun-1900
Oct-2008	3.885	3.885	
Nov-2008	3.966	3.966	
Dec-2008	4.955	4.955	
Jan-2009	14.325	14.325	
Feb-2009	21.385	21.385	
Mar-2009	18.696	18.696	
Apr-2009	12.379	12.379	
May-2009	10.314	10.314	
Jun-2009	6.749	6.749	
Jul-2009	4.258	4.258	
Aug-2009	4.621	4.621	
Sep-2009	5.390	5.390	Apr-1900

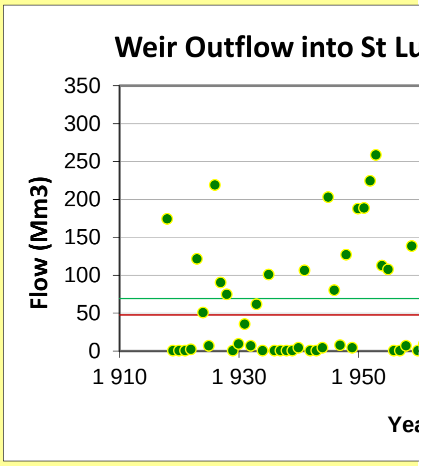
Oct-2009	7.974	7.974	
Nov-2009	13.957	13.957	
Dec-2009	11.704	11.704	
Jan-2010	6.878	6.878	
Feb-2010	4.966	4.966	
Mar-2010	3.992	3.992	
Apr-2010	2.934	2.934	
May-2010	2.364	2.364	
Jun-2010	1.856	1.856	
Jul-2010	8.014	8.014	

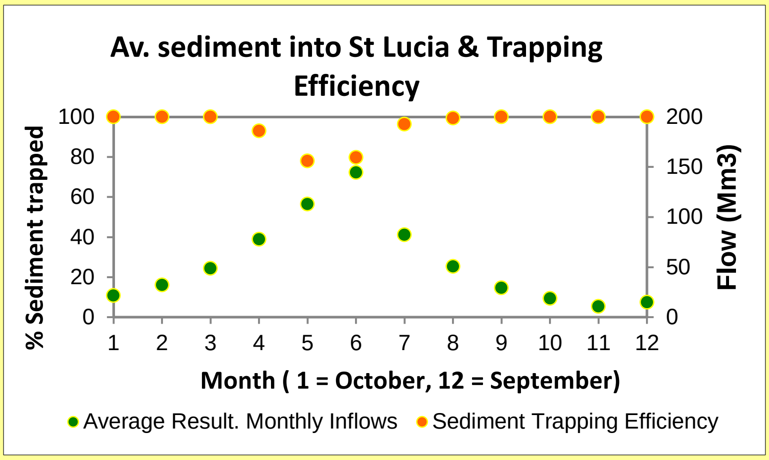

Probability Exceedance - Resultant Mfolozi Inflow
Flow (Mm3)
400.000
300.000
200.000
100.000
0.000
0
20
40
60
80
100
Probability of being Exceeded (%)

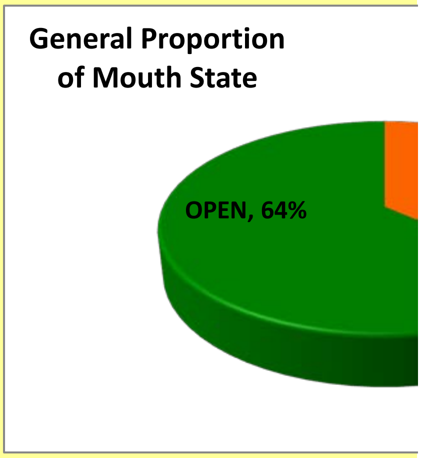

Probability Exceedance - Weir Outflow / month
Flow (Mm3)
60
40
20
0
0
20
40
60
80
100
Probability of being Exceeded (%)


Probability Exceedance - Weir Outflow / year
Flow (Mm3)
300.000
200.000
100.000
0.000
0
20
40
60
80
100
Probability of being Exceeded (%)









General Proportion of Mouth State

% of time mouth is closed: 36.48%

outflow	% closed	sed into s.l	trap eff.
69	36.48%	1156	95.75

Weir Outflow into St Lucia Lake

Yearly Outflow	(Mm^3)
Average:	68.94
Coefficient of Variance:	114%
Decade Outflow	
Average:	685.18
Coefficient of Variance:	51%

graph - monthly weir outflow

median line

Mar-1905	Feb-1900
Jul-1905	Feb-1900

average

Mar-1905	Mar-1900
Jul-1905	Mar-1900

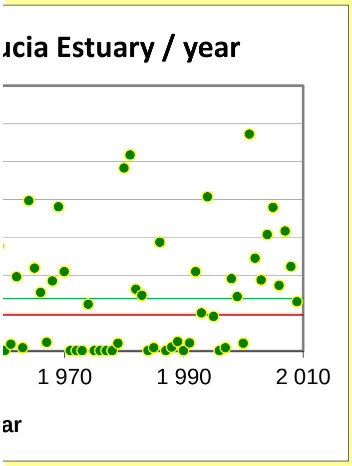
graph - decade weir outflow

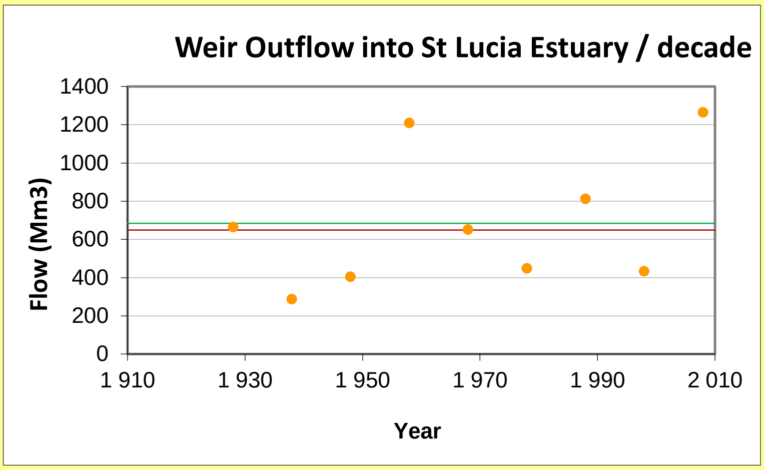
median line

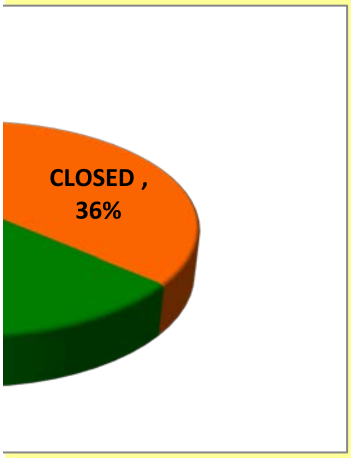
Mar-1905	Oct-1901
Jul-1905	Oct-1901

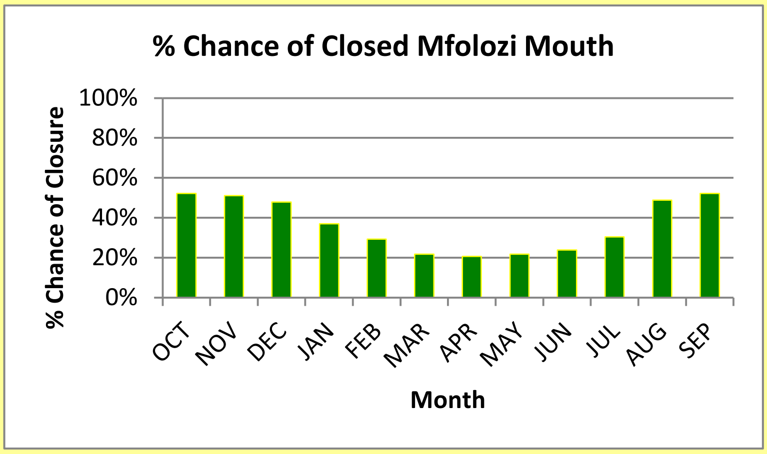
average

Mar-1905	Nov-1901
Jul-1905	Nov-1901









Calculate Average Yearly
Weir Outflow:

Average outflow for closed mouths =

68.94 Mm3 @ 1156 ton of sediment into St Lucia /year = 16.76 ton/Mm3
95.75% trapping efficiency

MEDIAN

AVERAGE

14.49 Mm3/month

0.48 Mm3/day

talk to robbyne about meshing th
pg 44 of lindsay 96 has a level at l
redo macros for sensitivity analys
add colums to check spm correlat
make a list of all sediment figures
list differences between grenfell a
make a diagram of cross sections
create a diagram for all sediment
add the summer and winter ave t
look at table 1 for figures, where
read up on bed shear stress N/m2
write up what linsay 96 talks abou
read up on tide cycles - duration

ıe two models together once it is complete - to calc the difference between the two WL - right now a
high water mean and an estimated area and volume covered. What is the high water leverl - how do
ıis
tion of lindsay 96 to mfolozi rivers sediment yield
; lindsay states and compare to grenfell
and lindsay SPM estimations and their advantages and disadvantages
available and how the balance may work
inputs and outputs
:o inflow data to check simulation datas suitability
does bedload come into all of this
2
ut the importance of sedimentation studies of mfolozi, even if separate mouths are maintained … the
etc

n infinite amout of water can flow through.
es it compare to our values?

ey talk about the sedimet going in from mfolozi to st lucia - where there seprate mouths at that stage